Fontys Hogeschool ICT

Opleidingsgids FHICT Voltijd Bachelor Nieuwe Curriculumarchitectuur

Dit is de opleidingsgids van FHICT. Het bevat alle informatieformats van alle vakken uit de curricula van de voltijds bacheloropleidingen van FHICT conform de curriculumarchitectuur vanaf 2019. Vakken die in meerdere curricula voorkomen, worden meermaals vermeld, maar zijn per definitie helemaal gelijk.

In deze opleidingsgids staan mogelijk vakken en/of onderwijseenheden vermeld die in het betreffende semester niet worden aangeboden. Enkel de informatie van onderdelen die daadwerkelijk worden aangeboden is van toepassing.

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1.1. Information about P-CB First semester Course-Based

Assumed knowledge

As a prospective Bachelor's student you must have a diploma of higher secondary education that is equivalent to Dutch standards. In order to be admitted to Fontys University of Applied Sciences students must be eligible for higher education through a diploma of secondary education / high school diploma with good results.

Examination of this educational unit

At Fontys School of Information and Communication Technology, we use learning outcomes as the base for the integral semester assessment. By the end of semester 1 you need to have demonstrated that you have achieved the learning outcomes. By the end of week 12 you demonstrate orientation level for all five profile learning outcomes, based on your overall development during the five orienting level courses and the introduction project. From week 13 you continue to develop towards the advanced level for one (or more) of these profiles of your choice. By week 18 you have demonstrated the advanced level for the learning outcome of your chosen profile, and your level on the Professional Skills learning outcome. See the figure on the next page for an overview of the assessment in semester 1 course-based.

A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. In this meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes: assignments, tests, demo's, teacher feedback, observations, etc. During semester 1 you will receive the following formative indications as specified below.

Week 12	5 formative indications on orienting level for the learning outcomes of all profiles: • ICT & Business • ICT & Media Design • ICT & Infrastructure • ICT & Software Engineering • ICT & Technology
Week 18	• 1 formative indication on advanced level for the learning outcome(s) of your chosen profile(s) • 1 formative indication for the learning outcome Professional Skills

Every learning outcome is valuated according to the decision guidelines below. Based on these decision guidelines all learning outcomes will be expressed in terms of the following formative indications: Outstanding (O), Good (G), Satisfactory (S), Unsatisfactory (U), Poor (P).

Valuation	**Explanation**
Outstanding (O)	You have demonstrated the learning outcome at an outstanding level. This means that you have shown your development at the level described in the explanation of the learning outcome. And, on top of that you have shown a significantly higher development on several of the assessment criteria.
Good (G)	You have demonstrated the learning outcome at a good level. This means that you have shown your development at the level described in the explanation of the learning outcome.
Satisfactory (S)	You have demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, but that you have shown sufficient level.
Unsatisfactory (U)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing one or more essential aspects in your development.
Poor (P)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing many essential aspects in your development.

Summative, integral semester assessment (week 19)

Based on the valuation of the learning outcomes, the assessors (= all involved teachers) decide during the assessor meeting in week 19 on your integral semester assessment result. The guidelines below are used to decide on this result. In well-motivated cases, the assessors can deviate from these guidelines.

Pass (30 EC)	Outstanding (O)	1 profile learning outcome advanced level: at least outstanding 5 profile learning outcomes orientation level: at least good Professional Skills learning outcome: at least good
Pass (30 EC)	Good (G)	1 profile learning outcome advanced level: at least good 5 profile learning outcomes orientation level: at least satisfactory Professional skills learning outcome: satisfactory / good

Pass (30 EC)	Satisfactory (S)	1 profile learning outcome advanced level: satisfactory 5 profile learning outcomes orientation level: satisfactory Professional skills learning outcome: satisfactory
Fail (0 EC)	Unsatisfactory (U)	< Satisfactory (S)

Tools allowed

Within the courses and projects you will receive specific information about permitted tools and aids. Collaborating on individual assignments, that you need to hand in for review, is only permitted with explicit consent from the teacher. In all other cases this will be considered to be fraud and may have serious consequences. For further details on this please read the FHICT fraud policy, available on Student Square (Fontys ICT portal).

Resits and repairs

During the semester you work on learning activities to develop towards and show the expected level on the learning outcomes. You have several opportunities to demonstrate your level, and will receive feedback on how your development progresses. As described above, in week 12 and in week 18 your teachers will evaluate your level on the learning outcomes. If by week 12 you have not yet demonstrated a satisfactory or higher level for one of the orienting level learning outcomes, your teachers can decide to give you an extra opportunity to develop and demonstrate your level on this during the advanced phase of the semester. Your teachers will together discuss and decide on these cases. You will be given this opportunity if the teachers' estimate is that you are able to reach the required level within a maximum of 15 hours additional study load. It is not possible to receive an extra opportunity to develop and demonstrate your level on the chosen profile advanced level or the Professional Skills learning outcome, if you have not shown this by the end of week 18.

If you fail the semester, you can retake it all during the following semester.

Determination of the grade

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 2 of the chosen advanced level profile. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC, and are not admitted to semester 2.

In case the grading procedure was not followed correctly or invalid criteria have been used to determine the grade, you can appeal to the Exam Board. Before doing this, we advise you to contact the teacher(s) concerned in the grading to ask for further clarification. If you decide to send an appeal to the Exam Board, you need to be explicit about which part of the procedure was not followed or which criteria were used incorrectly for grading. Simply disagreeing with the examiner is not a valid reason to appeal. You can contact your mentor for more information about appeals.

Transfer decision

At the end of the semester, based on the decisions taken at the assessor meeting, the exam board will place you in your follow-up semester. This will be one of the following options:

- You have completed the semester: You receive 30 EC and are admitted to semester 2 of the profile you chose for your advanced level.
- You have *not* completed the semester: You receive 0 EC and are *not* admitted to semester 2. You can retake semester 1 (semester 1 is scheduled both during the Fall and the Spring semester).

1.1.1. Information about P-CB-Prof Professional Skills

Content

At Fontys ICT you are preparing for your professional life in a field that evolves continuously. Because of this an ICT-professional will also continuously need to develop. To support this process, during your studies, you will also work on your professional skills: future-oriented organisation, investigative problem solving, personal leadership and targeted interaction..

Learning outcome

You display professional behaviour in the areas of future-oriented organisation, investigative problem solving, personal leadership and targeted interaction.

Explanation

Future-oriented organisation

For a given assignment you – with guidance - make a planning (timing & part-tasks) with your team members. You make agreements about the expected quality. And while working on the implementation you take into account the consequences of your chosen solution for the people and organisations involved.

Investigative problem solving

You remain curious and ask questions throughout the solution process. You answer questions by using an appropriate approach: pragmatic, critical and based on sources.

Personal leadership

You notice and seize opportunities. You motivate yourself. You take responsibility for your actions. You work result-oriented on your assignments. You make considered choices in your study programme. You recognize learning needs in yourself, are open to feedback, and reflect on this.

Targeted interaction

You take the direct stakeholder into account when working on an assignment. You pay attention to what you want to communicate and in which shape you do this. You recognize tasks within the group work, and take on your role within the group. You address others about their behaviour and role within the group.

1.1.2. Information about P-CB-BUSN

Content

IT innovations make that companies have to adapt their business process. The goal in most cases is to reduce cost or time. For example a supportive system for patient administration in a hospital, standardized system to report problems with your car, or a banking system you can use from your phone. With these innovations IT has an impact on the life that we have. These changes have two things in common: they are costly to implement, and they require a change in the process. Companies want to be able to steer their new IT implementations, being able to use them efficiently and to gain new insights within their process. For example when a supermarket introduces a new scanning system for their products, they can save on employees cost. On the other hand the customer is now charge of scanning the products. The question at hand, “Is this really a beneficial change?”. With the gathered data and a process analysis the ICT and Business expert is able to determine whether this is true and give a funded argument. Being able to see the whole picture of the organization, collecting and

organizing the data, and analysing the process is what you will work on during the upcoming period. You will learn that these topics cannot go without each other.

Learning outcome

You demonstrate how to convert data into information in order to achieve a recommendation that will make an improvement for a process in an organization.

Explanation

Explanation for Orientation

Improving an organisation Using the offered models you can describe a business process and you can indicate the bottlenecks.

Converting data into information

You process raw data into information, based on simple data modelling and provided tools

Advice

You provide a substantiated advice based on your data analysis and process description.

Explanation for Advanced

Improvements for an organisation

With the aid of available models and tools you create an IST design of a business process. based on a bottleneck analysis you create a SOLL design. You describe how the agreed key performance indicators can be achieved.

Converting data into information

You analyse and transform raw data from the source into meaningful information for a client, based on a data model of your own design.

Advice

You provide a substantiated and sustainable advice to improve an organisation for the client.

Substantiated documentation is provided in the form of legitimate literature and by using data analysis. Sustainability is created by showing the long term impact on the organization by the advice. The advice should be compact and to the point when presented.

1.1.3. Information about P-CB-Infra ICT & Infrastructure

Content

ICT & Infrastructure is about being able to manage the existing IT infrastructure in all its facets and being able to design and realise a new infrastructure. This concerns both the technical side (network and server environments, cloud, IT environments, security), and the business side (agreements, costs, privacy considerations, organisation). ICT infrastructure is understood to mean the totality of IT resources that handle the processing, storage and transport of digital data. In the first semester you will become acquainted with the basics of IT infrastructure, and learn to develop a secured network environment.

Learning outcome

You demonstrate a self-developed, secured network environment with hosts and servers based on a specific application requirement (services).

Explanation

Explanation for Orientation

Develop and demonstrate

You create and demonstrate a working web service or other network service that can be accessed from inside and outside of the local area network (LAN)

Server and network environment

You can design a simple network.

You can explain how the client-server communication works.

You can apply hardware-visualisation techniques.

Security

You have taken the basic security setting components into account.

Explanation for Depth

Develop You have carried out an analysis, design and realisation phase. You create and demonstrate a working service on the network which is accessible from various networks, and add justification of your choices. You are capable of implementing extra services on your network (for example NAT).

Demonstrate You show a working service exposed to client(s) that runs as a specific application on a small network environment. You can adjust the configuration and describe the impact on the environment. You justify the chosen network components.

The server and the network environment You analyse requirements in order to make a network design with a network drawing.

You create a server and network environment in a virtual infrastructure.

You are able to apply various configurations and determine the impact on the environment.

Security

You analyse the security factors of a self-developed infrastructure and can draw a conclusion from it.

1.1.4. Information about P-CB-Media

Content

ICT & Media Design is about coming up with ICT-based media concepts, transferring stories to your goal audience, and developing applications that are meaningful to your target audience. The core part of this profile is for you to learn how to design for the user experience, so you will be able to develop and implement interactive prototypes in an iterative process for the target users based on trends and developments. You get the opportunity to experiment and develop your technical and creative talents.

Learning outcome

You are able to develop and implement interactive prototypes in an iterative process for the target users based on trends and developments.

Explanation

Explanation for Orientation

Trends and developments

You orient on the actual state of affairs in the area of digital experience design and technology. This may include big data, mixed reality and artificial intelligence. You collect examples of these from daily life.

Iterative process

After having received feedback from users and experts, you repeatedly implement changes with the aim of improving your product. You show these iterations and the collected feedback in your work process.

Interactive prototypes

You have made prototypes to develop the interaction of your product. You use structure and style languages e.g. HTML and CSS.

Target group

You look into the interests and needs of the end user

Explanation for Advanced

Trends and developments

You have studied the various developments in the area of digital experience design. You have formed an opinion about it. Based on this you justify your choice of study direction in this domain. **Iterative process**

You show iterations in the work process and you explain how feedback from users and experts has contributed to your design choices. Your design meets the needs of the end user and is aesthetically justified.

Interactive prototypes You make digital products that create a specific, purposeful interaction between human and machine. As input for this you have made sketches, wireframes and prototypes. You use structure and style languages e.g. HTML and CSS.

Target group During the developmental process you take the interests and needs of the end user into account.

1.1.5. Information about P-CB-Soft ICT & Software Engineering

Content

In the ICT & Software profile you will learn how to develop complex software systems. In the first semester it is all about the basics of programming. With the basic programming concepts you will start writing very simple software applications. During the course it will become clear that Software Engineering is more than just programming. You will learn different techniques to create software applications in a structured manner. It is important that you practice a lot in the orienting phase and this way develop your analytical skills, which are essential for a software developer. Enthusiasm and perseverance are also important ingredients to become a skilled software developer. You will use the acquired programming knowledge also in the other profiles/streams to create meaningful products. In the advanced phase of the first semester you will make a start with developing software applications using object oriented design and implementation concepts.

Learning outcome

You develop software applications with attention for algorithmics and hereby demonstrate the basic skills of object-oriented programming.

Explanation

Explanation for Orientation

Attention for algorithmics You can write simple software applications that in a step-by-step manner find solutions to problems by performing logical tests and simple, stepwise calculations.

Basic skills

You comprehend and apply the following programming concepts: variables, conditional statements, loops, methods, lists/arrays and enum's.

Demonstrate

You ask a teacher to provide feedback and show that you have followed up on the feedback.

Explanation for Advanced

Attention for algorithmics You can write simple object oriented software applications that in a step-by-step manner find solutions to problems by performing logical tests and simple, stepwise calculations.

Basic skills

You comprehend and apply the following programming concepts: objects/classes, constructors, private fields/encapsulation, get/set- methods and/or properties, method/constructor overloading, class diagrams/relations/multiplicity (in addition to *basic skills orientation*).

The focus hereby is on the readability (e.g. naming conventions, indentation) and the maintainability of your software programmes.

You design a class diagram (with explanation) which shows the most important classes and their interrelationships.

Demonstrate

You ask a teacher to provide feedback and show that you have followed up on the feedback.

1.1.6. Information about P-CB-Tech ICT & Technology

Content

ICT & Technology is the profession of developing software for other platforms than standard PC's. These platforms, named Embedded Systems, often have a strong link with the physical world. This course is an introduction to programming on an embedded platform such as the Arduino. You can connect different types of sensors and actuators to this platform. You can use these sensors to get information about the outside world, and use actuators to influence the physical surroundings. This interaction requires you to make assumptions about the physical world and confirm your results with live tests.

Learning outcome

You develop and programme interactive embedded systems in which you use sensors and actuators and apply various I/O techniques.

Explanation

Explanation for Orientation

Interactive embedded systems

You compile and develop a system which comprises different component such as a micro controller board, sensors and actuators.

Your system can communicate with another system using your self-defined protocol.

Programming

You understand and apply the following programming principles: variables, conditional statements, loops, functions, arrays.

The focus is to make a working product.

Sensors

You can apply and use sensors such as a button, potentiometer, distance sensor etc..

Actuators

You can apply and use actuators such as led, buzzer, motor.

Various I/O techniques

You can apply various types of I/O techniques such as digital input and output and analogue input.

Explanation for Advanced

Interactive embedded systems

Your product can communicate with another systems using your self-defined protocol that supports parameters and which can handle invalid messages.

Programming

You apply all imperative programming concepts and the following Object Oriented concepts: objects, classes and encapsulation, i.e.: constructors, private fields, properties en methods.

The focus is on developing readable (e.g. naming and indentation), maintainable code and a robust product.

Sensors en actuators

You apply extra sensors and actuators which you made an analysis of.

Various I/O techniques

Besides the mentioned I/O techniques you can also apply pulse width modulation and interpret and apply analogue input.

2. Information about

2.1. Information about

Assumed knowledge

Op basis van je vooropleiding ben je aangenomen bij FHICT. De kennis, kunde en vaardigheden, die je hebt opgedaan in jouw vooropleiding zijn het uitgangspunt van het startsemester. Verdere specifieke voorkennis is niet nodig om dit eerste semester succesvol te doorlopen.

Examination of this educational unit

Beoordeling van het startsemester Bij Fontys Hogeschool ICT wordt gewerkt met leeruitkomsten. Aan het eind van het startsemester zal je moeten laten zien, dat je de leeruitkomsten hebt bereikt. Je toont de leeruitkomsten voor ieder profiel op het oriënterend niveau aan tot en met week 11. Vervolgens kies je één van deze leeruitkomsten, waarin je je wilt verdiepen. Tot en met week 18 toon je deze leeruitkomst voor het gekozen profiel op het verdiepende niveau aan. De leeruitkomst voor PO toon je aan in week 11 en in week 18, zodat jouw groei hierin duidelijk wordt. In de onderstaande tabel is het globale tijdspad voor de beoordeling van het startsemester in de demand-based leervorm weergegeven:

Week 11	- 5 formatieve indicaties* op oriënterend niveau voor de leeruitkomsten Business, Infrastructure, Media Design, Software engineering, Technology - 1 formatieve indicatie* voor de leeruitkomst PO

Week 18	- 1 formatieve indicatie* op verdiepend niveau van de leeruitkomsten voor het gekozen profiel (Business, Infrastructure, Media Design, Software engineering of Technology) - 1 formatieve indicatie* voor de leeruitkomst PO
Week 19	- Summatieve, integrale semesterbeoordeling (assessorenvergadering)

* Een formatieve indicatie is een ontwikkelingsgerichte, tussentijdse waardering, die als input dient voor de assessorenvergadering. In deze vergadering bepalen de assessoren op basis van alle formatieve indicaties de summatieve, integrale semesterbeoordeling.

Formatieve indicaties voor de leeruitkomsten (week 11 en week 18) Iedere leeruitkomst wordt gewaardeerd aan de hand van de onderstaande richtlijnen. Op basis van deze richtlijnen wordt de formatieve indicatie per leeruitkomst gegeven en uitgedrukt in: Outstanding (O), Good (G), Satisfactory (S), Unsatisfactory (U). De docent is verantwoordelijk voor de formatieve indicaties.

Item	**Toelichting**
Outstanding (O)	Je hebt aangetoond dat je de leeruitkomst op een uitstekend niveau hebt bereikt. Dit houdt in dat je alle beoordelingsaspecten, weergegeven in de toelichting van de leeruitkomst, volledig hebt laten zien. Daarnaast heb je – boven verwachting – iets extra's ten aanzien van de leeruitkomst laten zien. Elk beoordelingsaspect = minstens meer dan de helft O en overig G
Good (G)	Je hebt aangetoond dat je de leeruitkomst op een goed niveau hebt bereikt. Dit houdt in dat je alle diverse beoordelingsaspecten, weergegeven in de toelichting van de leeruitkomst, volledig hebt laten zien. Elk beoordelingsaspect = G
Satisfactory (S)	Je hebt aangetoond dat je de leeruitkomst op een voldoende niveau hebt bereikt. Dit houdt in dat je je nog kunt verbeteren ten aanzien van een of meerdere beoordelingsaspecten, weergegeven in de toelichting van de leeruitkomst, maar je hebt wel voldoende laten zien. Elk beoordelingsaspect = G of S, geen enkel beoordelingsaspect = U
Unsatisfactory (U)	Je hebt de leeruitkomst op een onvoldoende niveau aangetoond. Dit houdt in dat je een of meerdere beoordelingsaspecten, weergegeven in de toelichting van de leeruitkomst, onvolledig of niet hebt laten zien. Een beoordelingsaspect of meer = U

Hoe komt de summatieve, integrale semesterbeoordeling tot stand? (week 19) Als alle leeruitkomsten uit het startsemester individueel gewaardeerd zijn, wordt in overleg met alle betrokken assessoren de semesterbeoordeling voor jou bepaald. De assessoren hanteren daarbij de volgende beoordelingsrichtlijnen. Als hiervan wordt afgeweken, wordt de motivatie hiervoor vastgelegd.

Beoordelingsrichtlijnen

Behaald (30 EC)	Outstanding (O)	1 leeruitkomsten verdiepend: tenminste Outstanding (O) 5 leeruitkomsten oriënterend: tenminste Good (G) PO leeruitkomst: tenminste Good (G)

Behaald (30 EC)	Good (G)	1 leeruitkomsten verdiepend: tenminste Good (G) 5 leeruitkomsten oriënterend: tenminste Satisfactory (S) PO leeruitkomst: Satisfactory (S) / Good (G)
Behaald (30 EC)	Satisfactory (S)	1 leeruitkomst verdiepend: Satisfactory (S) 5 leeruitkomsten oriënterend: Satisfactory (S) PO leeruitkomst: Satisfactory (S)
Niet behaald (0 EC)	Unsatisfactory (U)	< Satisfactory (S)

De onderwijseenheid is behaald indien de beoordeling een O, G of S is. De student krijgt dan 30 EC. Is de beoordeling een U, dan is de onderwijseenheid niet behaald en krijgt de student 0 EC.

Tools allowed

Niet van toepassing.

Resits and repairs

Verbetermogelijkheden gedurende het semester Gedurende het semester krijg je frequent feedback en de mogelijkheid om producten en prestaties te verbeteren om zo alle leeruitkomsten aan te tonen. Aangezien op deze wijze het niveau van de leeruitkomsten van jou regelmatig en vroegtijdig gemeten wordt, zijn er geen herkansingen om de nog niet aangetoonde leeruitkomst na de bovenstaande momenten op het gewenste niveau te krijgen. Het oriënterend niveau van een bepaalde leeruitkomst kan bij uitzondering en na toestemming van je docent aangetoond worden in week 12 tot en met 18. Je maakt hiervoor zelf afspraken met de betrokken vakdocent en een onafhankelijke vakdocent of semestercoach, die de rol van tweede beoordelaar kan vervullen. De summatieve, integrale semesterbeoordeling kan niet herkanst worden binnen het semester. Herkansing is pas mogelijk in het aansluitende half jaar, middels herstart (zie OER, artikel 28).

Herstart In de demand-based leervorm is het traject voor elke student op maat, zoals beschreven in paragraaf 1.3 ‘Demand-based leervorm’ van dit blokboek. Voor studenten die herstarten gelden de onderstaande aandachtspunten.

- Herstarters tonen alle leeruitkomsten opnieuw aan middels nieuwe opdrachten. Er kan geen aanspraak worden gemaakt op eerder gemaakt werk.
- Er worden geen ‘vrijstellingen’ aan herstarters verleend. Alle leeruitkomsten dienen opnieuw door de herstarter te worden aangetoond.
- Herstarters mogen leeruitkomsten voor de verschillende profielen al eerder in de oriënterende fase aantonen, zodat zij de ruimte krijgen voor andere leeractiviteiten.
- Herstarters ontvangen de formatieve indicatie op hetzelfde moment als reguliere studenten.
- Er is voor herstarters extra aandacht op het gebied van de professionele ontwikkeling (PO) onder begeleiding van de semestercoach.

Determination of the grade

De summatieve, integrale semesterbeoordeling wordt aan het eind van de assessorenvergadering (in de vorm van een portfolioschouw) uitgedrukt in Outstanding (O), Good (G), Satisfactory (S) of Unsatisfactory (U). Outstanding (O), Good (G) en Satisfactory (S) resulteren in het toekennen van 30 EC en een doorstroom naar het tweede semester, aansluitend bij het gekozen verdiepende profiel. Unsatisfactory (U) resulteert in herstart. In dit geval ontvangt je 0 EC en stroom je niet door naar het tweede semester.

Transfer decision

Tijdens jouw studie worden er doorstroombesluiten uitgebracht. Aan het einde van het startsemester wordt een doorstroombesluit uitgebracht, waarbij de volgende opties mogelijk zijn: - Optie 1: De examenkamer stelt vast dat je geslaagd bent voor het startsemester. Je bent toegelaten tot semester 2. - Optie 2: De examenkamer stelt vast dat je niet geslaagd bent voor het startsemester. Je bent niet toegelaten tot semester 2.

Studieadvies Als je voor de tweede keer het startsemester hebt gevolgd (herstart of maatwerktraject), krijg je aan het einde hiervan een studieadvies, omdat je dan 12 maanden bent ingeschreven. Dit is vastgelegd in de Onderwijs en Examenregeling (OER), artikel 32. Er zijn er dan twee opties: - Optie 1: De examenkamer stelt vast dat je het startsemester hebt behaald. Je krijgt een positief studieadvies en wordt toegelaten tot semester 2 van de door de jou gekozen basisstudieroute (gekozen verdiepende profiel in het startsemester). - Optie 2: De examenkamer stelt vast dat je voor de tweede keer er niet in geslaagd bent om het startsemester te behalen. Je krijgt een Bindend Negatief Studieadvies en zal de opleiding moeten verlaten.

2.1.1. Information about P-DB-Prof

Content

Bij FHICT word je opgeleid voor een vakgebied met veel en blijvende vernieuwing. Een ICT-professional moet zich continu blijven ontwikkelen. Tijdens jouw studie bij FHICT is er aandacht voor jouw professionele ontwikkeling (PO), waarin toekomstgericht organiseren, onderzoekend probleemoplossen, persoonlijk leiderschap en doelgericht interacteren centraal staan. Dit betekent dat je in het startsemester onder andere leert op welke manier je goed kunt samenwerken en communiceren. Daarnaast wordt jouw zelfregulerend vermogen, waarbij je kunt denken aan zelfreflectie en leerbehoeften, gestimuleerd. Kortom: In het startsemester wordt een basis gelegd voor jouw professionele houding, zodat je een goed beeld krijgt van jouw talenten en verbeterpunten en je je kunt blijven ontwikkelen. Nu, in het startsemester bij FHICT, maar ook later tijdens jouw loopbaan in het brede beroepenveld ICT.

Learning outcome

Je gedraagt je professioneel op het gebied van toekomstgericht organiseren, onderzoekend probleem oplossen, persoonlijk leiderschap en doelgericht interacteren.

Explanation

Toekomstgericht organiseren Je faseert -onder begeleiding- een gegeven opdracht in tijd en deeltaken waarin alle teamleden zich kunnen vinden. Je maakt afspraken over de verwachte kwaliteit. Je denkt in de uitwerking na over het gevolg van de oplossing voor betrokken mensen en organisaties.

Onderzoekend probleem oplossen Je blijft gedurende het hele oplosproces nieuwsgierig en vragen stellen. Je beantwoordt vragen met een passende aanpak: pragmatisch, kritisch en gebaseerd op bronnen.

Persoonlijk leiderschap Je ziet en grijpt kansen. Je motiveert jezelf. Je neemt verantwoordelijkheid voor jouw handelen. Je werkt resultaatgericht aan je opdracht of taak. Je maakt overwogen keuzes in je studieprogramma. Je herkent bij jezelf leerbehoeften. Je staat open voor feedback en reflecteert daarop.

Doelgericht interacteren Je houdt rekening met directe belanghebbenden bij de opdracht. Je hebt aandacht voor wat je wil communiceren en in welke vorm. Je neemt je eigen rol in de groep. Je herkent taken in het groepswerk. Je spreekt anderen aan op hun rol.

2.1.2. Information about P-DB-BUSN

Content

IT innovaties zorgen er voor dat bedrijven op andere manieren gaan werken. Vaak met een kostenreductie als hoofddoel. Door de IT innovaties veranderen werkprocessen in bedrijven. Denk bijvoorbeeld aan ziekenhuizen die veel efficiënter en patiëntvriendelijker onderzoeken kunnen uitvoeren, het garagebedrijf die sneller inzichtelijk heeft welke problemen bij een auto horen, de bank die het mogelijk maakt om thuis je bankzaken te regelen. Al deze veranderingen hebben twee belangrijke eigenschappen. Ze grijpen in op de manier waarop we de dingen doen. Oftewel: Het proces gaat anders door de invoering van IT. En de tweede eigenschap is dat IT innovaties vaak heel duur zijn. Bedrijven willen daarom grip hebben op de efficiëntie en de werking van de IT die ingezet wordt. Processen leveren veel data op en die data willen we kunnen analyseren om te kunnen aantonen dat een investering inderdaad nuttig is geweest. Voorbeeld: Bij de Albert Heijn (AH) kun je zelf je boodschappen scannen en afrekenen aan de snelkassa. Daar is geen kassière meer voor nodig. Voordeel: we kunnen het salaris van een kassière uitsparen. De procesverandering is dat de klant nu zelf zijn boodschappen moet scannen en afrekenen. Dat deed de kassière voorheen. Maar levert dat de AH nu echt meer winst (of minder kosten) op door deze innovatie van IT? En hoe toon je dat aan? Simpel: door data te verzamelen, te analyseren en daar conclusies uit te trekken. Dit is wat we bij Business leren. De komende tijd ga je zelf aan de slag met processen en data en zul je zien dat data en processen niet zonder elkaar kunnen.

Learning outcome

Je laat zien hoe je data omzet naar informatie om zo tot een advies te komen voor een verbetering in een organisatie.

Explanation

Toelichting oriënterend

Verbeteren van een organisatie Met behulp van aangeboden modellen maak je een bedrijfsproces inzichtelijk en geef je knelpunten hierin aan.

Data omzetten naar informatie

Je verwerkt ruwe data naar informatie op basis van een eenvoudige dataset of op basis van eenvoudige datamodellering en aangereikte tools.

Advies

Je geeft een onderbouwd advies op basis van je data analyse en procesbeschrijving.

Toelichting verdiepend

Verbeteren van een organisatie Met behulp van aangeboden en zelf gevonden modellen en tools maak je een IST ontwerp van een bedrijfsproces. Je maakt op basis van een knelpuntanalyse een SOLL ontwerp. Je beschrijft hoe de afgesproken key performance indicators behaald kunnen worden.

Data omzetten naar informatie

Je analyseert en transformeert ruwe gegevens uit databronnen naar betekenisvolle informatie voor de opdrachtgever op basis van een eigen ontworpen datamodel.

Advies Je geeft een onderbouwd en verantwoord advies ter verbetering van een organisatie aan de opdrachtgever.

Onderbouwen doe je door gefundeerd literatuur en data-analyses te gebruiken. Verantwoorden doe je door je bewust te zijn van de impact die dit oplevert en dit verwerkt in het advies. Het advies dient zo kort en krachtig mogelijk te worden gepresenteerd.

2.1.3. Information about P-DB-Infra

Content

ICT & Infrastructure gaat over het kunnen managen van de bestaande ICT-infrastructuur in al zijn facetten en het kunnen ontwerpen en realiseren van een nieuwe infrastructuur. Daarbij gaat het zowel om de technische kant (netwerk en serveromgevingen, cloud, automatiseren omgevingen, beveiliging), als om de bedrijfsmatige kant (afspraken, kosten, privacy overwegingen, organisatie). Onder ICT-infrastructuur wordt het geheel van ICT-middelen verstaan die de verwerking, de opslag en het transport van digitale data verzorgt. In het eerste semester maak je kennis met de basis van ICT-infrastructuur. Het gaat hierbij om kennis en vaardigheden die je helpen te begrijpen hoe Internet-technologie en dienstverlening via het Internet technisch werkt.

Learning outcome

Je demonstreert een zelfontwikkelde, beveiligde server- en netwerkomgeving op basis van een specifieke toepassing (service).

Explanation

Toelichting oriënterend

Ontwikkelen en demonstreren

Je creëert en demonstreert een werkende web service of andere netwerk service die goed functioneert en bereikbaar is vanuit het lokale netwerk (LAN).

Server en netwerkomgeving

Je kunt een eenvoudige netwerktekening maken.

Je kunt uitleggen hoe client-server communicatie werkt.

Je kunt Hardware-virtualisatietechnieken toepassen.

Beveiliging

Je houdt rekening met elementaire beveiligingsinstellingen van componenten.

Toelichting verdiepend

Ontwikkelen

Je doorloopt een analyse-, ontwerp- en realisatie- fase. Je creëert en demonstreert een werkende service op het netwerk, toegankelijk vanuit verschillende netwerken en inclusief motivering van keuzes. Je bent in staat om extra diensten op je netwerk te implementeren (bijvoorbeeld NAT).

Demonstreren

Je laat een werkende service met cliënt(s) zien die als specifieke toepassing draait binnen een kleine netwerkomgeving. Je kunt de configuratie aanpassen en de impact op de omgeving daarvan beschrijven. Je verantwoordt de gekozen netwerkcomponenten.

De server en netwerkomgeving

Je analyseert requirements om van daaruit een netwerkontwerp met netwerktekening te maken.

Je server en netwerkomgeving realiseer je in een virtuele infrastructuur.

Je bent in staat om verschillende configuraties toe te passen en de impact daarvan op de infrastructuur te bepalen.

Beveiliging

Je analyseert de beveiligingsaspecten rondom de door jou ontwikkelde infrastructuur en kunt daar een conclusie aan verbinden.

2.1.4. Information about P-DB-Media ICT & Media Design

Content

ICT & Media Design is de verbindende factor tussen ICT en de mens. Je leert hoe je behoeften van gebruikers vertaalt naar digitale ontwerpen die van waarde zijn voor mens en maatschappij. Je ontwikkelt je creatieve vaardigheden, je bouwt prototypes en je test die onder gebruikers. Je werkt met JavaScript en HTML & CSS en elke andere programmeer- of codeertaal waarmee je de gewenste applicaties kunt maken. Studenten ervaren ICT & Media Design als een combinatie van user centered design, communicatie en front-end development.

Begrippen die je vaak zult tegenkomen zijn storytelling, gamificatie, experience design en interaction design. Dat zijn de termen die beschrijven hoe gebruikers hun omgang met de digitale wereld beleven. In bedrijven kun je aan de slag als webdeveloper, front-end developer, UX-designer en UX-researcher en als digital marketeer. In je opleiding krijg je ruimte om te experimenteren en je technische en artistieke talenten te ontwikkelen. Je studeert in een vrije omgeving waar fouten maken mag. De professionele houding die je ontwikkelt, kenmerkt zich door nieuwsgierigheid en ondernemend en onderzoekend gedrag.

Learning outcome

Je realiseert op basis van trends en ontwikkelingen middels een iteratief proces interactieve prototypes voor een doelgroep.

Explanation

Toelichting oriënterend

Trends en ontwikkelingen Je oriënteert je op de actuele stand van zaken op het gebied van digital experience design en technologie. Denk hierbij aan bijvoorbeeld big data, mixed reality en artificial intelligence. Je verzamelt hiervan voorbeelden in het dagelijks leven.

Iteratief proces Gevoed door feedback van gebruikers en experts voer je herhaaldelijk veranderingen door met als doel je product te verbeteren. Je laat deze iteraties, en de door jou verzamelde feedback, zien in je werkproces.

Interactieve prototypes Je hebt prototypes gemaakt om de interactie van je product te ontwikkelen. Je gebruikt een opmaaktaal zoals HTML en CSS.

Doelgroep Je hebt je georiënteerd op de interesses en behoeften van de eindgebruiker.

Toelichting verdiepend

Trends en ontwikkelingen Je hebt je verdiept in diverse ontwikkelingen op het gebied van digital experience design. Je hebt hier een mening over gevormd. Op basis hiervan beargumenteer je de keuze van je studierichting.

Iteratief proces Je laat iteraties zien in het werkproces en legt uit hoe feedback van gebruikers en experts heeft bijgedragen aan je ontwerpkeuzes. Je ontwerp voldoet aan de behoeften van de eindgebruiker en is esthetisch verantwoord.

Interactieve prototypes Je maakt digitale producten, die een doelgerichte interactie tussen mens en machine tot stand brengen. Je hebt hiervoor schetsen, wireframes en prototypes gemaakt. Je gebruikt hierbij o.a. HTML, CSS en andere programmeertalen.

Doelgroep Je houdt tijdens jouw ontwikkelproces rekening met interesses en behoeften van de eindgebruiker.

2.1.5. Information about P-DB-Soft

Content

Je leert bij Software Engineering de basis van programmeren. Daarnaast wordt tijdens het traject duidelijk wat Software Engineering nog extra inhoudt behalve programmeren. Je maakt kennis met verschillende technieken om een eigen product te ontwerpen en te programmeren. Je oriënteert je goed door veel te experimenteren. Voorkennis is niet belangrijk, enthousiasme en inspanning wel. Het lesprogramma stimuleert je om jouw analytische skills en doorzettingsvermogen te gebruiken. Je gebruikt de kennis die je opdoet ook bij de andere profielen om te komen tot zinvolle producten.

Learning outcome

Je ontwikkelt software applicaties met aandacht voor algoritmiek, waarmee je de basisvaardigheden programmeren aantoont.

Explanation

Toelichting oriënterend

Aandacht voor algoritmiek Je kunt eenvoudige applicaties schrijven die stapsgewijs oplossingen voor problemen vinden door het uitvoeren van logische testen en eenvoudige stapsgewijze berekeningen

Basisvaardigheden

Je begrijpt en past de volgende programmeerconcepten toe:

Variables, conditional statements, loops, methods, lists/ arrays and enum’s.

Aantonen

Je vraagt feedback van een docent en laat zien dat je deze feedback verwerkt hebt.

Toelichting verdiepend

Aandacht voor algoritmiek

Je kunt (eenvoudige) object-georiënteerde applicaties schrijven die stapsgewijs oplossingen voor problemen vinden door het uitvoeren van logische testen en eenvoudige stapsgewijze berekeningen

Basisvaardigheden

Je begrijpt en past de volgende programmeerconcepten toe:

objects/ classes, constructors, private fields/ encapsulation, get/ set- methods en/ of properties, method/ constructor overloading, class diagrams/ relations/ multiplicity.

De focus hierbij is op leesbare (b.v. naamgeving, indentation) en onderhoudbare software programma’s.

Je ontwerpt een class diagram (met uitleg) waarin de belangrijkste functionaliteit terug te vinden is.

Aantonen

Je vraagt feedback van een docent met software engineeringskennis en laat zien dat je deze feedback verwerkt hebt.

2.1.6. Information about P-DB-Tech

Content

ICT & Technology houdt zich bezig met het ontwikkelen van software voor andere platformen dan standaard PC's. Deze platformen, embedded systemen genaamd, hebben vaak een sterke koppeling met de fysieke wereld. Deze cursus laat je kennismaken met programmeren op een embedded platform zoals de Arduino. Op dit platform kun je verschillende sensoren en actuatoren aansluiten. Met sensoren kun je informatie aan de omgeving onttrekken en met actuatoren kun je de omgeving fysiek beïnvloeden. De interactie met de fysieke wereld brengt met zich mee dat je aannames en verwachtingen betreft de werking van gemaakte producten moet toetsen aan de werkelijkheid.

Learning outcome

Je ontwikkelt en programmeert interactieve embedded systemen, waarbij sensoren en actuatoren toegepast worden, die verschillende I/O technieken gebruiken.

Explanation

Toelichting oriënterend

Interactieve embedded systemen

Je stelt een systeem samen welke bestaat uit verschillende componenten. Hiervoor maak je gebruik van een microcontroller board, sensoren en actuatoren.

Je systeem kan communiceren met een ander systeem volgens een eigen gedefinieerd protocol.

Programmeren

Je begrijpt en past de volgende programmeerconcepten toe: variables, conditional statements, loops, functions, arrays.

De focus hierbij is op het werkend krijgen van het product.

Sensoren

Je kunt sensoren toepassen, zoals een button, potentiometer, afstandssensor.

Actuatoren

Je kunt actuatoren toepassen, zoals een led, motor, buzzer.

Verschillende I/O technieken

Je kunt verschillende I/O technieken toepassen, zoals digitale input en output en analoge input.

Toelichting verdiepend

Interactieve embedded systemen

Je product kan communiceren met een ander systeem volgens een eigen gedefinieerd protocol inclusief parameters waarbij ongeldige berichten worden afgevangen.

Programmeren

Je past alle imperatieve programmeer-concepten en de volgende OO concepten toe: objects, classes en encapsulation, d.w.z.: constructors, private fields, properties en methods.

De focus hierbij is op leesbare (b.v. naamgeving, indentation) en onderhoudbare programma's en robuustheid van het product.

Sensoren en actuatoren

Je past extra sensoren en actuatoren toe waarnaar een eigen analyse is gedaan.

Verschillende I/O technieken

Naast de genoemde I/O technieken kun je ook pulsbreedtemodulatie en analoge input interpreteren en toepassen.

3. Information about

3.1. Information about V-B2-BA BA ICT & Business OE2

Entry requirements

Voor professional skills worden nog geen eisen gesteld.

	Gebruikers interactie	Organisatieprocessen	Infrastruc-tuur	Software	Hardware interfacing
Analyseren					
Adviseren		1			
Ontwerpen	1	1		1	
Realiseren		1		1	
Manage & control					

Learning Outcomes

Learning outcome 1: Business analysis You show that you can systematically analyze organizational processes and advise how these processes can be optimized. You include relevant financial aspects in this.
Explanation The **organization** is small or medium sized. An organizations has a common purpose. This ultimately determines the application of IT. **Analyzing** an organization and its environment is a basic skill for any IT professional.

Learning outcome 2: Data modeling and design You model, design, prepare, store and question a dataset using proper and meaningful designing techniques
Explanation: **Modeling and designing a dataset** consists of creating a datamodel within a business context. Based on this datamodel you design and implement a database to store the company data. Based on company kpi's you implement management reports in the database.

Learning outcome 3: Dataset analysis

You prepare data and perform a statistical analysis on data to create meaningful information using a data analysis and reporting tool.
Explanation **Preparing data** includes tidying and transforming data into a clean and tidy dataset that is suitable to perform an exploratory data analysis. **The Analysis** consists of creating statistics, visuals and conclusions resulting in a report suitable for a client.

Learning outcome 4: Communicate with a customer
You propose a data-driven innovation with a motivated business case and you communicate this with the customer in an understandable way
Explanation A **data-driven innovation** takes the available data as the starting point of the search for a new product or service that answers customer demand. A **business case** adds meaning to the customer and / or organization and takes into account relevant, financial and non-financial aspects. The **Customer** can be either customer of our organization (external customer) or customer in our organization (internal customer). **Communication** with the customer includes selecting and applying a conscious form of communication to the customer.

Learning outcome 5: Systematic approach
You independently acquire knowledge and work in a methodical systematic way on problems from the professional field.
Explanation You describe how and why you have developed a working prototype according to the Minimal Viable Product Design, taking into account ethical aspects. Your independently acquired knowledge (aimed at the professional field) ensures sufficient understanding of the organization and relevance of your professional product

Learning outcome 6: Professional teamwork
You work professionally and are an effective co-worker
Explanation Professional means that you can functionally cooperate with other people, both with students, teachers and with employees of external organizations involved in S2B. You demonstrate that you

communicate, collaborate, organize and develop effectively at level 1.

Learning outcome 7: Study progress
You create insight into your own development by requesting, interpreting and applying feedback from teachers, coaches and fellow students in order to develop further.
Explanation Creating insight into your own development provides guidance for lifelong learning and gives you the opportunity to steer your development as a future professional

3.1.1. Information about V-B2-BA-CB BA B OE2 Course based

Introduction

Introduction

Welcome to semester 2 ICT and Business course-based at Fontys ICT.

In this semester the education is designed according to the principles of course-based learning. The focus lies on learning in the context of real-life tasks, and on clarity and predictability concerning learning outcomes, educational activities and assessment. At the beginning the education is more teacher-driven, and gradually you will take more ownership of your own learning process. You will first learn the basics concepts within the context of examples and tasks that you will encounter in your later work as an ICT professional. From this base, you will be stimulated to make well-founded choices about your own learning path.

The learning environment is organised in such a way that you interact closely with your teachers and fellow students. The physical learning environment, also called Open ICT Lab (OIL), consists of classrooms for planned lessons with your class, but also of more general areas for guided self-study, working on assignment & projects, learning and meeting up with fellow-students and teachers.

Content

The focus of this semester is on a small organization in the field of ICT and Business, making a start on your further development in the ICT and Business profile. In doing so you will also develop professional skills that are relevant to all ICT professionals. During this semester you will learn aspects from the following courses:

- Business Principles
- R Databases
- Business Research

You will be working on one large project scheduled for 18 weeks in total. During the project you will work in small student groups to assess a business problem and provide a possible solution. During the project you are supported by different courses and workshops. The workshops will be scheduled during the semester to give additional insight. Courses will be scheduled in blocks of six weeks, of which the last week is reserved to finalize the topic discussed during the earlier weeks.

In the following sections you can find a description of the different learning outcomes for this semester and assessment criteria. These learning outcomes describe the level you are expected to reach during this semester and form the entrance level to Semester 3.

Examination and grading

Examination

How is semester 2 couse-based assessed?

At Fontys School of Information and Communication Technology, we use learning outcomes as the base for the integral semester assessment. By the end of semester 2 you need to have demonstrated that you have achieved all the learning outcomes. By week 18 you have demonstrated the level for the learning outcome of the ICT and Business semester 2 profile, and your level on the Professional Skills learning outcome.

Formative indications for the learning outcomes

A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. In this meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes: assignments, tests, demo's, teacher feedback, observations, etc. During semester 2 you will receive the following formative indications as specified below. These outcomes are directly related to the different learning outcomes.

Week 18	3 formative indications are given per course • Business Principles • R Databases • Business Research
Week 18	1 formative indication is given for the project, including the: • Balanced score card • Factsheet • Prototype 1 formative indication is given for the professional skills demonstrated throughout the semester.

Every formative indication is valuated according to the decision guidelines below. Based on these decision guidelines all formative indications will be expressed in terms of the following formative indications: Outstanding (O), Good (G), Satisfactory (S), Unsatisfactory (U), Poor (P).

Valuation	**Explanation**
Outstanding (O)	You have demonstrated the learning outcome at an outstanding level. This means that you have shown your development at the level described in the explanation of the learning outcome. And, on top of that you have shown a significantly higher development on several of the assessment criteria.
Good (G)	You have demonstrated the learning outcome at a good level. This means that you have shown your development at the level described in the explanation of the learning outcome.
Satisfactory (S)	You have demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, but that you have shown a sufficient level.

Unsatisfactory (U)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing one or more essential aspects in your development.
Poor (P)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing many essential aspects in your development.

Summative, integral semester assessment (week 19)

Based on the valuation of the learning outcomes, the assessors (= all involved teachers) decide during the assessor meeting in week 19 on your integral semester assessment result. The guidelines below are used to decide on this result. In well-motivated cases, the assessors can deviate from these guidelines.

Pass (30 EC)	Outstanding (O)	The project formative indication: at least good 3 profile course lines formative indication: at least good Professional Skills learning outcome: at least good
	Good (G)	The project formative indication: at least good 3 profile course lines formative indication: at least satisfactory Professional skills learning outcome: satisfactory / good
	Satisfactory (S)	The project formative indication: satisfactory 3 profile course lines formative indication: satisfactory Professional skills learning outcome: satisfactory
Fail (0 EC)	Unsatisfactory (U)	< Satisfactory (S)

Tools allowed

Within the courses and projects, you will receive specific information about permitted tools and aids. You can find general information on this in the 'Exam procedures and fraud policy', available on Student Square (Fontys ICT portal).

Resits and repairs

During the semester you work on learning activities to develop towards and show the expected level on the learning outcomes. You have several opportunities to demonstrate your level, and will receive

feedback on how your development progresses. As described above, in week 18 your teachers will valuate your level on the learning outcomes.

If you fail the semester, you can retake it all during the following semester. In some cases you get the opportunity to do a tailor-made semester.

Grading

How is the assessment determined?

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 3 of the chosen advanced level profile. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC, and are not admitted to semester 3.

In case you do not agree with the grading you have received or how you have been assessed, you are entitled to appeal to the Exam Board. The Exam Board will then inform you about the further procedure. You can contact your mentor for more information about appeals.

Decision on placing in next semester

At the end of the semester, based on the decision taken at the assessor meeting, the exam board will place you in your follow-up semester. This will be one of the following options:

- You have completed the semester: You receive 30 EC and are admitted to semester 3 depending on your own choice of enrolment:
    - Course based semester 3ICT and Business profile;
    - Demand based semester 3 ICT and business;
    - An open semester in which you set your own learning outcomes.

Note: Enrolment information and deadline and materials to orientate for this choice will be available during the semester. Discuss your active orientation and choice with your semester coach.

You have *not* completed the semester: You receive 0 EC and are *not* admitted to semester 3. During the assessor meeting the decision will be made whether you need to restart semester 2, or whether you are offered the opportunity to do a tailor-made semester.

Appeal to Examboard

In case the grading procedure was not followed correctly or invalid criteria have been used to determine the grade, you can appeal to the Exam Board. In such case, you need to be explicit about which part of the procedure was not followed or which criteria were used for grading. Simply disagreeing with the examiner is not a valid reason to appeal. You can contact your mentor for more information about appeals.

Learning activities

Semester 2 is made up of many different learning activities, organised in courses and projects. During this semester you are guided by your tutor, both individually and as part of a group of fellow-students. Your tutor is a teacher who will guide you on the development of your professional skills (which you develop during the courses and projects).

Project Phase (week 1-18)

During the project phase you will apply the studied materials from the different courses and workshops in an authentic project.

Courses

The three course lines are the following:

- Business Principles
- R Databases

- Business Research

The courses correlate strongly to the project and will help you to complete the required deliverables. However, in these courses you are also introduced to basic skills and knowledge that are relevant to all ICT professionals. The learning activities are placed in the context of real-life tasks, to show the relevance to your future working life. All courses have weekly lessons, and additional guided self-study hours.

Note: You can find all the detailed information about the content, learning materials and assignments of these courses in the canvas course.

Business Principles (week 1-18)

In business principles you will learn about the generic operational processes of the organization. These will help you to analyse and understand an organization and places you in to position to give an advice on managerial level. The course is subdivided in three blocks of 6 weeks, of which the last week is reserved to complete the subtopic discussed in this block. All different formal deliverables for this course will be taken into account for the formative indication. The Canvas course specifies on the details regarding the deliverables.

R Databases (week 1-18)

In R Databases you will learn how to structure data and to research the available data. Making the transformation from data to information allows you to communicate and support the advice you want to give within the organization. The analysis you make with the gained data is supported with statistical support. The course is subdivided in four blocks of 6 weeks, of which the last week is reserved to complete the subtopic discussed in this block. All different formal deliverables for this course will be taken into account for the formative indication. The Canvas course specifies on the details regarding the deliverables.

Business Research (week 1-18)

In Business Research you will learn how to conduct an applied research for an organization. Being able to formulate the correct research proposal with corresponding question, planning and final reporting allows you to communicate effectively with the organization. The course is subdivided in two blocks of 6 weeks, of which the last week is reserved to complete the subtopic discussed in this block. All different formal deliverables for this course will be taken into account for the formative indication. The Canvas course specifies on the details regarding the deliverables.

Summative Assessment (week 19)

All the work you did and the development you showed during the orientation and the advanced phase are assessed by your teachers. The assessor meeting takes place without the students. You will be informed about the outcome of the assessor meeting by your mentor. The official result will follow after the exam board has formalised the assessment decisions.

Huge leap week (week 20)

During the last week of the semester you have the opportunity to participate in workshops and other sessions organised by your fellow students (and perhaps by you too). These sessions can be on all kinds of topics that can be relevant to the IT profession. You will get to meet and discuss with students from all years, teachers, and our Partners in Education (companies that we collaborate with in our education).

Resources

All materials are available via Canvas and the internet.

3.1.2. Information about V-B2-BA-DB BA B OE2 Demand based

Introduction

1.1.Demand-based leervorm

Deze uitvoering van het semester is ingericht met als basis de demand-based leervorm. Uit de keuze voor een leervorm of didactiek kun je opmaken hoe de docent kennis en vaardigheden overbrengt naar studenten, zodat zoveel mogelijk tegemoet gekomen kan worden aan de verschillende behoeften van zowel studenten, als docenten. Binnen de demand-based leervorm kies je voor een flexibele leerweg, waarbij de leeruitkomsten en beoordelingscriteria door de opleiding zijn vastgelegd. Dit betekent dat je als student zelf je eigen leerproces in handen kunt nemen en zelf keuzes kunt maken in de leerweg naar het aantonen van de leeruitkomsten toe. Je kunt gedurende het semester in de demand-based leervorm keuzes maken uit diverse onderwijsactiviteiten en studiematerialen, waaronder ook het doen van een eigen voorstel. In het semester zal je op die manier aan de slag gaan met als vertrekpunt een uitdagende vraag, probleem of challenge, waarbij je zelf leervragen gaat formuleren. Deze leervragen zullen betrekking hebben op het analyseren van het vraagstuk en het ontwerpen en realiseren van een oplossing. Op deze manier ga je nieuwe kennis en inzichten opdoen, zodat je deze kennis en inzichten vervolgens in de praktijk kunt gaan toepassen. Ieder vraagstuk leidt dus tot een concreet product of meerdere deelproducten, gericht op jouw oplossing voor het vraagstuk dat je zelf gekozen hebt. Om je op weg te helpen met het oplossen van een bepaald vraagstuk zul je zowel inhoudelijke begeleiding, als begeleiding op het proces van de docent ontvangen. De nadruk zal op de procesbegeleiding liggen, aangezien jij zelf bepaalt met welk vraagstuk je aan de slag wilt gaan en wat jouw leervragen hierbij zijn. Op basis van jouw vragen en behoeften, zal de docent je coachen en begeleiden bij het maken van concrete producten, waarmee je de leeruitkomsten kunt aantonen. Jij bent zelf aan zet!

1.2.Inhoud

In semester 2 Business ga je werken aan veel verschillende thema's. Je bekwaamt je in bedrijfskundige thema's, data-analyse en overkoepelende professionele skills. Omdat de thema's niet los van elkaar kunnen bestaan, werk je in dit semester aan een drietal beroepsproducten waarin deze thema's samenkomen. Deze werk je uit in de context van de proftaak. In semester 1 heb je al kennis gemaakt met de verschillende thema's bij Business. In semester twee bouwen we hierop voort.

Beroepsproducten De beroepsproducten die in dit semester gemaakt worden zijn:

Balanced Score Card Je werkt hierbij het model van de balanced score card uit binnen de proftaak.

Factsheet In de factsheet vertaal je data-analyses naar een aantrekkelijk, begrijpelijk en leesbaar document.

Prototype Het prototype is een realisatie van de abstracte uitwerking van de balanced score card en de factsheet naar een voor de opdrachtgever herkenbaar en werkbaar product.

Proftaak (PT)

In semester 2 komen veel verschillende onderwerpen aan bod die allemaal essentieel zijn bij het begrijpen, verbeteren en ontwikkelen van bedrijfsprocessen met behulp van ICT-middelen. Omdat geen enkel onderwerp op zichzelf staat en juist het begrijpen en benutten van de onderlinge samenhang de kracht is van een goede ICT & Business professional, staat toepassing van opgedane kennis en kunde centraal in dit semester. Hiertoe is de proftaak leidend, wat betekent dat je alle leeruitkomsten van dit semester dient aan te tonen met behulp van de proftaak.

Onder een proftaak verstaan we het in groepsverband formuleren, uitvoeren en voltooien van een totaalopdracht. In de proftaak wordt op projectmatige wijze een op de praktijk gesimuleerde probleemsituatie aangepakt. Er wordt een gezamenlijke uitgangssituatie geschetst maar vervolgens staat het de proftaakgroepen vrij een onderwerp te kiezen. Ook is het mogelijk dat probleemsituaties worden verstrekt door één of meerdere van onze Partners in Education (PiE's). De PiE's fungeren in dat geval als opdrachtgever.

Professioneel Handelen

Naast goed vakmanschap is ook professioneel handelen van groot belang. Goede professionals zijn mensen die uiterst sensitief zijn in organisatiebelangen, goed kunnen samenwerken en goed kunnen

communiceren. Dit ook om invloed te kunnen uitoefenen op je omgeving. Een professional word je niet zomaar. Je zal jezelf hierin diepgaand en langdurig moeten bekwamen. Hierin onderscheidt een professional zich dan ook van een puur inhoudelijk deskundig of bekwaam persoon.

Professionele Ontwikkeling (PO)

In het startsemester heb je je kunnen oriënteren op ICT én jezelf. Ook heb je ervaren en geleerd wat er allemaal komt kijken bij het samenwerken in een project: elkaar goede feedback geven, plannen, vergaderen en het maken van goede onderlinge afspraken. Hierop pakken we bij ICT & Business in semester 2 door. Je toont niet alleen aan wat je kunt, maar ook hoe je dat bereikt. Je werkt op een prettige manier samen, je neemt niet alles klakkeloos aan en reflecteert op wat je nog wilt leren. Dit soort vaardigheden behoren tot jouw Professionele Ontwikkeling (PO). Om je hierbij te helpen doorloop je PO-workshops. Ook toon je aan dat je op B2 niveau kunt schrijven. Dat kun je aantonen door de toets te halen van een online zelfstudie- en toetsprogramma of door op andere manier (oefenresultaten) in je portfolio aan te tonen dat je voor het afstuderen op C1 niveau zit.

Om jouw professionele ontwikkeling in kaart te brengen ontwikkel je gedurende het semester een verantwoordingsdocument. Hierin verantwoord je jouw gemaakte keuzes en toon je jouw ontwikkelingsgerichte groei.

Examination and grading

Examination

Hoe wordt het semester getoetst?

Gedurende het semester verdiep je je via velerlei werkvormen in de verschillende thema's. Je laat zien hoe je leert, jezelf ontwikkelt en daarbij gebruik maakt van feedback, -up en -forward. Je leer- en ontwikkelproces laat je regelmatig valideren* door de themadocenten en semestercoach. De opgedane kennis en ervaring pas je toe in beroepsproducten. Door gebruik te maken van feedback, -up en -forward maak je beroepsproducten waarmee je een leeruitkomst aantoont. Uiteindelijk laat je je beroepsproducten regelmatig valideren* door de themadocenten en semestercoach.

Zowel de resultaten van je ontwikkel- en leerproces alsmede je gevalideerde beroepsproducten neem je op in een semesterportfolio. Aan het einde van het semester vindt een integraal assessment plaats in de vorm van een portfolioschouw, waarin een eindbeoordeling van het gehele semester wordt gegeven.

De portfolioschouw vindt alleen plaats als een portfolio op tijd en volledig wordt opgeleverd. Als er geen portfolioschouw plaatsvindt, resulteert dit in een onvoldoende eindbeoordeling.

De portfolioschouw is van inzagetype A.

* Validatie kan op de volgende manieren:

- formatieve feedback van de themadocent, schriftelijk gegeven;
- formatieve feedback van de themadocent, mondeling gegeven en vervolgens door de student in Canvas gedocumenteerd en -op initiatief van de student- door de themadocent gevalideerd;
- terugkoppeling in de vorm van een formatieve UOBPA (Undefined-Orienting-Beginning-Proficient-Advanced. Zie ook 4 Hoe wordt de beoordeling vastgesteld).

Tools allowed

Niet van toepassing.

Resits and repairs

Ons onderwijs maakt mogelijk dat jij gedurende het semester leeruitkomsten kunt aantonen. Dit doe je op basis van longitudinale feedback waarbij je jouw product en prestaties veelvuldig toont en de docent een goed beeld heeft van het doorlopen leerproces. Voorwaarden hiertoe zijn dat je regelmatig aanwezig bent (≥ 80%) en regelmatig feedback vraagt van de docent (≥ eens per twee weken). Je verwerkt deze feedback en valideert dit bij de docent. Indien je tijdens het semester niet voldoende

aanwezig bent, niet regelmatig feedback vraagt én de verwerking hiervan niet valideert, kan dit niet meer in de laatste week of weken rechtgezet worden. Een goed beeld van het doorlopen leerproces zou in dat geval namelijk ontbreken. De portfolioschouw kan dan ook **niet** herkanst worden binnen het semester. Herkansing is pas mogelijk in het aansluitende half jaar, middels herstart of maatwerk (zie OER, artikel 28).

Grading

Als alle leeruitkomsten uit dit semester individueel gewaardeerd zijn, wordt in overleg met alle betrokken assessoren de eindbeoordeling van het semester bepaald conform de planning op canvas. De assessoren hanteren daarbij beoordelingsrichtlijnen, of leggen uit waarom ze hiervan afwijken.

De beoordelingsrichtlijn betreft de vertaalslag van de ontwikkelingsgerichte feedbackschaal (Undefined-Orienting-Beginning-Proficient-Advanced) naar de summatieve, integrale semesterbeoordeling (Unsatisfactory-Satisfactory-Good-Outstanding).

Beoordelingsrichtlijnen:

- Een student die voor een leeruitkomst de status lager dan Proficient (P) heeft, kan nooit een hogere eindbeoordeling dan Unsatisfactory (U) krijgen.
- Een student die voor alle leeruitkomsten de status Proficient (P) heeft, krijgt de eindbeoordeling Satisfactory (S) of Good (G).
- Een student die voor een of meer leeruitkomsten de status Advanced (A) heeft, krijgt de eindbeoordeling Good (G) of Outstanding (O).

De assessoren bepalen de eindbeoordeling op basis van het beeld wat de student gedurende de **hele** periode heeft laten zien.

De summatieve beoordeling wordt aan het eind van de portfolioschouw uitgedrukt in Unsatisfactory (U)/ Satisfactory (S)/ Good (G)/ Outstanding (O). Unsatisfactory resulteert in herstart.

Learning activities

Inspiratiecolleges, werkcolleges, gastcolleges, workshops, groepsgewijs werken aan een casusopdracht, onderzoeksopdracht bij (of in samenwerking met) een extern bedrijf, projectwerk (proftaak), werkgroep besprekingen en zelfstudie.

Resources

(Status: x = verplicht, o = aanschaffen na overleg)

ISBN	Titel	Druk	Auteur	Uitgever	Prijs	Status
9789001876814	Beginselen van de Administratieve Organisatie	3e	M. Paur e.a.	Noordhoff Uitgevers	€48,95	O
9789001831592	Basisvaardigheden toegepaste statistiek HO	2e	Buuren, H. en Reus, G.J.	Noordhoff Uitgevers	€28,95	O
9781615473021	Slaying Excel Dragons (e-book)		Mike Girvin	Holy Macro Books	€18,50	O
9781491910399	R for Data Science	2e	Hadley Wickham & Garrett Grolemund	O'Reilly	€34,99	O
	Licentie Hogeschool Taal		www.hogeschooltaal.nl	Noordhoff	€55,00	X

De lijst van gebruikte software is te vinden in de canvas course van semester 2.

3.2. Information about V-B3-BA BA ICT & Business OE3

Entry requirements

Professional skills op niveau 1.

	Gebruikers interactie	Organisatieprocessen	Infrastruc-tuur	Software	Hardware interfacing
Analyseren	1	1	1	1	
Adviseren	1	1	1		
Ontwerpen	1	1		1	
Realiseren		1		1	
Manage & control		1	1		

Learning Outcomes

Learning outcome 1: Business analysis You show that you can systematically analyse organisational processes and advise how these processes can be optimized.
Clarification The **organisation** is medium to large size and part of a supply chain and therefore **processes** are assessed on governance, risk and compliance. **Analysis** consists of the correlation of the bottlenecks and cause-effect relationships of the organisation within the supply chain.

Learning outcome 2: Exploratory Data Analysis You create informal insight through an Exploratory Data Analysis (EDA).
Clarification **Creating insight**, comprises the definition of the right sources, collecting usable data (subsets) from those sources, joining, transforming and cleaning the data. In addition, you evaluate and assess the **quality of the data** (completeness, consistency, conformity, accuracy, integrity and timeliness). Finally, you create visuals of the prepared data. The insight creation is in the visualisation of the data and the possible interpretation of it. Often, it is up to the business representative to come up with conclusions and actions based on these visualizations.

Exploratory Data Analysis (EDA) includes usage of SQL, tidyverse (with R Studio) and end user BI tools.

Learning outcome 3: Explanatory Data Analysis
You create formal insight in the data using basic statistical modelling.
Clarification
Explanatory Data Analysis continues where Exploratory Data Analysis stops: based on the data preparation and the insights gained from informal, visual analysis, **formal models** are applied to the data to get further insight. Use of **models** in Explanatory Data Analysis in LE3 Business will be restricted to **simple linear modelling** and **simple time series analysis**.

Learning outcome 4: Business optimisation
You realise the suggested IT system (or part thereof) based on the design, implement this in the organisation and measure and monitor the usage.
Clarification
Realise the **implementation** and acceptance of procedures in correlation with new or adapted information provision and control. Educate and train end users in the renewed processes and use of a new IT. Build and validate the Proof of Concept. Structure a standard application (for example, CRM, ERP, BI).

Learning outcome 5: Targeted interaction
You determine which partners play a role in the IT assignment, constructively collaborate and fitting communication aimed at achieving the desired impact.
Clarification
You have attention for the various groups of collaborative **partners** including the stakeholders, interest groups and own team members. You pay attention to what you wish to **communicate** and the impact you wish to make, the most appropriate form to achieve this and the actual execution thereof. You are aware of your role in the context of the IT assignment, exploring and tackling the tasks involved, addressing others,

searching for enrichment and building up trust in an inter-disciplinary and inter-cultural context.

Learning outcome 6: Investigative problem solving
Critically consider IT assignments from various perspectives, identify problems, finding an effective approach and coming up with appropriate solutions.
Clarification **Identifying the problem**, determining the aim of **solution** and picking an appropriate **approach**. Being curious throughout the solving process and asking questions from **various perspectives**, matching these questions with fitting **approach** that is pragmatic, critical and based on answering sources. Being able to **methodically** and creatively solve problems, finding alternatives and **critically** analysing own and others' line of reasoning.

Learning outcome 7: Future-oriented organisation
You explore the organisational context of IT assignments making corporate, sustainable and ethical considerations and managing all aspects of carrying out the assignment.
Clarification In **the organisational context** you identify the hallmarks and roles of the environment of the assignment and know the business legitimisation. By **making corporate, sustainable and ethical considerations** you know the ethical standards, involve social ethical themes in the judgement process, recognise own boundaries and those of others and act accordingly. **Managing all aspects** means you make an inventory of subtasks, plan and monitor time, money, quality and ethics of the execution of the work activities, recognise opportunities and risks and ensure a future-oriented embedding of the solution in the organisation.

Learning outcome 8: Personal leadership
You are entrepreneurial in regard to the IT assignments and personal development, while being aware of own learning capacity and keeping in mind what ambitions drive IT professionals and/or which types of positions.
Clarification

Entrepreneurial means you are aware, seeing opportunities and seizing them, motivating oneself and others, being able to profile oneself, a team and others. You are aware of your own development, showing leadership and taking responsibility.

According to **personal development** you make a well-considered choice of study, enhancing your own learning capacity, recognising a learning need in yourself and acting accordingly through reflection, evaluation, demanding and giving feedback actively.

You examine what type of professional you want to be in the long term, which field and type of positions you aspire to and how you can stand out from others in the branch.

Introduction

This document contains general information about the 3rd semester. Some sections are split into Eindhoven/Tilburg where differences apply.

Course-based learning

With the course-based teaching method, you know what you will be studying in advance and what your learning activities will be. The lessons, the workshops, the guidance and the projects in practice have been planned by the teachers beforehand. You get frequent feedback on the lessons, during the guidance moments and on the submitted assignments.

The order of the learning activities is also established in advance. This provides structure and the assurance of knowing to expect. Once you have good theoretical knowledge, you will start learning how to apply it in practice.

Demand-based learning

With demand-based learning, you are free to decide how you will approach the semester. This will correspond with what you already know. You can also determine your own pace.

The learning outcomes have already been set and these form the basic starting points of this teaching method. On your own, you search for knowledge and the skills you need (together with other students in your group) in order to be able to solve important real-world issues. Teaching materials are offered in an online learning environment, but you can also consult your own sources. The instructor will help you with any questions you may have and provide feedback frequently. If necessary, workshops and instructions can be arranged.

Contents

Information about IPHB3 Integraal Professioneel Handelen voor Business S3

The focus of this semester is on a medium to large sized organisation which is part of a supply chain. During this semester you show that you can **systematically analyse organisational processes** and **advise** how these **processes** can be **optimised**. In order to **analyse** these processes you will **create informal insight** through an **Exploratory Data Analysis** (EDA). Besides that, you will **create formal insight** in the **data** using **basic modelling**. Using these insights, you **realise** a suggested **IT system** (or part thereof) based on your **design**, **implement** this in the **organisation** using given techniques and **measure** and **monitor** the **usage** using given formats and/or **methods**.

Professional Task

The professional task, in which we work together with our Partners in Education (PiE's), offers you the opportunity to integrate and apply the above skills together with your fellow students. In addition, you will professionalise yourself during the professional task with regard to the following four learning outcomes in the field of Personal Development: **Targeted interaction, Investigative problem solving, Future-oriented organisation** and **Personal Leadership**.

Examination and grading

Examination

Testing

During the semester, you work in various ways on varying themes and topics. You show the teachers how you learn, develop yourself and use feedback, feed-up and feed-forward. You regularly validate* your process of learning and development with the theme teachers and semester coach. The acquired knowledge and experiences are applied into your professional products. By using the feedback, -up and -forward you create professional products to prove that the learning objectives of this semester have been achieved. In the end, you regularly have your professional products validated* by the teachers and semester coach as well.

Both the validated outcomes of your learning and development process, and the validated professional products, are collected in your semester portfolio. At the end of the semester an assessment takes place in the form of a portfolio check in which the integrated semester assessment is taken.

The portfolio check will only be executed when the portfolio was delivered completely and before the deadline. No portfolio check results automatically in unsatisfactory. The portfolio check is an inspection type A.

* Validation of your proof can be achieved by:

- formative feedback from the theme teacher, in writing,
- formative feedback from the theme teacher, orally and then documented by the student in Canvas -initiated by the student -validated by the teacher,
- formative feedback in the form of a P-U-S-G-O (Poor, Unsatisfactory, Satisfactory, Good, Outstanding).
- formative feedback in the form of Undefined – Orienting – Beginning - Proficient – Advanced.

Tools allowed

NA

Resits and repairs

Our educational system is giving you the opportunity to prove reached learning outcomes during the semester. You receive multiple times (longitudinal) feedback while repetitively showing your results to the teachers, so they have a good view on your product and progress. You are expected to be present regularly (≥ 80%) and to ask feedback frequently (≥ per two weeks). You apply the feedback on your work and have the teacher validate your product. When insufficient presence, asking and applying the feedback and validating the feedback, this cannot be corrected the last week(s), as a profound view of your learning process would be missing. The portfolio check is part of the Practice-related Testing category (see Article 28 of the OER). The portfolio check **cannot** be retaken within the semester. Retake and/or repair is only possible in the next half year, by means of restart or customization.

Grading

The summative assessment is expressed, at the end of the portfolio check, in U-S-G-O (Unsatisfactory, Satisfactory, Good, Outstanding). An unsatisfactory result leads to restart or a customized semester.

Learning activities

Lectures, seminars, self-study, presentations, quizzes, interviews, presentations to the customer, support for professional task by lecturers / semester coaches.

Resources

Books

Theme	ISBN	Title	Author(s)	Publisher	Price
IT	1615470522	Super Charge Power BI: Power BI Is Better When You Learn to Write DAX	Matt Allington	Holy Macro! Books; 1 edition (June 1, 2018)	€ 17,34
IT	-	Super Charge Power BI: Power BI Is Better When You Learn to Write DAX (Kindle Edition)	Matt Allington	Holy Macro! Books; 1 edition (June 1, 2018)	€ 10

Software

Theme	Title	Url	Price
IT	Power BI Desktop	https://powerbi.microsoft.com/en-us/desktop/	Free
Professional Development	Hogeschooltaal	https://www.hogeschooltaal.nl	± € 75
Business	LinkedIn Learning	https://www,linkedin.com/learning	Free

4. Information about

4.1. Information about BA ICT & Infrastructure OE2

Entry requirements

To start with this educational unit, you must have completed the firsth semester of FHICT with an advanced level in Infrastructure.

In het Nederlands (Dutch)

Om aan dit semester te kunnen deelnemen dient de student het startsemester met succes te hebben behaald en het verdiepende niveau voor Infrastructure te hebben aangetoond.

Learning Outcomes

The 8 learning outcomes have been determined for this semester:

-

4 learning outcomes with relation to application of attitude, knowledge and skills in the professional IT & Infrastructure context

-

4 learning outcomes for professional development: Future-oriented organisation, Investigative problem solving, Personal Leaderschip, and Targeted interaction

To all learning outcomes is applicable:

	Explanation
The learning outcomes relate to **Infrastructure.**	The **infrastructure** means the entire IT systems with their organizational processes. This concerns the traditional hardware and software infrastructure.
The learning outcomes are implemented in a **professional context**.	**Professional context** means the circumstances or situations in which the student finds himself/herself working as a professional in the field of IT Infrastructure.
A student shows in the **course-based** form that he/she has acquired competences in the learning outcomes	By **course-based** form means that a student follows the 4C/ID-model roadmap of provided courses, assignments and projects in order to prove the acquisition of the leaning outcomes.

The 9 learning outcomes:

Learning outcome	*Explanation*
Provisioning & Connecting (1). You use **platforms** to set up and **connect** various **system components** and **make system resources available** to applications	**platforms:** hardware, operating systems and/or virtualization forms. **connect system components** in such a way that quality, mutual consistency, continuity and performance are demonstrated and validated. **system resources**: storage, computing capacity. **make available**: prepare for use to comply to selected requirements.
Programming (2). You write program code that facilitates and/or automates **supporting processes**.	**supporting processes:** processes that are used within the infrastructure.
Securing (3). You take **measures** to secure all system components of the infrastructure.	**measures:** physical, organizational and technical measures.
Managing (4). You use processes and systems with which you can realize **support services**.	**support services:** services that are necessary within the infrastructure to guarantee quality and continuity.
Future-oriented organisation (5). The organisational context of ICT assignments explore making corporate, sustainable and ethical considerations and	• You recognise ethical and social issues. • You recognise your own and other people's boundaries and act accordingly. • You phase - under supervision - a given assignment in time and sub-tasks in which all team members agree.

managing all aspects of carrying out the assignment.	• You make agreements about the expected quality. • In the elaboration, you think about the consequences of the solution for the people and organisations involved.
Investigative problem solving (6). Critically consider ICT assignments from various perspectives, identify problems, finding an effective approach and coming up with appropriate solutions.	• You remain curious and ask questions throughout the entire solving process. • You answer questions with an appropriate approach: pragmatic, critical and resource-based.
Personal Leaderschip (7). Being entrepreneurial in regard to the ICT assignments and personal development, while being aware of own learning capacity and keeping in mind what ambitions drive ICT professionals and/or which types of positions.	• You see and take chances. • You motivate yourself. • You take responsibility for your actions. • You work on your assignment or task in a result-oriented way. • You make considered choices in your study programme. • You recognise learning needs by yourself. • You are open to feedback and reflect on it.
Targeted interaction (8). Determine which partners play a role in the ICT assignment, constructively collaborate and fitting communication aimed at achieving the desired impact.	• You take into account the direct stakeholders in the assignment. • You pay attention to what you want to communicate and in what form. • You take your own role in the group. • You recognise tasks in group work. • You appeal to others on their role.

In het Nederlands (Dutch):

Voor dit semester zijn 8 leeruitkomsten vastgesteld:

4 vakinhoudelijke leeruitkomsten in relatie tot het toepassen van attitude, kennis en vaardigheden in de professionele IT & Infrastructuur context

4 leeruitkomsten voor professionele ontwikkeling: Toekomstgerichte organisatie, Onderzoeksproblemen oplossen, Persoonlijk leiderschap en Gerichte interactie

Voor alle leeruitkomsten geldt:

	Toelichting
Dat de leeruitkomsten betrekking hebben op **Infrastructuur**.	Met **infrastructuur** wordt het geheel aan ICT-systemen, waarmee organisatieprocessen gefaciliteerd worden, bedoeld. Het gaat hier om de traditionele hardware-infrastructuur, maar zeker ook de software-infrastructuur zoals die gebruikelijk zijn voor organisatie die qua complexiteit vergelijkbaar is met een SOHO. De eindproducten zijn gemaakt volgens standaardmethodes.

Dat de leeruitkomsten in een **professionele context** uitgevoerd worden.	Onder **professionele context** worden de omstandigheden of situaties, waarin iemand zich bevindt wanneer hij als beroepskracht in het werkveld van ICT-Infrastructuur werkzaam is, verstaan.
Dat de student in een **zelf gekozen vorm** laat zien dat hij/zij bekwaamheid heeft verworven in de leeruitkomsten.	Met **zelf gekozen vorm** wordt hier bedoeld dat de student zelf kan kiezen welke bewijzen hij/zij aanlevert, en zelf kan kiezen welke activiteiten hij/zij uitvoert om deze bewijzen te verzamelen.

De leeruitkomsten:

Leeruitkomst	*Toelichting*
Provisioning & Connecting: Je gebruikt **platformen** om **systeemresources** en **verbindingen** tussen deze systeemresources ter beschikking te stellen aan toepassingen	**platformen:** hardware, operating systemen, en/of virtualisatie-vormen. **systeemresources:** opslag, rekencapaciteit. **verbindingen:** verbind de systeemcomponenten voor data-uitwisseling op een zodanige wijze dat kwaliteit, continuïteit, en performance gewaarborgd zijn.
Programming: Je schrijft programmacode waarmee **ondersteunende processen** vergemakkelijkt en/of geautomatiseerd kunnen worden.	**ondersteunende processen:** processen die binnen de infrastructuur gebruikt worden.
Securing: Je treft **maatregelen** om alle systeemcomponenten van de infrastructuur te beveiligen.	**maatregelen:** dit betreft zowel fysieke, organisatorische als technische maatregelen.
Managing: Je gebruikt processen en systemen waarmee je **ondersteunende diensten** kunt realiseren.	**ondersteunende diensten:** diensten die binnen de infrastructuur noodzakelijk zijn om de kwaliteit en continuïteit te waarborgen.
Toekomstgericht organiseren: De organisatorische	• Je herkent ethische en maatschappelijk kwesties.

context van ICT-opdrachten verkennen, zakelijke, duurzame én ethische afwegingen maken en alle aspecten van de uitvoering van de opdracht managen.	• Je herkent eigen en andermans grenzen en handelt daarnaar. • Je faseert -onder begeleiding- een gegeven opdracht in tijd en deeltaken waarin alle teamleden zich kunnen vinden. • Je maakt afspraken over de verwachte kwaliteit. • Je denkt in de uitwerking na over het gevolg van de oplossing voor betrokken mensen en organisaties.
Onderzoekend probleemoplossen: ICT-opdrachten kritisch vanuit verschillende perspectieven beschouwen, problemen identificeren, vinden van een effectieve aanpak en komen tot passende oplossingen.	• Je blijft gedurende het hele oplosproces nieuwsgierig en vragen stellen. • Je beantwoordt vragen met een passende aanpak: pragmatisch, kritisch en gebaseerd op bronnen.
Persoonlijk leiderschap: Ondernemend zijn rond ICT-opdrachten en persoonlijke ontwikkeling, daarbij aandacht hebbend voor het eigen leervermogen en voor ogen houdend wat voor ICT-professional en/of welk type functies men ambieert.	• Je ziet en grijpt kansen. • Je motiveert jezelf. • Je neemt verantwoordelijkheid voor jouw handelen. • Je werkt resultaatgericht aan je opdracht of taak. • Je maakt overwogen keuzes in je studieprogramma. • Je herkent bij jezelf leerbehoeften. • Je staat open voor feedback en reflecteert daarop.
Doelgericht interacteren: Bepalen welke partners een rol spelen bij de ICT-opdracht, constructief met hen samenwerken en passend communiceren gericht op de gewenste impact.	• Je houdt rekening met directe belanghebbenden bij de opdracht. • Je hebt aandacht voor wat je wil communiceren en in welke vorm. • Je neemt je eigen rol in de groep. • Je herkent taken in het groepswerk. • Je spreekt anderen aan op hun rol.

4.1.1. Information about BA I OE2 Course Based

Introduction

Welcome to semester 2 ICT & Infrastructure course-based at Fontys ICT.

In this semester the education is designed according to the principles of course-based learning. The focus lies on learning in the context of real-life tasks, and on clarity and predictability concerning learning outcomes, educational activities and assessment. At the beginning the semester is more teacher-driven, and gradually you will take more ownership of your own learning process.

The main theme of the this semester is a roadmap to the Cloud ICT solutions. The entire semester program will be structured around five focus areas or building blocks of this roadmap. Learning these building blocks will set a strong foundation for becoming ICT & Infrastructure professional. Later in your educational and professional path, you will be stimulated to make well-founded choices based on this foundation.

The learning environment is organized in such a way that you interact closely with your teachers and fellow students. The physical learning environment, also called Open ICT Lab (OIL), consists of classrooms for planned lessons with your class, but also of more general areas for guided self-study, working on course assignments & case-study projects, learning and meeting up with fellow-students, tutors and teachers.

Examination and grading

Examination

During the 18 weeks semester program, a student composes the individual **Personal Development Portfolio** (PDP) with a Case study, course exercises and Multidisciplinary project. The Case study and Multidisciplinary project serve as evidence to demonstrate the 10 learning outcomes. Additionally, course exercises in the form of learning and practical materials also with regard to the 10 learning outcomes, are the supportive activities for a student in realizing Case study.

Assessment model

During the semester there are several scheduled consultations with Semester 3 teachers, in which a student's PDP is evaluated. The aim of such a consultation is to give a student insight into his progress towards learning outcomes. The consultation provides formative indication indicating a certain level of progress. **Table 1** defines different formative indication levels.

Status	Explanation
Undefined (U)	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers.
Orienting (O)	The student has set up exploratory actions to understand what the learning outcome is about. The student looked for theories that might match his goals and has tried to apply a few things at a basic level.
Beginning (B)	The student has produced more complex work and made attempts to show that he controls the learning outcome. However, the teacher's feedback indicates that he still needs to make an improvement.
Proficient (P)	The student has convincingly demonstrated that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.
Advanced (A)	The student has shown in different situations that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.

Table 1. UOBPA, Formative indications (F.C.W. Deenen, 2019).

Integral assessment

In week 19, the assessor meeting will take place in the form of an integral assessment. During the assessor meeting, the individual Personal Development Portfolio of a student is summarily assessed by a teacher(s) and tutor(s). The individual PDP is assessed by at least 2 assessors. For each learning outcome, the development-oriented UOBPA scale is converted into a summative semester assessment (see **Table 2**).

Result	Assessment	Criteria
Passed	Outstanding (**O**)	50% or more learning outcomes: "Advanced".

	Good (**G**)	Multiple learning outcomes: “Advanced”. Other learning outcomes: “Proficient”.
	Satisfactory (**S**)	All learning outcomes: “Proficient”.
Failed	Unsatisfactory (**U**)	One or more learning outcomes: below “Proficient”.

Table 2. Integral assessment model. Transformation of formative indications to summative scores.

Tools allowed

-

Resits and repairs

Our education makes it possible for the student to demonstrate learning objectives during the semester. The student does this on the basis of regular feedback in which product and performance are frequently shown and the teacher therefore has a good picture of the learning process that has been completed. We expect the student to be regularly present and regularly request feedback from the teacher (≥ once every two weeks). The student processes this feedback and validates it with the teacher. If the student is not sufficiently present during the semester, does not regularly request feedback and does not validate the processing of this, this cannot be corrected in the last week or weeks. In that case, a good picture of the completed learning process would be lacking. The portfolio inspection can therefore not be retaken within the semester. Resit is only possible in the following six months, by means of a restart or customization (see OER, Article 28 Re-sit).

Grading

How am I being guided and judged?

The Personal Development Portfolio (PDP) serves as an input for the feedback discussions you have with your teachers and tutors. During the feedback interview you can ask specific questions about your case study (tutor) and course exercises (teacher). Table 3 shows the *time path* and *guidance* of three case studies. In addition, you can see per case study in which weeks you have a possible *feedback talk* with your teacher or tutor. Furthermore, Table 3 shows which weeks your PDP is provided by the teachers and tutor(s) with a *formative indication* and *written feedback* in Canvas.

You do not need to be present as a student during the *integral assessment* meeting. During this meeting your PDP is summarily assessed by teachers and tutors. Your PDP is assessed by at least 2 assessors.

	Case study 1	**Case study 2**	**Case study 3**
Weeks	Week 2, 3, 4, 5	Week 6, 7, 8, 9	Week 10, 11, 12, 13, 14, 15, 16, 17
Guidance *Case study*	Tutor 1 = Teacher 3	Tutor 1 = Teacher 3	Tutor 1 Tutor 2 Tutor 3
Guidance *Course exercises*	Teacher 1	Teacher 1	Teacher 1 Teacher 2

	Teacher 2 Teacher 3	Teacher 2 Teacher 3	Teacher 3
Formative feedback *Possible with teachers and tutors*	Week 2, 3, 4	Week 6, 7, 8	Week 10, 11, 12, 15, 15, 16
Formative indication of PDP, *written in Canvas - UOBPA**	Week 5	Week 9	Week 13, 17
Integral assessment *Canvas – USGO***	Week 18		

Table 3.

* Development-oriented feedback scale: Undefined, Orienting, Beginning, Proficient, Advanced.

** The result of summative and integral assessment: Unsatisfactory, Satisfactory, Good, Outstanding.

Appeal to Examboard

In case the grading procedure was not followed correctly or invalid criteria have been used to determine the grade, you can appeal to the Exam Board. In such case, you need to be explicit about which part of the procedure was not followed or which criteria were used for grading. Simply disagreeing with the examiner is not a valid reason to appeal. You can contact your mentor for more information about appeals.

Learning activities

Learning activities

The next tabe shows the leaning acitivities

Weekno.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Learning activities																				
Inspiration	X																			
Case study		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Course Excercises		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Formative feedback		X	X	X	X		X	X	X		X	X	X		X	X	X			

Formative indication PDP						X			X				X				X			
Integral Assesment																		X		
Administration																				X

During week 1 inspiration and introduction week

During the week 2 – 9, the case study coaching (formative feedback) is reserved for one half day (4 academic hours) per week.

During the week 10 – 17, the case study coaching (formative feedback) is reserved for three half day (4 academic hours) per week.

During the week 2 – 9, the course exercises are given in two full days (8 academic hours) per week:

- Connecting Infrastructure/Provisioning Infrastructure course exercises
- Managing Infrastructure/Securing Infrastructure course exercises and in half day (4 academic hours) per week:
- Programming for Infrastructure course exercises

During the week 10 – 17, all course exercises are given in three half days (4 academic hours) per week:

- Connecting Infrastructure/Provisioning Infrastructure course exercises
- Managing Infrastructure/Securing Infrastructure course exercises
- Programming for Infrastructure course exercises

During the 18 weeks semester program a student composes the individual **Personal Development Portfolio** (PDP) with 3 case studies and course exercises. Case studies serve as evidence to demonstrate the 8 learning outcomes. Course exercises in the form of learning and practical materials also with regard to the 8 learning outcomes, are the supportive activities for a student in realizing case studies.

In week 1 inspiration takes place, see Figure 1. The following aspects are explained and discussed with the students in week 1:

- Structure of semester 2 ICT & Infrastructure
- Personal Development Portfolio (PDP)
- Integral assessment – individual formative feedback and individual formative indication
- Apollo Game

In addition, the ICT & Infrastructure domain is presented by teachers and tutors on the basis of concrete practical examples from professional field. Here is also a room for experimentation, inspiration, research and workshops during this week.

Case studies

Case studies are authentic professional-related ICT & Infrastructure challenges in which a student applies his/her acquired knowledge and skills from supportive course exercises. Each case study is an educational form of a project, related to the focus areas: Connecting, Provisioning, Managing, Securing and Programming (learning outcome 1 to 5). From week 2 to 17 there are 3 case studies in which students work together:

- case study week 2-5 – pair groups – tutor 1
- case study week 6-9 – pair groups – tutor 1
- case study week 10-17 – three-person groups – tutor 1, 2 or 3

A student describes the case studies activities/results in Personal Development Portfolio. A tutor coaches a student in the form of *formative feedback* for the case study (project-based collaboration). The tutor(s) and teachers give in week 5, 9, 13 and 17 individual *formative indication* using the development-oriented feedback scale Undefined, Orienting, Beginning, Proficient and Advanced in

Canvas. This gives a student an insight in his/her development towards the 8 learning outcomes based on the case study.

Status	Explanation
Undefined (U)	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers.
Orienting (O)	The student has set up exploratory actions to understand what the learning outcome is about. The student looked for theories that might match his goals and has tried to apply a few things at a basic level.
Beginning (B)	The student has produced more complex work and made attempts to show that he controls the learning outcome. However, the teacher's feedback indicates that he still needs to make an improvement.
Proficient (P)	The student has convincingly demonstrated that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.
Advanced (A)	The student has shown in different situations that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.

Table 1. UOBPA, development-oriented feedback scale.

Professional development

Professional development is integrated by a student in case studies. Teacher(s) and tutor(s) also provide individual formative feedback on professional development. The 3 learning outcomes that are related to professional development: Analysis, Communication and Learning skills (learning outcomes 6 to 8), see Appendix 1.

Course exercises

During the week 2 to 17, a student realizes course exercises for the focus areas: Connecting, Provisioning, Managing, Securing and Programming (learning outcome 1 to 5) and professional development: Analysis, Communication and Learning skills (learning outcomes 6 to 8). The course exercises are supportive to the case studies. Teachers coach students in the form of *formative feedback* for the course exercises. A teacher starts a class with an instruction / learning and practical materials, after which a student performs the appropriate course exercises with personalised coaching.

During the 18 weeks semester program a student composes the individual **Personal Development Portfolio** (PDP) with 3 case studies and course exercises. Case studies serve as evidence to demonstrate the 8 learning outcomes. Course exercises in the form of learning and practical materials also with regard to the 8 learning outcomes, are the supportive activities for a student in realizing case studies.

In weeks 19 and 20 the administrative processing of the assessor meeting takes place.

How to organize your Personal Development Portfolio?

In your Personal Development Portfolio (PDP) you collect the individual evidence regarding the 8 learning outcomes (see pages 4 and 5 for the 8 learning outcomes. Three case studies are the basis of your PDP. Course exercises is supportive not mandatory evidence for the case studies.

PDP is an **individual** development portfolio with a selection of the learning activities in this semester. You are responsible for the structure and implementation of your PDP. In PDP you give a critical reflection on the work delivered. This facilitates your progress and gives an insight into your learning process.

There are different forms of evidence. It can be a report, presentation, video, photo or audio material, link to a project repository. For semester 2 ICT & Infrastructure, the following types of evidence are important:

- elaborated case study 1, 2 and 3 with self-description
- course assignments with self-description *
- reflection
- self-evaluation
- feedback from a fellow student
- feedback from teachers and tutors
- bibliography
- presentation slides
- link to a project repository with a history of activities and software/hardware solutions files
- observation *
- interview *
- recorded presentation *
- business visit photos *
- photos of brainstorm session *

* optional.

You may also provide additional the evidence that is important to you. I

Resources

Canvas contains all the teaching material and this is also the hand-in place for the elaboration of problems. In addition to oral feedback, written feedback on the submitted assignments and the learning report will be given and registered via Canvas. The student always has access to the submitted assignments, the semester report and the feedback received.

There are also orientating sources in Canvas. The exploratory sources can be information sites, online courses, videos, articles, books, etc. These sources help the student to orient himself on underlying theory, common methods and / or concepts.

4.1.2. Information about BA I OE2 Demand Based

Introduction

Semester 2 van ICT & Infrastructure gaat van het managen van bestaande ICT-infrastructuur tot het ontwerpen en realiseren van een nieuwe infrastructuur. Daarbij gaat het zowel om de technische kant (netwerk en serveromgevingen, cloud, automatiseren, beveiliging), als om de bedrijfsmatige kant (afspraken, kosten, privacyoverwegingen, organisatie).

Onder ICT-infrastructuur verstaan we alle ICT-middelen die de verwerking, de opslag, het transport en toegang van digitale data verzorgen. In dit semester maak je kennis met de basis van die ICT-infrastructuur.

De demand-based (DB) variant van onderwijseenheid 2 (OE2), waarover dit blokboek gaat, biedt jou bij uitstek de mogelijkheid je eigen passie en talenten in te zetten bij het behalen van het semester. De grootste succesfactor is een sterke intrinsieke motivatie. Daarom bieden we aan jou ook een grote vrijheid als het aankomt op kiezen van onderwerp, activiteiten en projectaanpak. Omdat jij, als student in dit tweede semester van je opleiding, nog relatief weinig ervaring hebt in het zelf inrichten van je onderwijs, wordt hier meer dan in latere semesters aandacht aan gegeven. Ook bieden we een veilig

pad, dat afhankelijk van jouw behoefte als vangnet dan wel springplank kan dienen. Al met al, biedt Infra OE2 DB een rijke leeromgeving waarin jij kan leren en werken op een manier die bij jou past.

Binnen de demand-based leervorm kies je voor een flexibele leerweg, waarbij de leeruitkomsten en beoordelingscriteria door de opleiding zijn vastgelegd. Dit betekent dat je als student zelf je eigen leerproces in handen kunt nemen en zelf keuzes kunt maken in de leerweg naar het aantonen van de leeruitkomsten.

Je kunt gedurende dit semester keuzes maken uit diverse onderwijsactiviteiten en studiematerialen, waaronder ook het doen van eigen voorstellen. In dit semester zal je op die manier aan de slag gaan met als vertrekpunt een uitdagende vraag, probleem of challenge, waarbij je zelf leervragen gaat formuleren. Deze leervragen zullen betrekking hebben op het analyseren van het vraagstuk en het ontwerpen en realiseren van een oplossing. Op deze manier ga je nieuwe kennis en inzichten opdoen, zodat je deze kennis en inzichten vervolgens in de praktijk kunt gaan toepassen. Ieder vraagstuk leidt dus tot een concreet product of meerdere deelproducten, gericht op jouw oplossing voor het vraagstuk.

Semester 2 is een sleutelsemester, waarin je volledig ondergedompeld wordt in de wereld van ICT & Infrastructure. Dit is het moment waarop je bij jezelf moeten afvragen: “Is dit het profiel dat bij me past en kan ik het niveau aan?”

Om dat te kunnen onderbouwen moeten de docenten een goed beeld van jou en je competenties hebben gevormd. Omdat we niet geloven in momentopnames is het van belang jouw leerproces te volgen en op die manier een integraal beeld, en daardoor een beoordeling, van jou op te bouwen. Tijdens het semester ga je dan ook met betekenisvolle opdrachten aan de slag waarmee jij alle leeruitkomsten van dit semester kan aantonen.

Om je op weg te helpen met het oplossen van een bepaald vraagstuk krijg je zowel inhoudelijke begeleiding, als begeleiding op het proces van de docent. De nadruk zal op de procesbegeleiding liggen, aangezien jij zelf bepaalt met welk vraagstuk je aan de slag wilt gaan en wat jouw leervragen hierbij zijn. Op basis van jouw vragen en behoeften, zal de docent je coachen en begeleiden bij het maken van concrete producten, waarmee je al de leeruitkomsten kunt aantonen. Jij bent zelf aan zet!

Examination and grading

Examination

In de demand-based leervorm wordt een model van longitudinaal toetsen gehanteerd. Hierbij word je continue gevolgd, letterlijk van dichtbij. Op basis van geobserveerd gedrag, gevoerde gesprekken en opgeleverde beroepsproducten wordt feedback, feedup en feedforward gegeven.

Doordat je continue wordt bevraagd en wordt voorzien van feedback, feedup en feedforward kan deze manier van toetsing als onderdeel van het leerproces worden gezien. Door jou ook nog eens in je eigen woorden de feedback te laten vastleggen wordt er nog meer verantwoordelijkheid en eigenaarschap voor je eigen leren gegeven.

Peer-review

Er wordt actief gebruik gemaakt van peer-review waarmee je elkaar van feedback voorziet over het handelen. Door dit vaker te doen wordt hiervoor de drempel lager en is de kans dat frustraties vroegtijdig worden uitgesproken groter. Daarnaast kun je daarmee ook leren hoe je zelf feedback moet geven en ontvangen.

Oplevermomenten

De iteratieve projectaanpak van zowel de proftaak als de challenges zorgen voor een voorspelbaar ritme gedurende het semester. Ook dwingt het jou tot bewust plannen en timeboxen. Elke paar weken een oplevering vergroot de ‘sense of urgency’, maar maakt ook dat het telkens makkelijker wordt om producten die misschien nog niet perfect zijn op te leveren en daar feedback op te krijgen. Eén van de onderdelen van de opleveringen is een zelfreflectie op de leeruitkomsten, waarbij jij zelf reflecteert op de door jou uitgevoerde activiteiten als aanvulling op de feedback van coaches.

Portfolio

Je legt een portfolio aan van alle beroepsproducten waar de leeruitkomsten mee kunnen worden aangetoond. Ook neem je hierin de zelfreflecties, ontvangen feedback en peer-reviews in op. Dit

portfolio is de basis waarop de periodieke indicaties en beoordelingen gebaseerd zijn. Tussentijds wordt meerdere malen een formatief portfolio assessment ingepland.

Na elke oplevering kan voor elke leeruitkomst (alle vakinhoudelijke leeruitkomsten en de overkoepelende professional skills leeruitkomst) een indicatie gegeven worden op welk niveau de student deze beheerst. Hiervoor zijn 5 niveaus gedefinieerd (Deenen, 2019):

Niveau	Toelichting	Criteria
Onbepaald	De student heeft nog geen activiteiten ondernomen voor het aantonen van de leeruitkomst.	Er is geen portfolio of er is bij de leeruitkomst niets uitgewerkt.
Oriënterend	De student is zich aan het oriënteren op het onderwerp of het vraagstuk door de mogelijkheden te verkennen, passend bij de leeruitkomst.	Je hebt een paar oefeningen voor de leeruitkomst uitgewerkt in je portfolio (je hebt een beetje geoefend).
Beginnend	De student heeft een begin gemaakt, stappen gezet en deze uitgevoerd om de leeruitkomst aan te kunnen gaan tonen.	Je hebt voldoende oefeningen voor de leeruitkomst uitgewerkt in je portfolio (je hebt voldoende geoefend).
Geoefend	De student heeft laten zien dat er een basis is gecreëerd om de leeruitkomst aan te tonen binnen een geschetste situatie.	Je hebt voldoende oefeningen voor de leeruitkomst uitgewerkt en: - je hebt de kennis en vaardigheden van de laag ook toegepast in een challenge of de proftaak en dat uitgewerkt bij de leeruitkomst in je portfolio of: - het niveau van de uitwerkingen van de challenges is meer dan voldoende.
Gevorderd	De student heeft laten zien dat de kennis, vaardigheden en attitude bij de leeruitkomsten, in meerdere situaties of in een complexe situatie kan worden aangetoond	De meeste van je bewijzen in je portfolio komen uit challenges of uit de proftaak.

Tools allowed

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Resits and repairs

Ons onderwijs maakt mogelijk dat de student gedurende het semester leerdoelen kan aantonen. Dit doet de student door op basis van regelmatige feedback waarbij product en prestaties veelvuldig getoond worden en hierdoor de docent een goed beeld heeft van het doorlopen leerproces. We verwachten dat de student regelmatig aanwezig is en regelmatig feedback vraagt van de docent (ongeveer eens per twee weken). De student verwerkt deze feedback en valideert dit bij de docent. Indien de student tijdens het semester niet voldoende aanwezig is, niet regelmatig feedback vraagt én de verwerking hiervan niet valideert, kan dit niet meer in de laatste week of weken rechtgezet worden. Een goed beeld van het doorlopen leerproces zou in dat geval namelijk ontbreken. De portfolioschouw kan dan ook **niet** herkanst worden binnen het semester. Herkansing is pas mogelijk in het aansluitende half jaar, middels herstart of maatwerk (zie OER, artikel 28 Herkansing).

Grading

De semesterbeoordeling wordt uitgedrukt in Outstanding (O), Good (G), Satisfactory (S), of Unsatisfactory (U). Als indicatie en richtlijn voor de beoordeling bij de portfolioschouw dient onderstaande tabel. Deze wordt daarbij gebruikt als startpunt.

Result	**Score**	**Criteria**
Behaald	Outstanding (O)	50% of meer leeruitkomsten op beheersingsniveau "Gevorderd", de overige leeruitkomsten op beheersingsniveau "Geoefend"
Behaald	Good (G)	25% of meer leeruitkomsten op beheersingsniveau "Gevorderd", de overige leeruitkomsten op beheersingsniveau "Geoefend"
Behaald	Satisfactory (S)	Alle leeruitkomsten op beheersingsniveau "Geoefend"
Niet behaald	Unsatisfactory	Een of meer leeruitkomsten op beheersingsniveau lager dan "Geoefend"

Learning activities

De volgende activiteiten worden er gedurende het semester aangeboden.

Leren

Om de nodige kennis te verwerven worden enkele leerbronnen aangeboden die je kunnen helpen om je te oriënteren op de onderwerpen die jij tegenkomt tijdens het project. Als deze oriëntatiemiddelen niet voldoende zijn, is het jouw verantwoordelijkheid om zelf (opnieuw) te zoeken naar andere bronnen.

Gedurende het gehele semester zijn er regelmatig workshops waarbij een docent een onderwerp binnen een gebied bespreekt en je zo op gang helpt.

Dit zijn facultatieve, interactieve sessies en deze kunnen zowel van tevoren worden voorbereid en ingepland door docenten alsook door jou worden geïnitieerd/aangevraagd. Dit kan zowel gericht zijn op de ‘lagen’ als op de professionele ontwikkeling.

Oefeningen:

Omdat kennis alleen niet voldoende is en je die pas goed beheerst als je die kennis kunt gebruiken, zijn er voor elke laag meerdere **oefeningen** waarmee je je vaardigheid daarin kunt vergroten.

Challenges:

Naast die oefeningen zijn er ook een aantal **challenges**. Dit zijn uitdagende, vraagstukken, problemen, of opdrachten die met meerdere lagen verband houden en die je individueel in (maximaal) een paar weken uitvoert. Met deze challenges kun je je kennis en vaardigheden verder vergroten en ook al oefenen met het toepassen daarvan. Je begint pas met een challenge nadat je de oefeningen van de laag, die met de challenge te maken hebben, voldoende hebt uitgewerkt.

Proftaak:

Het hoofdonderdeel van het ‘toepassen’ is in dit semester de **proftaak**. Deze voer je, met alle studenten in een projectteam, als één hoofdproject uit. De hele groep is gezamenlijk verantwoordelijk voor de planning en realisatie van de proftaak en de onderverdeling in deelprojecten. De deelprojecten worden onafhankelijk gepland en uitgevoerd door sub-teams. De goedkeuring en acceptatie van de eindproducten (van de deelprojecten) wordt gedaan door de proftaakgroep zelf.

De proftaak wordt iteratief in 3-wekelijkse periodes uitgevoerd met aan het einde van elke iteratie een oplevering. Dan vinden ook tussentijdse feedbackgesprekken over je portfolio plaats.

Bij deze proftaak kan een “Partner in Education” (PiE) de opdrachtgever zijn of de rol van expert en/of consultant vervullen. Alle docenten vervullen bij de proftaak en de deelprojecten daarvan de rol van begeleider/tutor.

Resources

In Canvas staat al het lesmateriaal en dit is tevens de inleverplaats voor de uitwerkingen van vraagstukken. Naast mondelinge feedback zal de schriftelijke feedback op de ingeleverde opdrachten en het leerverslag via Canvas gegeven en geregistreerd worden. De student heeft altijd toegang tot de ingeleverde opdrachten, het semesterverslag en de gekregen feedback.

Verder staan er in Canvas oriënterende bronnen. De oriënterende bronnen kunnen informatiesites, online cursussen, video’s, artikelen, boeken enz. zijn. Deze bronnen helpen de student om zichzelf te oriënteren op achterliggende theorie, gangbare methoden en/of begrippen.

4.2. Information about BA ICT & Infrastructure OE3

Entry requirements

To start with this educational unit, you must have completed semester 2 of ICT & Infrastructure.

For your body of knowledge you have shown the next levels from the HBO-i Competence framework:

ICT & Infrastructure Semester 2 **of vergelijkbaar**	Advise	Analysis	Design	Realisation	Manage & Control
User interaction					
Organisational Processes	1	1	1		
Infrastucture	1	1	1	1	1
Software				1	
Hardware interfacing					

For your professional skills you have shown the next levels.

Bachelor (HBO-I)	
Persoonlijk leiderschap	1
Onderzoekend probleemoplossen	1
Toekomstgericht organiseren	1
Doelgericht interacteren	1

In het Nederlands (Dutch)

Om aan dit semester te kunnen deelnemen dient de student semester 2 van ICT & Infrastructure met succes te hebben afgesoten.

Voor de Body of Knowledge heb je laten zien dat dat je het bovenstaande niveau van het HBO-i competentie framework en van de professional skills beheeerst.

Learning Outcomes

For the bachelor degree there are six learning outcomes related to the knowledge and skills and four learning outcomes related to personal development.

The following tables present the learning outcomes with a short explanation.

Focus Areas	Learning Outcome	Explanation
Orchestration	You have shown that you can create a process and choose the right tools that coordinate the installation, configuration and deployment of applications in an infrastructure.	The process and tools coordinate the infrastructure as a whole.
Network Orchestration	You have shown that you can create a process and choose the right tools that coordinate the topology of the network in an infrastructure.	Configure the network on logical level such as modification of the bandwidth, connections, routing, filtering etc.
Automation	You are able to develop the code to install, manage, and configure systems and networks.	The right tools that support the installation, configuration and deployment of application requires code in the form of scripts or playbooks for execution.
Security	You have demonstrated, using tools, that you are able to monitor an infrastructure on vulnerabilities.	To secure an infrastructure, all logging of the hosts and network equipment must be collected, normalized, correlated and analysed to alertthe security operator of the presence of vulnerabilities in the infrastructure.
Support Services	You are able to organize the (automated) processes in such a way as to create support services.	The support service includes an automated workflow that can transcend multiple departments.
Monitoring	You collect and interpret relevant data with the aim of forming a judgment and making proper considerations for the infrastructure.	To keep the infrastructure up and running, all critical hosts and network devices must be monitored on performance, availability and response.

4.2.1. Information about BA I OE3 Course Based

Introduction

Welcome to semester 3 ICT & Infrastructure course-based at Fontys ICT.

In this semester the education is designed according to the principles of course-based learning. The focus lies on learning in the context of real-life tasks, and on clarity and predictability concerning learning outcomes, educational activities and assessment. At the beginning the semester is more teacher-driven, and gradually you will take more ownership of your own learning process.

The main theme of this semester is a roadmap to Intelligent Infrastructure Automation. The entire semester program will be structured around six focus areas or building blocks of this roadmap. Learning these building blocks will set a strong foundation for becoming ICT & Infrastructure professionals. Later in your educational and professional path, you will be stimulated to make well-founded choices based on this foundation.

The learning environment is organized in such a way that you interact closely with your teachers and fellow students. The physical learning environment, also called Open ICT Lab (OIL), consists of classrooms for planned lessons with your class, but also of more general areas for guided self-study, working on course assignments & case-study projects, learning and meeting up with fellow students, tutors and teachers.

Examination and grading

Examination

During the 18 weeks semester program, a student composes the individual **Personal Development Portfolio** (PDP) with a Case study, course exercises and a Multidisciplinary project. The Case study and Multidisciplinary project serve as evidence to demonstrate the 10 learning outcomes. Additionally, course exercises in the form of learning and practical materials also with regard to the 10 learning outcomes, are the supportive activities for a student in realizing Case study and Multidisciplinary project.

Assessment model

During the semester there are several scheduled consultations with Semester 3 teachers, in which a student's PDP is evaluated. The aim of such a consultation is to give a student insight into his progress towards the learning outcomes. The consultation provides a formative indication indicating a certain level of progress. **Table 1** defines different formative indication levels.

Status	Explanation
Undefined (U)	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers.
Orienting (O)	The student has set up exploratory actions to understand what the learning outcome is about. The student looked for theories that might match his goals and has tried to apply a few things at a basic level.
Beginning (B)	The student has produced more complex work and made attempts to show that he controls the learning outcome. However, the teacher's feedback indicates that he still needs to make an improvement.
Proficient (P)	The student has convincingly demonstrated that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.
Advanced (A)	The student has shown in different situations that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.

Table 1. UOBPA, Formative indications (F.C.W. Deenen, 2019).

Integral assessment

In week 19, the assessor meeting will take place in the form of an integral assessment. During the assessor meeting, the individual Personal Development Portfolio of a student is summarily assessed by a teacher(s) and tutor(s). The individual PDP is assessed by at least 2 assessors. For each learning outcome, the development-oriented UOBPA scale is converted into a summative semester assessment (see **Table 2**).

Result	Assessment	Criteria
Passed	Outstanding (**O**)	50% or more learning outcomes: "Advanced".
	Good (**G**)	Multiple learning outcomes: "Advanced". Other learning outcomes: "Proficient".
	Satisfactory (**S**)	All learning outcomes: "Proficient".
Failed	Unsatisfactory (**U**)	One or more learning outcomes: below "Proficient".

Table 2. Integral assessment model. Transformation of formative indications to summative scores.

Tools allowed

During the course, a physical or virtual server will be assigned per group of students. The server will be used to work on a Case study, Multidisciplinary project and course exercises.

Additionally, Canvas will be used as an electronic learning environment.

Resits and repairs

Our education makes it possible for the student to demonstrate learning objectives during the semester. The student does this on the basis of regular feedback in which product and performance are frequently shown and the teacher has a good picture of the learning process that has been completed. We expect the student to be regularly present and regularly request feedback from the teacher (≥ once every two weeks). The student processes this feedback and validates it with the teacher. If the student is not sufficiently present during the semester, does not regularly request feedback and does not validate the processing of this, this cannot be corrected in the last week or weeks. In that case, a good picture of the completed learning process would be lacking. Therefore, the portfolio inspection cannot be retaken within the semester. Resit is only possible in the following six months, by means of a restart or customization (see OER, Article 28 Re-sit) of the semester.

Grading

How am I being guided and judged?

The Personal Development Portfolio (PDP) serves as an input for the feedback discussions you have with your teachers and tutors. During the feedback interview, you can ask specific questions about your Case study (tutor), Multidisciplinary project (tutor) and course exercises (teacher). **Table 3** shows the *time path* and *guidance* of Primary and Secondary phases. In addition, you can see during which weeks you have a possible *feedback talk* with your teacher or tutor. Furthermore, it shows during which weeks your PDP is evaluated by the teachers and tutor(s) with a *formative indication* and *written feedback* in Canvas.

You do not need to be present as a student during the *integral assessment* meeting. During this meeting, your PDP is summarily assessed by teachers and tutors. Your PDP is assessed by at least 2 assessors.

	Primary phase	**Secondary phase**
Weeks	Week 2 to 10	Week 11 to 18
Guidance *Case study*	Tutor	Tutor
Guidance *Multidisciplinary project*	Tutor	Tutor
Guidance *Course exercises*	Teacher 1 Teacher 2 Teacher 3	Teacher 1 Teacher 2 Teacher 3
Formative feedback *Possible with teachers and tutors*	Week 2, 3, 4, 5, 7, 8, 9	Week 11, 12, 13, 15, 16, 17
Formative indication of PDP, *written in Canvas - UOBPA*	Week 6, 10	Week 14, 18
Integral assessment *Canvas- - USGO***	-	Week 19

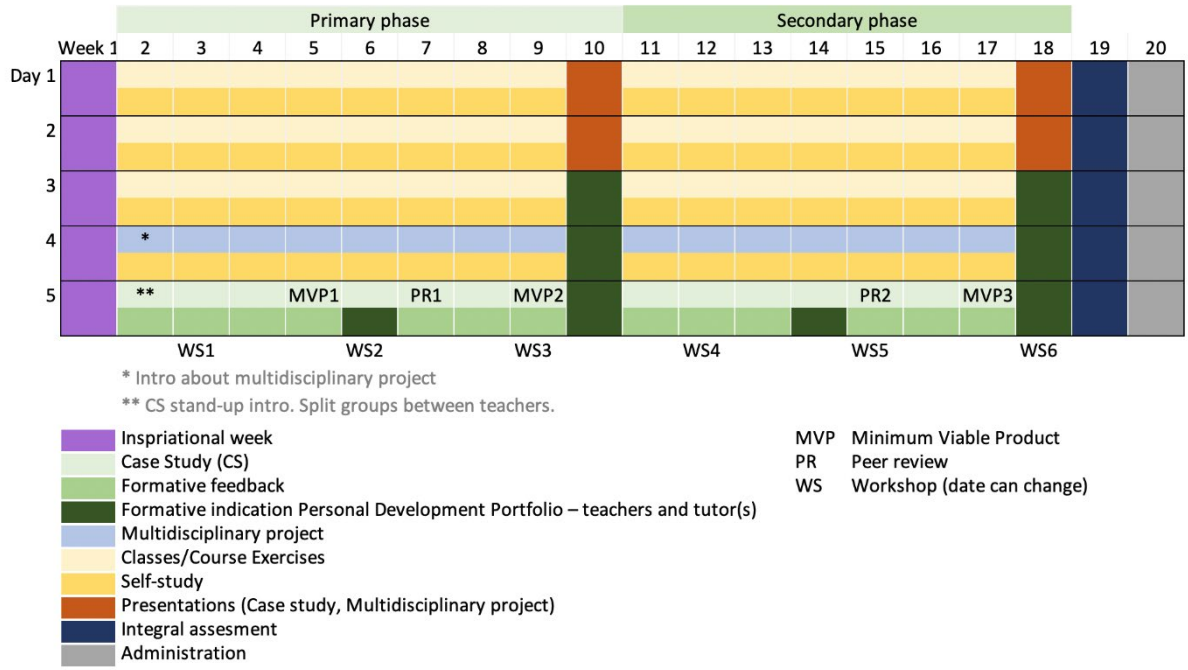
Table 3. Guidance, feedback and assessment weeks.

Appeal to Exam board

In case the grading procedure was not followed correctly, or invalid criteria have been used to determine the grade, a student can appeal to the Exam Board. In such a case, the student needs to be explicit about which part of the procedure was not followed or which criteria were used for grading. Simply disagreeing with the examiner is not a valid reason to appeal. The student can contact his/her mentor for more information about appeals.

Learning activities

The next table shows the learning activities



Week 1: inspiration takes place (see **Table 1**). The following aspects are explained and discussed with the students in week 1:

- Structure of semester 3 ICT & Infrastructure
- Personal Development Portfolio (PDP)
- Integral assessment – individual formative feedback and individual formative indication

In addition, the ICT & Infrastructure domain is presented by teachers and tutors on the basis of concrete practical examples from the professional field. Here is also a room for experimentation, inspiration, research and workshops during this week.

Week 2 – 9 and 11 – 17: The Case study coaching (formative feedback) is reserved for one half-day (4 academic hours) per week.

Week 2 – 9, the course exercises are given in four half days (16 academic hours) per week:

- Automation & Orchestration course exercises
- Monitoring & Supporting Services course exercises
- Security & Network Orchestration course exercises

Week 11 – 17, all course exercises are given in three half days (12 academic hours) per week:

- Automation & Orchestration course exercises
- Monitoring & Supporting Services course exercises
- Security & Network Orchestration course exercises

During the 18 weeks semester program a student composes the individual Personal Development Portfolio with a Case study, Multidisciplinary project and course exercises. Case study and Multidisciplinary project serve as evidence to demonstrate the 10 learning outcomes. Course exercises in the form of learning and practical materials, also with regard to the 10 learning outcomes, are the supportive activities for a student in realizing case studies.

In weeks 19 and 20 the administrative processing of the assessor meeting takes place.

Case study

A Case study is an authentic professional-related ICT & Infrastructure challenge in which a student applies his/her acquired knowledge and skills from supportive course exercises. The Case study is an educational form of a project, related to the focus areas: Automation, Orchestration, Monitoring, Supporting Services, Security and Network Orchestration (learning outcome 1 to 6). From week 2 to 17 there is a Case study in which students work together in a pair group, which is guided by a tutor.

A student describes the Case study activities/results in Personal Development Portfolio. A tutor coaches a student in the form of *formative feedback* for the Case study (project-based collaboration). In weeks 6, 10, 14 and 18 the tutor(s) and teachers give individual *formative indication* using the development-oriented feedback scale **U**ndefined, **O**rienting, **B**eginning, **P**roficient and **A**dvanced in Canvas. This gives a student insight into his/her development towards the 10 learning outcomes based on the case study.

Multidisciplinary project

A Multidisciplinary project is an authentic professional-related ICT & Infrastructure challenge in which a group of students applies their acquired knowledge and skills from supportive course exercises while implementing requirements of another group: students' group from a different study stream(s), external client or a stakeholder(s) that needs infrastructure to be prepared for his/her project. The Multidisciplinary project is an educational form of a task, related to the focus areas: Automation, Orchestration, Monitoring, Supporting Services, Security and Network Orchestration and learning outcomes (1 to 6) and professional skills (1 to 4). The Multidisciplinary project continues from week 2 to 17, where students work together in a pair group guided by a tutor.

A student describes the Multidisciplinary project activities/results in Personal Development Portfolio. A tutor coaches a student in the form of *formative feedback* for the project (project-based collaboration). In weeks 14 and 18 the tutor(s) and teachers give individual *formative indication* using the development-oriented feedback scale **U**ndefined, **O**rienting, **B**eginning, **P**roficient and **A**dvanced in Canvas. This gives a student insight into his/her development towards the 10 learning outcomes based on the Multidisciplinary project.

Professional development

Professional development is integrated by a student in the Case study and Multidisciplinary project. Teacher(s) and tutor(s) also provide individual formative feedback on professional development. The 4 learning outcomes that are related to professional development: Future-oriented organization, Investigative problem solving, Personal Leadership and Targeted interaction skills.

Course exercises

During the week 2 to 17, a student realizes course exercises for the focus areas: Automation, Orchestration, Monitoring, Supporting Services, Security and Network Orchestration (learning outcome 1 to 6) and professional development: Future-oriented organization, Investigative problem solving, Personal Leadership and Targeted interaction skills (learning outcomes 7 to 10). The course exercises are supportive to the Case study and Multidisciplinary project. Teachers coach students in the form of *formative feedback* for the course exercises. A teacher starts a class with an instruction/learning and practical materials, after which a student performs the appropriate course exercises with personalized coaching.

How to organize your Personal Development Portfolio?

In your Personal Development Portfolio (PDP) you collect the individual evidence regarding the 10 learning outcomes. The Case study and Multidisciplinary project are the basis of your PDP. Course exercises are supportive and not mandatory evidence for the Case study and Multidisciplinary project.

PDP is an **individual** development portfolio with a selection of the learning activities in this semester. You are responsible for the structure and implementation of your PDP. In PDP you give a critical reflection on the work delivered. This facilitates your progress and gives an insight into your learning process.

There are different forms of evidence. It can be a report, presentation, video, photo or audio material, link to a project repository. For semester 3 ICT & Infrastructure, the following types of evidence are important:

- elaborated Case study and Multidisciplinary project with self-description
- course assignments with self-description *

- reflection
- self-evaluation
- feedback from a fellow student
- feedback from teachers and tutors
- bibliography
- presentation slides
- link to a project repository with a history of activities and software/hardware solutions files
- observation *
- interview *
- recorded presentation *
- business visit photos *
- photos of brainstorm session *

* optional.

You may also provide additional evidence that are important to you.

Resources

Canvas contains all the teaching material and this is also the hand-in place for the elaboration of problems. In addition to oral feedback, written feedback on the submitted assignments and the learning report will be given and registered via Canvas. The student always has access to the submitted assignments, the semester report and the feedback received.

There are also orientating sources in Canvas. The exploratory sources can be information sites, online courses, videos, articles, books, etc. These sources help the student to orient himself on the underlying theory, common methods and / or concepts.

4.2.2. Information about BA I OE3 Demand Based

Introduction

Semester 3 covers the different aspects of intelligent automation of the infrastructure. Due to the size and diversity of the various systems and software in the context of manageability, it is necessary to master this from a well-organized point. This semester approaches orchestration from 6 different focus areas:

1. **Orchestration** is the automated configuration, coordination, and management of computer systems and software.
2. **Network Orchestration**, also known as **Software-defined networking** (SDN) is the process of automatically programming the behaviour of the network so that the network smoothly coordinates with the hardware and the software elements to further support applications and services.
3. **Automation** means completing a single task or function without human intervention**.** In the context of this semester, automation covers the creation and configuration of scripts (playbooks) to make orchestration possible.
4. **Security Incident and Event Management** is a security management approach, which combines functions of **Security Information Management (SIM)** and **Security Event Management (SEM)** to define a sound security management system. While SIM focuses on automating the collection of log data, events, and flows from security devices on a network, SEM is all about real-time monitoring and alerts. These make SIEM as a blend of real-time collection and analysis of security alerts and correlation of events to deduce it to detect incidents and malicious patterns of behaviours.
5. **Monitoring** is a service where system engineers monitor the infrastructure in a proactive way.
6. **Supporting services** in the context of this semester are the services and business processes required to make the intelligent infrastructure automation possible.

Examination and grading

Examination

Longitudinal and integral

This semester Infrastructure 3 demand based uses the model of longitudinal testing. The student is continuously monitored, nearby. Feedback feed up and feedforward are given based on observed behaviour, conversations and professional products delivered.

Students create a portfolio of all professional products that demonstrate the learning outcomes. In addition to the set of professional products, a learning report / personal development report (PDR) / reading guide is also included in this portfolio. This is also pre-sorting on the internship / graduation project, where this method is also increasingly used.

Delivery moments

The iterative project approach of both the project and the challenges ensure a predictable cadence during the semester. It also forces students to consciously plan and time boxes. Delivery every few weeks increases the *'sense of urgency'* among students, but it also makes it easier to deliver products that may not be perfect and to receive feedback on them. One of the components of the deliveries is a self-reflection on the learning outcomes, in which the student does a self-assessment in addition to the feedback from coaches.

After each delivery, a formative indication can be given for each learning outcome at what level the student has mastered it. 5 levels have been defined for this (Deenen, 2019).

The table below defines the different formative indication levels:

Status	**Explanation**
Undefined (U)	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers.
Orienting (O)	The student has set up exploratory actions to understand what the learning outcome is about. He has looked for theories that might match his goals and has tried to apply a few things at a basic level.
Beginning (B)	The student has produced more complex work and made attempts to show that he controls the learning outcome. However, the teacher's feedback indicates that he still needs to make an improvement.
Proficient (P)	The student has convincingly demonstrated that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.
Advanced (A)	The student has shown in different situations that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.

Feedback and review as learning

Because a student is continuously questioned and provided with feedback, feed up and feedforward, this way of assessment is part of the learning process. By letting the student record the feedback in their own words, ownership is given.

FeedPulse can be used as a tool for recording feedback.

Peerreview

Peer-review is actively used with which the project group members provide each other with feedback on their actions. Doing this more often lowers the threshold and increases the likelihood of expressing frustrations early. In addition, students can learn how to give and receive feedback themselves.

Integral assessment of the portfolio

In week 19, all assessors involved with the student will schedule a portfolio review. During this conversation, the work of the students will be discussed in their presence by at least 2 assessors. In most cases, the outcome of this conversation will be clear before, and based on the feedback recieved previously, students will already have a good idea of their performance and the extent to which they have demonstrated the learning outcomes. This assessment is the summative assessment moment and this assessment is also communicatyed to the student at that time.

Tools allowed

Canvas will be used as electronic learning environment.

Resits and repairs

Our education makes it possible for the student to demonstrate learning objectives during the semester. The student does this on the basis of regular feedback in which product and performance are frequently shown and the teacher therefore has a good picture of the learning process that has been completed. We expect the student to be regularly present and regularly request feedback from the teacher (≥ once every two weeks). The student processes this feedback and validates it with the teacher. If the student is not sufficiently present during the semester, does not regularly request feedback and does not validate the processing of this, this cannot be corrected in the last week or weeks. In that case, a good picture of the completed learning process would be lacking. The portfolio inspection can therefore not be retaken within the semester. Resit is only possible in the following six months, by means of a restart or customization (see OER, Article 28 Re-sit).

Grading

During the semester there are several scheduled consultations (Feedback moment) with the teacher team in which your portfolio is evaluated. The aim of such a feedback moment is to give your insight into his progress towards learning outcomes. The feedback (feedback, feed forward, feed up) provides indications, indicating a certain level of progress. During the semester, the student will get a formative indication on the progress he or she has made in relation to all learning outcomes.

The table below defines the different formative indication levels

Status	**Explanation**
Undefined (U)	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers.
Orienting (O)	The student has set up exploratory actions to understand what the learning outcome is about. He has looked for theories that might match his goals and has tried to apply a few things at a basic level.
Beginning (B)	The student has produced more complex work and made attempts to show that he controls the learning outcome. However, the

	teacher's feedback indicates that he still needs to make an improvement.
Proficient (P)	The student has convincingly demonstrated that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.
Advanced (A)	The student has shown in different situations that he controls the learning outcome and the teacher has confirmed this by giving positive feedback.

In week 19, all assessors involved with the student will schedule a portfolio review. During this conversation, the work of the students will be discussed in their presence by at least 2 assessors. This assessment is the summative assessment moment and this assessment is also communicated to the student at that time.

The transformation from the formative scores to the summative scores will occur according the following table.

The semester assessment is expressed in Outstanding (O), Good (G) or Satisfactory (S) or Unsatisfactory (U) as follows:

Result	**Score**	**Criteria**
Passed	Outstanding (O)	50% or more learning outcomes at the control level "Advanced"
Passed	Good (G)	Some learning outcomes at the master's level "Advanced". The other learning outcomes at the control level "Proficient"
Passed	Satisfactory (S)	All learning outcomes at the control level "Proficient"
Failed	Unsatisfactory (U)	One or more learning outcomes at the control level lower than "Proficient"

Learning activities

Project:

Projects for a group of students with a client. The project runs throughout the semester and is performed "agile" (in sprints). For this project, a Partner in Education (PiE) can be the client or fulfil the role of expert and / or consultant.

Challenges:

These are multiple challenging, transcending focus areas, issues, problems, or assignments with which you can work independently and / or in small groups.

Workshops:

A series of optional, interactive sessions offered on topics from the different “focus areas” and professional skills in which you can practice with several relevant techniques. You will work individually or in smaller groups. These workshops can be prepared and planned by teachers as well as initiated by you.

Resources

Canvas contains all the teaching material and this is also the hand-in place for the elaboration of problems. In addition to oral feedback, written feedback on the submitted assignments and the learning report will be given and registered via Canvas. The student always has access to the submitted assignments, the semester report and the feedback received.

There are also orientating sources in Canvas. The exploratory sources can be information sites, online courses, videos, articles, books, etc. These sources help the student to orient himself on underlying theory, common methods and / or concepts.

4.3. Information about BA ICT & Infrastructure OE6

Entry requirements

Dit onderdeel wordt in het najaar van 2021 ontwikkeld.

Learning Outcomes

Introduction

Examination and grading

Examination

Tools allowed

Resits and repairs

Grading

Learning activities

Resources

5. Information about Bachelor ICT & Media Design

5.1. Information about BA ICT & Media OE2: Explore the Universe of Media Design

Entry requirements

To start with this educational unit, you must have completed the first semester of FHICT with an advanced level of Media Design.

Learning Outcomes

1. Interactieve media

Je maakt prototypes van interactieve mediaproducten voor je opdrachtgever door gebruik te maken van iteraties, gebruikersonderzoek en voorbeelden uit het vakgebied.

Toelichting Prototypes van interactieve media: eenvoudige gebruikersinteractie met standaard prototypingtechnieken. Gebruikers hebben minimale instructie nodig om producten te gebruiken of tests uit te voeren. Technieken varîren van low-fidelity papieren prototypes en schetsen tot high-fidelity tooling met Adobe XD (of vergelijkbaar). Voorbeelden zijn interfaces (met of zonder visuele en audio-ondersteuning), webapps, online games, dashboards. Iteraties: het doorlopende proces van productverbetering in kleine, opeenvolgende stappen. Gebruikersonderzoek: onderzoek naar de behoeften, wensen en gedrag van eindgebruikers door middel van deskresearch en interviews en het verzamelen van feedback door het uitvoeren van gebruikerstesten. Voorbeelden uit het vakgebied: succesvolle, populaire, veelgebruikte of vaak aangehaalde mediaproducten.

2. Development

Je programmeert en integreert proofs of concepts op basis van gevalideerde eisen en gedocumenteerd in een versiebeheertool.

Toelichting

Proofs of concepts (poc's): het programmeren van kleine pocís om basisvaardigheden eigen te maken. Je integreert verschillende kleinere poc's in een grotere applicatie. De focus ligt op een fundamenteel begrip van een front-end programmeertaal.

Gevalideerde eisen: te bepalen door de bachelorstudent door middel van onderzoek (met eindgebruikers en stakeholders). Voor de associate degree-student: vooraf gegeven in de instructies van oefeningen en opdrachten. Versiebeheertool: een tool (bijvoorbeeld GitHub, GitLab) om voortgang te bewaken en een back-up van je werk te maken (push, pull, commit).

3. Design

Je maakt visuele ontwerpen van hoogwaardige kwaliteit met een professionele toolset.

Toelichting

Professionele toolset: veel gebruikte tools in het werkveld, bijvoorbeeld Adobe Creative Cloud of een alternatieve set van vergelijkbare applicaties. Visuele ontwerpen: lay-out en look and feel van mediaproducten, zoals posters, banners, animaties (2D/3D), AR/VR, videoproducties, websites, apps. Hoogwaardig: erkend door het publiek, professionals of deskundigen als vakkundig gemaakt.

4. Research

Je past verkennende onderzoeksmethoden toe, gedreven door een nieuwsgierige en kritische houding.

Toelichting

Verkennend onderzoek: onderzoek gericht op het leren kennen van een onderwerp, het opdoen van ervaring en het verwerven van nieuwe inzichten in een bepaalde situatie. Verkennend onderzoek is flexibel en adresseert onderzoeksvragen als wat, waarom en hoe. Methoden: het gebruiken en toepassen van werkwijzen uit het DOT-framework en het CMD-methods pack. Nieuwsgierige en kritische houding: je laat je verbazen en je staat open voor verwondering. Je houdt ervan om nieuwe dingen uit te proberen, je bent op zoek naar nieuwe kennis en je voelt de drang om je bevindingen te begrijpen. Je neemt feiten of resultaten niet als vanzelfsprekend aan, maar je verifieert je inzichten door meerdere bronnen te controleren en in dialoog te gaan met collega's en experts.

5. Communication

Je communiceert effectief met je stakeholders (in tekst en beeld) over de voortgang van je project en de onderbouwing van je keuzes.

Toelichting

Effectieve communicatie: je houdt je stakeholders online en face-to-face op de hoogte van je werkzaamheden om misverstanden te voorkomen, doelstellingen te verduidelijken en je productiviteit te verhogen. Je stemt je communicatie af op de behoeften en voorkennis van je publiek. Je respecteert de belangen van je publiek (bijvoorbeeld door het bijhouden van de tijd). Stakeholders: iedereen met een belang bij jouw project of het product dat je maakt.

6. Professional Identity

Je presenteert je professionele identiteit als media designer in een portfolio waarin je groei en keuzes gedocumenteerd staan.

Toelichting

Professionele identiteit: een overzicht van je ervaring tot nu toe, je beeld van je huidige zelf en een uitspraak over wat voor soort professional je wilt worden. Portfolio: een interactieve, goed gestructureerde en vormgegeven verzameling van authentiek en recent werk, reflecties, (peer) feedback en zelfbeoordelingen. Groei: je individuele ontwikkeling in dit semester, oftewel het verschil tussen start- en eindstand.

5.1.1. Information about BA M OE2 Course Based

Introduction

Before you started your study at FHICT you have chosen for the course-based learning method and now you have successfully completed the starting semester. This means that you are now ready to start in the second semester (S2) within ICT & Media Design in the course-based learning method! Within the course-based learning method students are provided for a structured and predictable learning path, the learning outcomes and assessment criteria are set by the study program.

The learning environment is organised in such a way that you interact closely with your lecturers, tutors and fellow students. The physical learning environment consists of classrooms for planned lessons and Open ICT Lab (OIL), where all kinds of study activities (for instance, guided self-study, working on assignment or projects, meeting up with fellow-students etc..) have been well arranged.

Content

In S2, there are four modules running through for the whole semester in parallel. Next to that, the whole semester (20 weeks) is divided into 6 sprints, that is Sprint 1 2, 3, ...6 (starting from week1 every 3 weeks formed into a sprint). The last 2 weeks will be an assessor meeting in week19 and the final assessment (administrative) in week 20 respectively.

One of the four modules is the challenging project module based on an authentic situation in practice. Besides of this project module there are three modules offered as the supporting information (in the form of lessons, learning instruction and different assignments etc.).

Throughout the whole semester 2 the lecturers and project tutors monitor your development, meanwhile you also get feedback along your learning process. In this way you gain new knowledge and insights in media design domain; In turn, you can put your knowledge into practice to complete your project and courses study.

Examination and grading

Examination

Learning outcomes

The goal of ICT & Media Design is to develop and implement an interactive user experience that leads to multiple prototypes to meet the target users' needs and requirements. In S2 the core part of ICT & Media Design are developing media products by programming and integrating proofs of concepts based on validated requirements that meet the client's needs.

1. You create prototypes of interactive media products for your client by using iterations, user research and examples from the professional field.

Prototypes of interactive media: simple user interaction with standard prototyping techniques. Users need minimal instruction to use products or do tests. Techniques vary from low-fidelity paper prototyping and sketching to high-fidelity tooling with Adobe XD (or similar). Examples are interfaces (with or without visual and audio support), web apps, online games, dashboards.

Iterations: the ongoing process of product improvement in small successive steps. User research: research into the needs, wishes and behavior of end users by doing desk research and interviews and gathering feedback by conducting user tests.

Examples from the professional field: successful, popular, commonly used or referenced media products.

2. You program and integrate proofs of concepts based on validated requirements and documented with version control tools. Proofs of concepts (pocs): programming small pocs to focus on basic skills. Integrating various smaller pocs into a larger application. The focus is a fundamental understanding of JavaScript.

Validated requirements: to be determined by the bachelor student by doing research (end users, stakeholders). For the AD students: given in advance in the instructions of exercises and assignments.

Version control tools: a tool (e.g. GitHub, GitLab) to monitor your progress and backup your work (push, pull, commit).

3. You craft quality visual designs with a professional toolset professional toolset: apply industry standard tools, for instance Adobe Creative Cloud or an alternative set of similar applications.

Visual designs: layout and look and feel of media products, like posters, banners, animations (2D/3D), AR/VR, video productions, websites, apps.

Quality: recognized by the public, professionals and experts as skillfully crafted.

4. You apply exploratory research methods, driven by a curious and critical attitude. Exploratory research: research aimed to gain familiarity with a phenomenon, to gain experience and to acquire new, significant personal insights into a given situation. Exploratory research is flexible and can address research questions of all types: what, why and how.

Methods: use and apply methods from the DOT framework and the CMD methods pack.

Curious and critical attitude: you have the ability to be amazed and you are open to wonder. You like to try out new things, you want to access new knowledge and you feel the urge to gain an understanding of your findings. You do not take facts or results for granted, but you verify your insights by checking multiple sources and engaging in dialogue with peers and experts.

5. You communicate effectively with your stakeholders (text and visuals) about the progress of your project and the motivation of your choices. Effective communication: you keep people informed online or face-to-face about your activities in order to limit misunderstandings, clarify objectives and improve productivity. You tailor your communication based on your audience's needs and current knowledge. You respect the interests of you audience (e.g. keeping time).

Stakeholders: all people involved in your project or the use of your product.

6. You present your professional identity as a media designer in a portfolio that shows your growth and choices. Professional identity: an overview of your past experiences, your current view on yourself and a statement of what kind of professional you would like to become.

Portfolio: a well-designed and interactive personal development report that contains authentic and recent work, reflections, (peer-)feedback and self-assessments

Growth: your individual progress this semester.

Tools allowed

Not applicable

Resits and repairs

During the semester you work on learning activities to develop towards and show the expected level on the learning outcomes. You have several opportunities to demonstrate your level, after demonstrations you will receive feedback on how your development progresses.

It is impossible to receive an extra opportunity to develop and demonstrate your level on learning outcomes if you have not shown this by the end of week 18. If you fail the semester, you can retake it all during the following semester. In some cases, you get the opportunity to do a tailor-made semester (see OER, article 28).

Appeal to Examboard

In case the grading procedure was not followed correctly, or invalid criteria have been used to determine the grade, you can appeal to the Exam Board. In such case, you need to be explicit about which part of the procedure was not followed or which criteria were used for grading. Simply disagreeing with the examiner is not a valid reason to appeal. You can contact your semester coach for more information about appeals.

Grading

How is semester 2 course-based assessed?

Learning outcomes are used at FHICT. At the end of the semester, you will have to show that you have achieved the learning outcomes. In the second semester (S2) within ICT * Media Design you demonstrate a total of 6 learning outcomes, at the latest in week 18.

Integrated learning outcomes will be assessed in the project. You will be judged during the weeks based on those learning outcomes. Learning outcome 1 – 6 has formative indications in total in week 6, 9, 15 and 18. The table below shows the global time-line for the assessment process during S2.

week	Assessment process
6	Formative indications
9	Formative indications
15	Formative indications
18	Formative indications
19	Assessor meeting=> Summative assessment of all learning outcomes
20	Final assessment (administrative)

Table 1: the global time-line for the assessment process during S2

* A formative indication is a development-oriented, interim evaluation, which forms the input for the summative, integral semester assessment. The summative integral semester assessment is determined by the assessors involved.

Formative indications

A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. The summative, integral semester assessment is determined by the assessors involved. In this way the student gains insight - at least three times - during the semester into the

learning process. The teacher for each module is responsible for giving feedback about the students' performance and how students have achieved so far (process level). Each learning outcome is valued based on the development-oriented feedback (no scale).

How is the final assessment of the semester achieved?

If all learning outcomes from S2 have been assessed individually, the final assessment of the semester in weeks 19 and 20 will be determined for you in consultation with all the assessors involved. The assessors use the following assessment guidelines or explain why they deviate from this.

Evaluation	Explanation
Outstanding (O)	A student who has the status Good (G) and/or Outstanding (O) for all learning outcomes will receive the final assessment Outstanding (O).
Good (G)	A student who has Good (G) status for more than half of the learning outcomes will receive Good (G) final assessment
Satisfactory	A student who has at least Satisfactory (S) status for all learning outcomes will receive the final assessment Satisfactory (S).
Unsatisfactory (U)	A student who has the status lower than Satisfactory (S) for one or more learning outcomes will receive the final assessment unsatisfactory (U).

How is the assessment determined?

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 2 of the chosen advanced level profile. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC, and are not admitted to semester 2.

Learning activities

Semester 2 consists of various learning activities, which cover four modules in total: media production, user centered design and web programming and project. The

way you gain the knowledge in media design domain through modules: media production, user centered design and web programming, meanwhile you apply what you have learned, that is those knowledge and skills, to your fourth module project through the whole semester 2.

As we stated before, the whole semester 2(20 weeks) is divided into 6 sprints, that is Sprint 1 2, 3, ...6 (starting from week1 every 3 weeks formed into a sprint). Please see Appendix A. Weekly Planning of the semester 2.

Four modules running in parallel (week 1~17)

Week 1: Kick-off for the project, and introduction for other three modules.

Four modules focus on:

- Learning tasks related to learning outcomes
- Supportive information for the project that runs through semester
- Project: combined with professional skills

The lessons are planned from week 1 to 17 (Please see the detailed weekly planning blow). The assessment of the modules(see the assessment part) is designed to match the specific learning outcomes of the different modules. This can be with an weekly assignment, a demo, presentation etc..

Workshop and guest lectures: they contain all kind of organized workshops and guest lectures, it is intended to broaden your view in the media design domain.

Project: Just in time guidance

Throughout the whole semester, your lecturers and tutors will be available in classroom or the OIL for guidance on all modules. The client, lecturers and tutors give continuously feedback on your deliveries, in term of whether you as the student has completed the task, module and project, furthermore at what kind of level. The feedback is both for students who are doing well, and want to improve further; but also for students who need more guidance than the standard guidance given during the modules' study.

Final assessment (week 18~20)

At the end of week17, you are supposed to finalize all your project work and deliverables. Week 18 is final demo and assessment for you. The last 2 weeks will be assessor meeting in week 19 and the final assessment (administrative) in week 20 respectively

Resources

All the learning materials are provided in Canvas.

5.1.2. Information about BA M OE2 Demand Based

Introduction

Wat fijn dat je voor ICT & Media Design hebt gekozen! In het startsemester heb je je georiënteerd op de diverse richtingen van de brede bachelor ICT. Nu je eenmaal je keuze bepaald hebt, ga je in dit semester jouw toekomstige vakgebied ICT & Media Design in de volle breedte verkennen. Het thema van het semester is daarom 'Explore the Universe of Media Design'. Je gaat op avontuur.

'Explore the Universe of Media Design' betekent dat nagenoeg alles kan, mag en welkom is. Je hebt vrijheid om te experimenteren en eigen keuzes te maken. De resultaten daarvan, de successen en ook de minder geslaagde pogingen, documenteer je in een actueel en interactief portfolio met authentiek eigen werk. Jij bent de eigenaar van jouw portfolio en jij bent de eindbeslisser als het gaat om de vorm en inhoud ervan. Je portfolio vormt de basis van je eindbeoordeling. Je slaagt als jouw portfolio laat zien dat de zes leeruitkomsten van het semester bereikt zijn.

De vrijheid om eigen keuzes te maken, betekent wel dat je verplichtingen nakomt. Je onderwijs is 'demand based'. Dat houdt in dat je in een groep werkt aan een gezamenlijk project. Uit dat project komt het materiaal voort dat de basis vormt voor je portfolio. Je hebt zeggenschap over welk project je kiest en over wat de inhoud van het project wordt. Je dient daarbij de afspraken met je groep na te leven en dagelijks van negen tot vier voor de opleiding beschikbaar te zijn voor je onderwijs. De studie vereist dat je je opstelt als een verantwoordelijke professional-in-opleiding.

Jouw docenten helpen bij het tot stand komen van je project en je portfolio, in de eerste plaats door feedback te geven op je producten, zodat je met iteraties verbeterde versies aflevert. Verder zijn je docenten er om je te adviseren bij het maken van keuzes en, wanneer de situatie daarom vraagt, om je van uitleg en instructies te voorzien. Eén van je docenten is jouw persoonlijke semestercoach. Een vast team van drie of meer docenten gaat over jouw integrale beoordeling.

Examination and grading

Examination

Formatief

Reviews

Tijdens het semester krijg je ten minste drie keer een formatieve docentreview (Waar sta je?) van je portfolio-in-ontwikkeling. Je ontvangt dan feedback en feed-forward over je persoonlijke groei aangaande de zes leeruitkomsten. Je bent er zelf voor verantwoordelijk dat jouw portfolio ten minste

drie reviews krijgt. De semestercoach monitort dit. Je vindt in Canvas de informatie hoe je portfolioreviews precies georganiseerd zijn. Onderdeel van de formatieve beoordeling zijn peer reviews. Je krijgt hiervoor via Canvas de uitnodiging feedback te geven op het portfolio van een medestudent. De peer reviews worden random toegewezen. Je verstrekte peer reviews passen in leeruitkomsten 5 en 6.

4.2. Aanvullende feedback in FeedPulse

Minimaal 1x per week vul je als groep FeedPulse in. Je vermeldt daarin de 'lessons learned' van de vorige week en de werkplanning voor de komende week. De blokeigenaar zorgt dat er een rating komt van deze groeps-FeedPulse. Daarnaast vul je minimaal 1x per week FeedPulse in voor je individuele voortgang. Je vermeldt daarin welke feedback je in de voorgaande week hebt ontvangen en van welke docenten. Het staat je vrij aan te vullen met persoonlijke reflecties. Je semestercoach zorgt voor een rating van de individuele FeedPulse. Verder kunnen alle docenten en je semestercoach een FeedPulse-moment aanmaken zodra zij daartoe aanleiding zien. Je kunt altijd een docent vragen een moment voor je aan te maken. Ga zoveel mogelijk feedbackgesprekken aan met je docenten en gebruik FeedPulse voor de vastlegging ervan. Zorg ervoor dat je regelmatig feedback vraagt op je voortgang met betrekking tot de leeruitkomsten.

Summatief

4.3. Definitieve beoordeling

Voor je individuele beoordeling vormt je portfolio het uitgangspunt. In een mondeling assessment wordt dit portfolio beoordeeld en ontvang je feedback en je beoordeling. Bij Fontys Hogescholen zijn alle mondelinge toetsen openbaar. Je kunt dus toehoorders uitnodigen. De portfolio-assessments vinden plaats in MS Teams, tenzij de ontwikkelingen rondom covid-19 in 2021 anders doen besluiten. De docenten leggen per leeruitkomst op het beoordelingsformulier in Canvas uit hoe en waarom zij tot hun oordelen zijn gekomen.

Voor het hele semester krijg je een eindbeoordeling op de schaal Outstanding – Good – Satisfactory – Unsatisfactory. De docenten baseren hun eindoordeel op jouw prestaties ten aanzien van de leeruitkomsten, waarbij ze uitleggen welke aspecten doorslaggevend zijn geweest voor je eindresultaat.

Je eindbeoordeling is outstanding, good, satisfactory of unsatisfactory. Bij unsatisfactory heb je het semester niet behaald. Als je het semester haalt, ontvang je de 30 Europese studiepunten. Je krijgt een melding in Canvas die je semesterresultaat bevestigt. Vooruitlopend op de summatieve beoordeling horen docenten tijdens de reviews een indicatie te kunnen geven hoe je er per leeruitkomst voor staat. Ben je hier onzeker over, vraag ernaar.

Tools allowed

Partners in Education

Tijdens dit semester is er een samenwerking met drie Partners in Education (PiE's).

LiveWall Group BV, Stationsstraat 5, 5038 EA Tilburg, Jules Verneweg 26A, 1515 BM Tilburg, is een creatief digitaal bureau.

BR-ND Emotive Transformers, Vijzelstraat 68, 1017 HL Amsterdam, www.br-nd.nl houdt zich bezig met branding, strategie en concepten.

Happy Horizon, Nieuwe Emmasingel 12-14, 5611 AM Eindhoven, happyhorizon.com is een veelzijdige digital marketing agency.

De Partners in Education geven vanuit de beroepspraktijk feedback op studentproducten , bijvoorbeeld tijdens de demo's ter afsluiting van een sprint. De partners kunnen masterclasses verzorgen en optreden als opdrachtgever bij projecten. De betrokkenheid van Partners bij het Onderwijs is een dynamisch proces en meer partners kunnen tijdens het semester worden betrokken, afhankelijk van de vraag of wanneer nieuwe kansen verschijnen.

Resits and repairs

Vanwege het vormende karakter van de formatieve reviews bestaat er geen herkansing na het eindassessment. Het voortdurende proces van verbeteren en uitwerken van je ontwikkelingsgerichte portfolio, is immers al onderdeel van het semester. Als het eindoordeel unsatisfactory is, geven je docenten aan of je herstart of maatwerk krijgt. In alle gevallen geldt dat docenten in het belang van de student tot het meest zorgvuldige oordeel moeten komen en bij uitzondering, als dat noodzakelijk is, aangepaste procedures kunnen volgen.

Ben je het niet eens met je beoordeling of met de manier waarop je bent beoordeeld, dan heb je het recht om in beroep te gaan bij de examenkamer. Als je dat doet, informeert de examenkamer je over de verdere procedure. Je kunt bij je semestercoach terecht voor inlichtingen over beroep en bezwaar. Raadpleeg desgewenst de FHICT Onderwijs- en Examenregeling.

Grading

Je eindassessment vindt plaats in week 18. Jouw docenten zetten daarvoor een rooster in Canvas. Zie verder wat al is vermeld bij Toetsing

Learning activities

Het semester bestaat uit de volgende onderdelen.

A. Groepsproject

Het groepsproject is de kern van het semesteronderwijs en bestaat uit sprints van elk een aantal weken. (Afhankelijk van de jaarkalender is er soms een week meer of minder.) Je werkt elke dag van negen tot vier samen met je projectgroep in een Open ICT Lab (OIL) danwel online aan je project. 9 Het project begint met Sprint 0. In Sprint 0 maak je een verkenning van de brede media-context waarin je opdrachtgever zich bevindt. Die mediaverkenning is een bloemrijk, inspirerend en overtuigend vormgegeven document waarin je aan je opdrachtgever presenteert wat je in Sprint 1, Sprint 2 en Sprint 3 gaat maken. In Sprint 0 bepaal je dus zelf in overleg de inhoud van je project. De mediaverkenning moet akkoord bevonden worden door je opdrachtgever en een drietal docenten met elkaar aanvullende expertise. Aan het eind van een sprint presenteer je je producten aan Partners in Education van FHICT. Doel daarvan is dat je projectwerk feedback krijgt van een deskundige uit het vakgebied. Aan het einde van sprint 3 presenteer je alle producten aan je opdrachtgever. Docenten ondersteunen je tijdens het project met advies en feedback. Naar gelang de behoefte bieden docenten workshops aan. De workshops worden bij voorkeur één week, maar uiterlijk één dag tevoren aangekondigd op Canvas.

B. Individueel: project X

Project X is een individueel traject waarin je voor jezelf een uitdaging formuleert. De planning zie je in je jaarrooster op Canvas. Doel is dat je laat zien zelfstandig aan een opdracht te kunnen werken en daarbij systematisch opereert, van plan van aanpak tot eindresultaat. Het is bij uitstek de gelegenheid om onderzoekend en ondernemend gedrag te laten zien en je professionele identiteit te profileren. C. Speciale Weken Tussen sprints door worden er speciale weken georganiseerd, waarin inspiratie en je eigen ontwikkeling centraal staat. De planning en inhoud van deze weken varieert per locatie. Raadpleeg Canvas voor een overzicht.

D. Professional identity

Gedurende het semester wordt er expliciet aandacht besteed aan het ontwikkelen van je professionele identiteit. De manier waarop dit vorm krijgt verschilt voor associate degree studenten en bachelor studenten. Associate degree: Studenten lopen in dit semester één week mee met een professional ter oriëntatie op het beroepsprofiel. De invulling van deze ministage is afhankelijk van geldende coronarichtlijnen en wordt gedurende het semester bekend gemaakt. Bachelor: Bachelor studenten onderzoeken dit semester welke aspecten van het vakgebied Media Design goed bij ze passen. Je krijgt hiervoor op diverse manieren (afhankelijk per locatie) de kans je op deze gebieden te ontwikkelen en profileren.

E. Portfolio

Je portfolio is een weergave van je talent en laat zien wie jij bent als mediadesigner. Het is ook de basis waarop je aan het einde van het semester beoordeeld wordt. Gedurende het semester wordt regelmatig tijd gereserveerd om aan je portfolio te werken.

F. Feedback, review en assessments

Zie hoofdstuk Toetsing

Planning

Deze semestergids geldt voor de uitvoering van ICT & Media Design demand based (DB) bij Fontys Hogeschool ICT in Tilburg en Eindhoven. De uitvoeringsplanning tussen Tilburg en Eindhoven (bijvoorbeeld de precieze weekindeling) kan variëren. Kijk daarom voor de verdere onderwijsplanning op Canvas.

Docentbegeleiding

Als vuistregel kunnen zowel studenten als docenten initiatief nemen tot workshops, presentaties, overleg, coaching en alle andere onderwijsactiviteiten. Wanneer je je docenten niet raadpleegt, word je geacht aan je groepsproject, je portfolio of aan individuele opdrachten te werken. Er is op elk dagdeel van de week een docent beschikbaar voor consult en feedback. Het rooster staat op Canvas en Sharepoint. Omdat je het gehele semester bezig bent met het opbouwen van je ontwikkelingsgerichte portfolio, onderneem je elke dag zelf initiatief om feedback te vragen. Je docenten zijn gekoppeld aan leeruitkomsten 1 t/m 6. Iedere docent is deskundig ten aanzien van ten minste drie leeruitkomsten. Dit kun je nagaan op het roosterschema op Canvas. Je kunt per leeruitkomst dus terecht bij alle betreffende docenten. Eén docent is jouw semestercoach. Deze docent is je persoonlijke coach ten aanzien van alle leerinhoud-overstijgende vraagstukken. Wanneer zaken om een oplossing vragen, verwijst de semestercoach je naar het juiste loket. De semestercoach houdt tevens in de gaten hoe jouw projectgroep functioneert en wat jouw positie daarin is.

Inhoudelijke focus

‘Explore the Universe of Media Design’ betekent dat je uitgedaagd wordt tot het volgende.

Nieuwsgierigheid: onderzoek, durf fouten te maken en durf te leren

Verken en ontdek het medialandschap: duik in de interactieve, digitale media

Ontwikkel je skills: design, prototyping, concepting, produceer en itereer

Kritisch denken: wees niet snel tevreden, evalueer en verbeter

Professionele identiteit: word media designer, maak keuzes, toon je ambitie Gebruik dit semester om te tonen dat ICT & Media Design qua capaciteiten en interesse voor jou een passende opleiding is.

Resources

Er is een Canvas-cursus beschikbaar. Canvascursussen omvatten modules met dia's, opdrachten, quizzen en verwijzingen naar externe bronnen en gratis online studiemateriaal (MOOC). Afhankelijk van de bron kan studiemateriaal Nederlandstalig of Engelstalig zijn. Afhankelijk van de aanwezige sprekers of toehoorders kunnen er Engelstalige workshops zijn.

5.2. Information about BA ICT & Media OE3: Choose Your Media Adventure

Entry requirements

OE2 ICT & Media Design or equivalent

Learning Outcomes

Learning outcome 1. Concept

You discover and define a concept for an interactive media product as an answer to the client's problem.

Discover = gather insights into the client’s problem, business opportunities and motivations of the target group, i.e. through the combination of interviews, surveys and desk research. *Define* = the challenge

definition is validated - i.e. discussed with expert(s) - and the concept tested with end users. *Concept* = a clear statement, vision and strategy on target users, business value and feasibility

Learning outcome 2. Interaction Design

You design an interactive media product that matches the needs and characteristics of the end users based on appropriate interaction design principles and one or more prototypes.

Design = creating and validating interaction design decisions, i.e. creating and comparing many variations of wireframes, visual designs, lo-fi and hi-fi prototypes. *Characteristics of end users* = Insights into the target group have been applied in the design and validated through user research with end users *Based on appropriate IxD principles* = the chosen IxD principles are consistent with and reinforce the design *Based on prototype(s)* = the intended interaction can be experienced and tested through a prototype

Learning outcome 3. Interactive Media Product

You realize an interactive media product by combining hardware and software, based on functional requirements, obtained from user stories.

Realizing = creating and validating the product and its content through proof-of-concepts *Combining hardware and software* = based on comparison of alternatives *Functional requirements* = prioritized according to a standard method *User stories* = drawn up from a user perspective and validated using the INVEST-method

Learning outcome 4. Transferable Code

You develop efficient, well-organized and working code which is transferable through documentation and version control in a team context.

An efficient and well-organized = neatly structured with logical variable/method names and a modular structure. Own or external libraries are used to design the application. The design is based on user stories derived from clear architecture diagram. *Documentation* = code contains meaningful comments, i.e. for doc. generators. *Version control in a team context* = there is at least 1 codebase to which several people have contributed, making use of branching and merging, for example in git. *In a team context* = You can co-operate with others and manage an operational team to achieve a shared result.

Learning outcome 5. Professional Iterations

You present the connection between successive iterations in your methodically substantiated, iterative design and development process in a professional manner.

Iterations = improvement steps based on set goals, starting points and revenues. *Methodically substantiated* = a suitable research question has been formulated and the choice of different research methods has been substantiated. *Iterative design process* = demonstrable divergence and convergence techniques have been used which have resulted in the creative concept. *Iterative development process* = the application of the agile project methodology has improved over the sprints, there has been demonstrably active and effective collaboration on the media product. *Professional manner* = all deliverables should be of professional quality, i.e. skillfully crafted, visually pleasing, created using a professional toolset

Learning outcome 6. Advice to Stakeholder

You advise one or more stakeholders on the effectiveness and technical feasibility of the product you have realized.

Advising = communicating with and presenting to a client in a professional and proactive manner. *Stakeholder* = an external party that has an interest in or is affected by your product. *Efficiency and technical feasibility* = the product is provided with conclusions and recommendations for a next iteration.

Learning outcome 7. Personal Professional Focus

You investigate what type of professional you would like to become in the long-term, how you distinguish yourself from others in the workfield and demonstrate this in a product.

Investigate = research, use and transfer knowledge and skills belonging to the ambition, reflect on that process on the basis of requested feedback from experts and act accordingly. *Type of professional* = which professional field and type of positions you aspire to *In the long-term* = you focus on future profession (after graduation), on your internship and on the next (specialization) semester. *Product* = an interactive media product in which your depth of knowledge is reflected.

5.2.1. Information about BA M OE3 Course Based

Introduction

Welcome to Semester 3 – Choose Your Own Adventure!

Congratulations again on successfully finishing the first year and obtaining your propedeuse diploma. Right ahead of you is the second year, consisting of your profile semester (this one) followed by a specialization semester (Semester 4), after which you will do your first internship (Semester 5).

"Choose Your Own Adventure" This semester's theme is "Choose your own adventure". Semester 2 was aimed at providing you with a solid foundation of media design practices. The goal of Semester 3 is to prepare you for your internship and as such we have thought it important for you to be introduced to your future work field, which includes orientation on the knowledge and skills that fit with your personal professional focus. Simply put, it means that next to the things we think everyone should learn, you will have some freedom to determine what knowledge and skills you would like to explore on a deeper level.

The course-based team has chosen to gamify the learning content. Splitting the various topics into standalone modules that students can complete and unlock to be able to proceed to the next, more challenging modules. We have identified three different character development arcs within the skill tree, (Front-end) Developer, UX Designer, and Media Producer (see below). All students have to complete modules for all three characters. However, as you proceed through the semester and start figuring out your professional identity, you can specialize and will have more choices of which modules to complete.

Differences from previous semester executions

The last time, this semester was executed, some improvements have been suggested by the students and teachers. Here are these improvements:

- Instead of planning lessons for half days 5 times a week, students really asked for having full days to focus on their work. The plan is now to have 2 full days and 1 half day in the week with the plan that all contact hours will be in the Fontys building and not online.
- The non-mandatory challenges that students can do for practice were previously not contributing to achieving the learning outcomes of the semester. This has now been changed so that any deliverables submitted by the student can be used as evidence in their portfolio to contribute towards the summative assessment at the end of the semester.

Examination and grading

Examination

Formative Indications

During the semester you will build up a portfolio of project deliverables which will be used to assess your progress in regards of the learning outcomes. You will submit all your deliverables in Canvas by handing in meaningful (partial) products on the designated assignments.

During the entire semester – so not just around the assessments mentioned below – you are encouraged to gather feedback from your instructors, which will allow you to iteratively improve your portfolio contents up to the final assessment in week 19.

The table below shows the global timeframe for this semester's formally planned formative assessments:

Week 6 Formative indications* after sprint 2

Week 12 Formative indications* after sprint 4

Week 18 Formative indications* after sprint 6

Week 19 Assessors meeting

Week 20 Complete integral semester assessment

* A formative indication is a development-oriented, interim valuation, which forms the input for the summative, integral semester assessment. The summative, integral semester assessment is determined by the assessors

Grading Scale

A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. In this meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes assignments, tests, etc.

Each learning outcome is evaluated according to the development-oriented feedback scale below. This way, during the semester – at least after every sprint – the student will gain insight into the progress of their learning process within the semester.

Undefined	You have not yet undertaken activities to demonstrate the learning outcome.
Orienting	You have made a start and explored the possibilities to demonstrate the learning outcome.
Beginning	You have taken the first steps and carried them out which contribute to demonstrating the learning outcome.
Proficient	You have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.
Advanced	You have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.

Tools allowed

Before starting your studies at FHICT, you made the choice to follow the course-based learning form and you have successfully completed 2 (two) semesters in this learning form. This means that you are now ready to start in the third semester (S3) within ICT & Media Design in the course-based learning form.

Within the course-based learning method, you choose a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program. As in the previous semesters, we have a distribution of courses and guided self-study. In S3 you will demonstrate

a total of 7 learning outcomes. These learning outcomes and associated assessment criteria are described in the “Learning Outcomes” section of this document.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). This means that we work with authentic learning tasks that are offered in a structured manner, where there is also room for instruction and training, and where the guidance and support from the lecturer gradually decreases. Education is pre-structured in terms of content, working methods and guidance. Knowledge and skills are applied in practical assignments, which increase in size and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

The starting point in S3 is a challenging project based on an authentic situation from practice. Supporting information that you need to carry out your project is offered in the form of lessons and background information. In addition, your tutor will guide you in the implementation of your project. During the semester you will work on different assignments. The teacher will track your development throughout the semester, and you will frequently receive feedback on this. In this way you gain new knowledge and insights so that you can apply them in practice.

Resits and repairs

During the semester you will receive frequent feedback and the opportunity to improve deliverables and performance in order to demonstrate all learning outcomes (at least at the Proficient level). Since in this way the level of your learning outcomes is measured regularly and early, there are no re-sits to raise the not-yet-proven learning outcome(s) to the desired level after the above moments. A re-sit is only possible in the following semester, by means of a restart or customization.

Grading

All learning outcomes will be graded per individual during the semester. Based on this, the final semester grade will be decided upon in consultation with all assessors during the assessors meeting in week 19. The assessors will be using the following guidelines or explain how they have deviated from.

Assessment guidelines

- A student with one or more outcomes graded below Proficient will obtain Unsatisfactory (U)

- A student with all outcomes graded Proficient will obtain Satisfactory (S) or Good (G)

- A student with one or more outcomes graded Advanced will obtain Good (G) or Outstanding (O)

The final assessment of the semester is expressed in the form of a transfer meeting at the end of the assessor meeting in Outstanding (O), Good (G), Satisfactory (S) or Unsatisfactory (U). Outstanding (O), Good (G) and Satisfactory (S) result in the award of 30 EC and a transfer to the next semester. Unsatisfactory (U) results in restart or customization. In both cases you will receive 0 EC and you will not progress to the next semester.

Learning activities

Structure

Semester 3 lets you choose what you can do best and what you really want to learn. We all start with a basic level in which you get some insight in the three character classes you can choose from and learn the basics that you need in all three disciplines to move forward. This will take two sprints and will be done with all fellow students together. From Sprint 2 on you will choose your own character class and receive expert knowledge and education in one special skillset. You will learn in depth graphical and 3D animation skills, object-oriented programming or the needed tools and skills to reach new heights of user friendly UI and UX design. After this phase of specialising and gaining your character class, the whole semester meets up again for one big final challenge - a hackathon - in which you combine your skills with those of other character classes to innovate and design something truly remarkable. With all these challenges behind you, you are ready to move on to Semester 4, onto new Adventures.

Client Project

Next to developing your skills in one of three specialisations you will work together on one big project that spans over the course of the Semester. Your customer is FHICT, and as part of your education you will work on new media, applications, interactive experiences and everything else that you might come up with to make Semester 3 Course Based Media more awesome. The theme for this year being "Cyberpunk Future" think about ways to improve the flow through the Semester, apps that help you figuring out in which skills you are best or new ways to make blended learning in the new normal more effective. As part of this project you will discuss everything you produced with the stakeholders at Fontys, and there is a real chance that what you build up will be used for the next generations of students. That way, you not only learn for yourself but also help making learning better for everyone who starts after you.

Gamification System

As part of your way through Semester 3 you will earn points from two resources – the project and challenges. In theory you don't need to do any challenges if you make a perfect project and demonstrate your skills in all learning outcomes. In reality however, you will probably focus on a few aspects of your project and other team members will do something else. That is why you have the challenges to make sure you cover all learning outcomes.

Topics

Research For both gathering insights as well as substantiating your choices, you will be taught to find and apply the correct research methods. Every time you need to make a choice, an underlying question exists; sometimes very obvious and sometimes hard to find. Learning to recognize these questions may be the hardest part, but once you master it, research becomes a lot easier and much more meaningful.

Interaction Design A lot of research has been conducted in the area of Interaction Design (IxD). You will be taught the most important basic principles from which you can further explore and expand your knowledge as needed for your project. Applying this knowledge, you will be able to lift your first prototypes to a higher level, avoiding the waste of time of getting answers you could have thought of yourself.

Building Interactive products To be able to come up with an innovative interactive user experience, you will conduct a lot of experiments using combinations of software and hardware. Don't limit yourself to the confines of the (laptop) screen and the usual input methods (keyboard, mouse/touchpad), but actively explore possibilities that lie beyond, for example: wearables, sensors, knobs and dials, computer vision, skeleton tracking, face tracking, … Anything goes, as long as it enriches your intended user experience in a meaningful way.

Professional Development On top of the media design topics mentioned above, you will be working on your own professional development. In this semester, this will be shown primarily by presenting the steps of your iterative design and development process, by presenting your proceedings in a professional manner towards your client, by striving to deliver all of your work in a professional way and of professional quality and finally by presenting your explorations of and the resulting insights into your future work field.

Resources

The learning materials are published in Canvas.

Recommended software:

- Adobe Creative Cloud
- Maya/Blender
- Unity 3D

5.2.2. Information about BA M OE3 Demand Based

Introduction

Welcome to OE3 – Choose Your Own Adventure!

Congratulations again on successfully finishing the first year and obtaining your propaedeutic phase. Right ahead of you is the second year, consisting of your *profile* semester (this one) followed by a *specialization* semester (OE4), after which you will do your first internship (OE5).

"Choose Your Own Adventure"

This semester's theme is *"Choose your own adventure".* Let's get a little deeper into the meaning of this, from the perspective of the ICT & Media Design profile:

OE2 was aimed at providing you with a solid foundation of media design practices. The goal of OE3 is to prepare you for your internship and as such we have thought it important for you to orient on your future work field, which includes orientation on the knowledge and skills that fit with your *personal professional focus.* Simply put, it means that next to the things *we* think everyone should learn, you will have some freedom to determine what knowledge and skills *you* would like to explore on a deeper level.

Examination and grading

Examination

Formative assessments

During the semester you will build up a portfolio of *project deliverables* which will be used to assess your progress in regards of the learning outcomes. You will compose this *learner portfolio* in Canvas by handing in meaningful (partial) products on the designated assignments. A crucial element of each assessment is your *portfolio abstract* (NL: 'leeswijzer') which mainly serves as a reading guide. This process will be explained in detail in a series of workshops.

During the entire semester – so not just around the assessments mentioned below – you are encouraged to gather feedback from your coaches, which will allow you to iteratively improve your portfolio contents up to the final assessment in week 19.

These are the formally planned formative assessments:

Week 5 - Preliminary research (Sprint 1)

The first official moment during which your progress on demonstrating the learning outcomes will be registered. Your portfolio should contain all deliverables concerning the preliminary research phase and your Sprint 1 presentation.

Week 9 - Mid-term assessment (Sprint 2 & 3)

During this second assessment, coaches will register your progress on the learning outcomes based on all portfolio deliverables showing your individual contributions to Sprint 2 & 3 of the client project.

Week 14 - Client Project delivery (EXPO)

After your group's presentation of the Client Project's product and process during the EXPO-event in week 13, coaches will register your progress on the learning outcomes based on all portfolio deliverables concerning the whole of your individual contributions to the client project, hoping to oversee your entire design process, touching on all 4 phases of the Double Diamond.

Week 19 - Portfolio review and optional assessment interview

Right after the semester's final EXPO-event where you will present the outcomes of your personal professional orientation, coaches will review your entire portfolio, with special attention for the outcomes of your Passion Project, to determine your preliminary semester grade. This may result in an invitation for an assessment interview.

Finally, your definitive semester grade will be determined and communicated by your semester coach.

Tools allowed

Demand-based didactics

What does that mean: demand-based? In short, it means your short-term learning goals will be based on what is necessary for you to work on the next steps of your project.

Practically speaking, this means that you will plan your learning trajectory, aimed at the overall goal of demonstrating the required learning outcomes, together with your semester coach. Things to take into consideration may be: your personal skill level, the context of the project and your role in the group, user stories you have been assigned, personal and/or professional ambitions, the project phase, a certain lack of knowledge or skills that may have come to the surface, et cetera.

Rest assured, your coaches are not going to lean back and wait for you to come with your specific demands. There will be an extensive program of workshops and classes planned ahead, but be aware that most of them will address their subjects on an introductory level. They are meant to inspire you, make you aware of the existence of certain technologies, research methods, design processes and techniques, or mere theoretical models or frameworks.

After such a class or workshop, you will have enough basic knowledge to start exploring the subject on a deeper level in the context of your project, learning by doing. Every workday, at least one coach will be available at all times for further guidance. For this, **it is important that you pro-actively ask them for feedback on your works-in-progress**.

In short: working on your project, iteratively improving your (partial) products based on the acquired feedback, you will build up your portfolio.

One of the coaches will be your semester coach: your personal coach considering all matters beyond course contents. The semester coach also helps you plan your personal learning trajectory and keeps an eye on your group's working process, group dynamics and your role in the group.

Resits and repairs

Because your learning progress is being measured regularly and early, there will be no retakes, nor any other chances to lift yet unaccomplished outcomes to the *Proficient* grade.

Grading

Grading scale

Fontys School of ICT uses learning outcomes to define and determine your learning progress. During and at the end of the semester you will need to prove whether you have accomplished these outcomes. Each learning outcome will be graded using the following scale, to provide insights of your learning progress in those moments.

Level & Explanation

Undefined: You have not yet undertaken activities to demonstrate the learning outcome.

Orienting: You have made a start and explored the possibilities to demonstrate the learning outcome.

Beginning: You have taken the first steps and carried them out which contribute to demonstrating the learning outcome.

Proficient: You have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.

Advanced: You have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.

Final semester grade

All learning outcomes will be graded per individual during the semester. Based on this, the final semester grade will be decided upon in consultation with all assessors during the assessors meeting in week 19. The assessors will be using the following guidelines, or explain how they have differed from:

- A student with any outcome graded below Proficient will obtain Unsatisfactory (U)

- A student with all outcomes graded Proficient will obtain Satisfactory (S) or Good (G)
- A student with half or more outcomes graded Advanced will obtain Good (G) or Outstanding (O)

You have passed the semester after scoring *Outstanding (O), Good (G)* or *Satisfactory (S)*. This means you will earn this semester's 30 ECTS.

If you do not agree with your assigned final grade or the way you have been assessed, you have the right to appeal at the examination board (NL: 'examenkamer'). If you choose to do so, the examination board will inform you on the procedure. You can always ask your semester coach and/or the semester coordinator (NL: 'blokeigenaar') for more information on appealing. All official rules and regulations can be found in FHICT's *"Onderwijs- en examenregeling" (OER)*: https://fontys.nl/Over-Fontys/Organisatiestructuur-en-sturing/Onze-organisatieNieuw/Regelingen-statuten-en-reglementen/Fontys-Hogeschool-ICT.htm

Learning activities

Structure After kicking off with a launch week, this semester's education is based around 2 major projects: the Client Project (NL: "proftaak") and the Passion Project.

Launchweek

In the course of 4 days, you will get acquainted with the Double Diamond design process, touching the surface of each of the 4 phases, 1 each day. During this playful project you will work in duo's, but each working on your own individual execution.

The last day of the week involves the kick-off of the Client Project: The Partners in Education (PIE) involved with this semester will pitch their assignment for the client project. Groups will be made based on the preferred choices of the student; final formation is done by the teachers.

Client Project

Based around an open problem statement by one of the involved Partners in Education you will work 4 days a week for 12 weeks on a potential solution for this problem, using the Double Diamond design process and an Agile working process. In the last week of the project you will deliver and present your *MVP (Minimum Viable Product)* during the Client Project Exhibition.

During the Client Project you will attempt to gather a multitude of deliverables in your portfolio, to demonstrate most of the learning outcomes, so you have all the time and peace of mind to work on your personal professional focus during the Passion Project.

Passion Project

As mentioned, in this phase you are given the chance to focus on your personal professional focus, meaning that – after already demonstrating most of the learning outcomes – you will investigate deeper into the areas and subjects of your own professional interest. You will actively orient towards your preferred future function profile and undertake actions – that is: learn and use the corresponding knowledge and skills to create a product – to demonstrate and share your findings.

During this phase you will spend one day a week working on your *Showcase Portfolio*, a portfolio in which you present your personal highlights of your media design activities so far.

The Passion Project phase will be completed with a festive event (Semester Expo) during which you will present your personal growth as a media designer and your future aspirations.

Subjects

Human Centered Design and the Double Diamond design process

As you may remember from OE2, we firmly believe that in order to create a valuable product, the user's needs are of utmost importance. In addition, since such a product doesn't create itself, some sort of economic value cannot be ignored and finally, even the most brilliant ideas will not see the light of day if its realization isn't technically feasible. Altogether, we see three core values that need to be considered when developing an interactive media product: desirability, feasibility and viability.

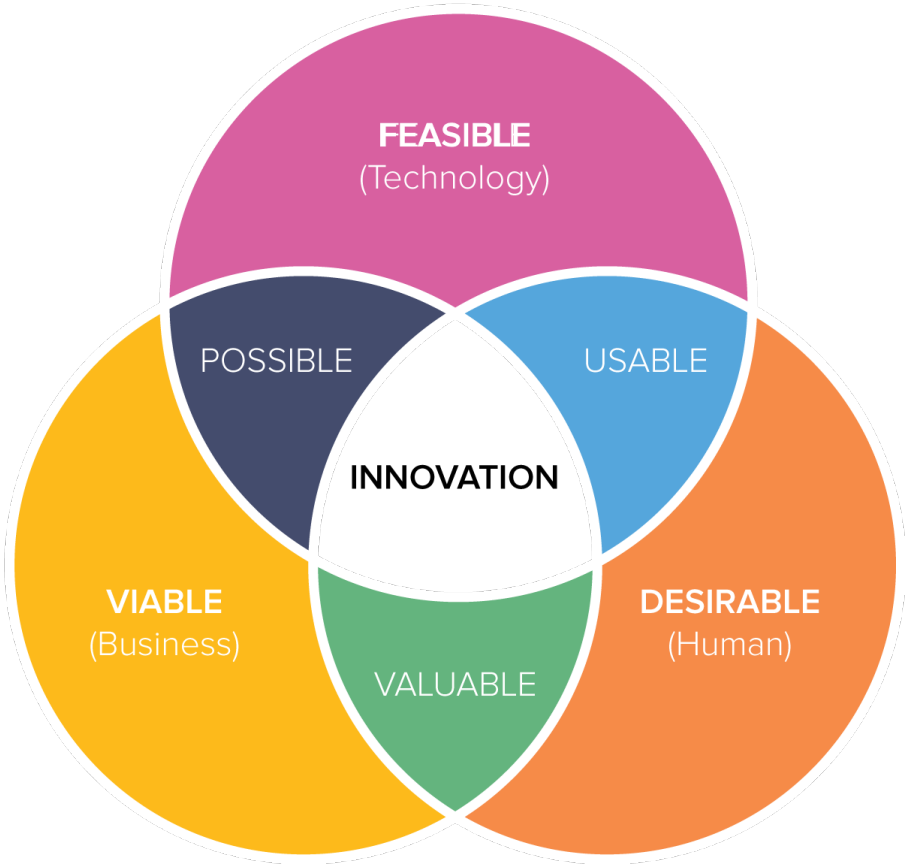
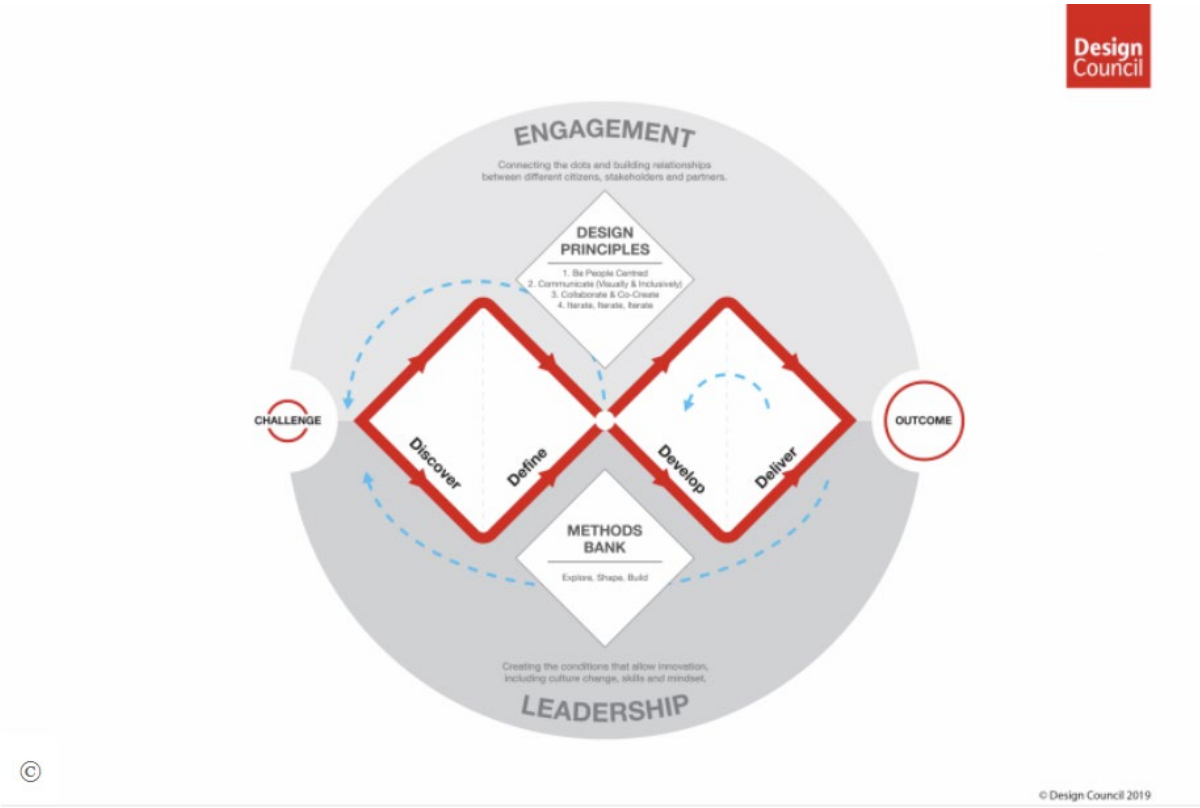


Image credit: https://www.linkedin.com/pulse/why-all-product-managers-should-understand-trinity-benji-soto/

The Double Diamond is one of many approaches to model a design and development process; one that fits perfectly with what we expect from you as a media designer in this semester. How to apply this model and use it to its full power in your projects will be explained further during the semester.



Sources:

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- https://uxdesign.cc/how-to-fuck-up-the-design-thinking-process-and-make-it-right-dc2cb7a00dca

Diverging / Converging methods

The Double Diamond design process is all about diverging (gathering inspiration and insights / exploring possible solutions / doing lots of experiments) and converging (reducing this multitude of options to a statement or a solution that best fits the context and its requirements).

Teachers from very diverse backgrounds will be available to inspire you (diverging) and to help you make and substantiate all sorts of choices (converging).

Research

For both gathering insights as well as substantiating your choices, you will be taught to find and apply the correct research methods. Every time you need to make a choice, an underlying question exists; sometimes very obvious and sometimes hard to find. Learning to recognize these questions may be the hardest part, but once you master it, research becomes a lot easier and much more meaningful.

Interaction Design

A lot of research has been conducted in the area of Interaction Design (IxD). You will be taught the most important basic principles from which you can further explore and expand your knowledge as needed for your project. Applying this knowledge, you will be able to lift your first prototypes to a higher level, avoiding the waste of time of getting answers you could have thought of yourself.

Building Interactive products

To be able to come up with an innovative interactive user experience, you will conduct a lot of experiments using combinations of software and hardware. Don't limit yourself to the confines of the (laptop) screen and the usual input methods (keyboard, mouse/touchpad), but actively explore

possibilities that lie beyond, for example: wearables, sensors, knobs and dials, computer vision, skeleton tracking, face tracking, … Anything goes, as long as it enriches your intended user experience in a meaningful way.

Professional Development

On top of the media design topics mentioned above, you will be working on your own professional development. In this semester, this will be shown primarily by presenting the steps of your iterative design and development process, by presenting your proceedings in a professional manner towards your client, by striving to deliver all of your work in a professional way and of professional quality and finally by presenting your explorations of and the resulting insights into your future work field.

Peer feedback & retrospective

For your own professional development, it is important not only to receive feedback on your work, but also on your professional attitude. By periodically giving and receiving feedback to your teammates (peers) during the semester, you can not only improve cooperation but also develop yourself in the field of communication and learning skills.

After the conclusion of each sprint demo, you and your group hold a retrospective in which the cooperation and the professional development points of each team member are central. It is preferred to keep this retrospective together with the product owner or subject teacher.

Resources

All learning materials are published in Canvas

5.3. Information about BA ICT & Media OE6: Prepare for Launch

Entry requirements

Learning Outcomes

Introduction

Examination and grading

Examination

Tools allowed

Resits and repairs

Grading

Learning activities

Resources

6. Information about Bachelor ICT & Software

6.1. Information about BA ICT & Software OE2

Entry requirements

To start with this educational unit, you must have completed the first semester of FHICT with an advanced level in Software Engineering.

Learning Outcomes

LO1: You base your choices on feedback from *stakeholders* and *justify* them in a *clear and professional* manner	
Stakeholder	A stakeholder is someone with a certain role (and interest) in the project in the project; however large or small. You can identify those stakeholders with their interests and are able to prioritize their interests.
Justify	You can provide reliable and relevant sources for all the decisions you made. The provided sources are judged by you on their reliability and relevance for the project.
Clear and professional	Your documentation is complete but concise, non-trivial, spellchecked and appropriate for the intended stakeholders.

LO2: You *collaborate, communicate professionally* and *act constructively* with others	
Collaborate professionally	You work together towards a common goal and take initiative to improve the process.
Communicate professionally	You can deliver artefacts to stakeholders and have meaningful meetings on relevant topics in the team. An artifact is a deliverable relevant to a stakeholder. This can be, but is not limited to, analysis documents, design documents, code and installed software.
Act constructively	You reflect regularly on the way you work and how your actions influence yourself, others and the end result. To do this, you regularly ask feedback about your behaviour and use it to define actions to improve your behaviour and act upon them.

LO3: You can document *validated user requirements* for applications and translate these to *specific software designs*

Validated user requirements	You make sure the user requirements are accepted by the stakeholders and you can prioritize them in a logical manner (i.e. features that provide the most value for the stakeholder should have the highest priority). User requirements are about expected behaviour of the system which should be described in specific terms of interaction between user and system. User requirements are validated to be specific by means of acceptance tests that can be executed to validate the product(s).
Specific software designs	You can translate requirements to relevant diagrams depicting the technical design, which can be implemented accordingly. Relevant diagrams are those diagrams needed to be able to implement the product and can be (but are not limited to) architecture, domain models, database designs.

LO4: You can *repeatedly design*, build and *deliver secure* and *maintainable* applications (at least one of which is web-based) that connect to a database using *OO principles* and *standard techniques* based on validated user requirements	
Repeatedly	You can create, extend and maintain different projects.
Design	Extending and maintaining projects starts with rethinking the requirements and the design.
Deliver	You provide or deploy the software in a way the stakeholders can use it.
Secure	A software system should be protected against unintended and unexpected errors. Unintended errors occur when users use the product in ways that were not foreseen and not part of the requirements. Unexpected errors occur when something in the system fails, for example when the connection to the database is down.
Maintainable	A design should be ready for future requirements and changes on existing requirements.
OO principles	Use mainstream OO principles to design and justify the implemented software.
Standard techniques	A standard technique is a way of working that is easily transferred to other developers and accepted as a good practice.

LO5: You can reason about *computational problems* and implement *algorithmically non-trivial problems* in software	
Computational Problems	Implement existing algorithms to solve a logical problem. You also use standard techniques to prove the algorithm works.
Algorithmically non-trivial problems	Design and implement an algorithm that satisfies the business rules of the stakeholder.

LO6: You can *design*, implement and *query* a relational database system and *integrate it with an application*	
Design	You can differentiate between software and database designs. In addition, your database contains at least one-to-many and many-to-many relations.
Query	You can execute CRUD operations on data in a relational database, while considering performance; CRUD: Create, Read, Update, Delete.
Integrate it with an application	You can write code that executes queries on a relational database from the software. Appropriate techniques are used for querying and you can justify why it is done in the chosen way.

LO7: You can *continuously improve* and *prove* the quality of your software using *standard techniques and tools*	
Continuously	You work in a way where software is created in iterations, without breaking existing functionality and changes are tracked.
Improve	You use standard tools and techniques to check and improve the quality of the code.
Prove	Code needs is tested for happy flow and expected or encountered error situations. These tests must be executable multiple times in different phases of the project. Expected errors can be either following from the requirements (unintended errors) or external dependencies in the software (unexpected errors).

Standard techniques and tools	Usage of a versioning system, acceptance tests and unit tests.

6.1.1. Information about BA S OE2 Course Based

Course Based

Introduction

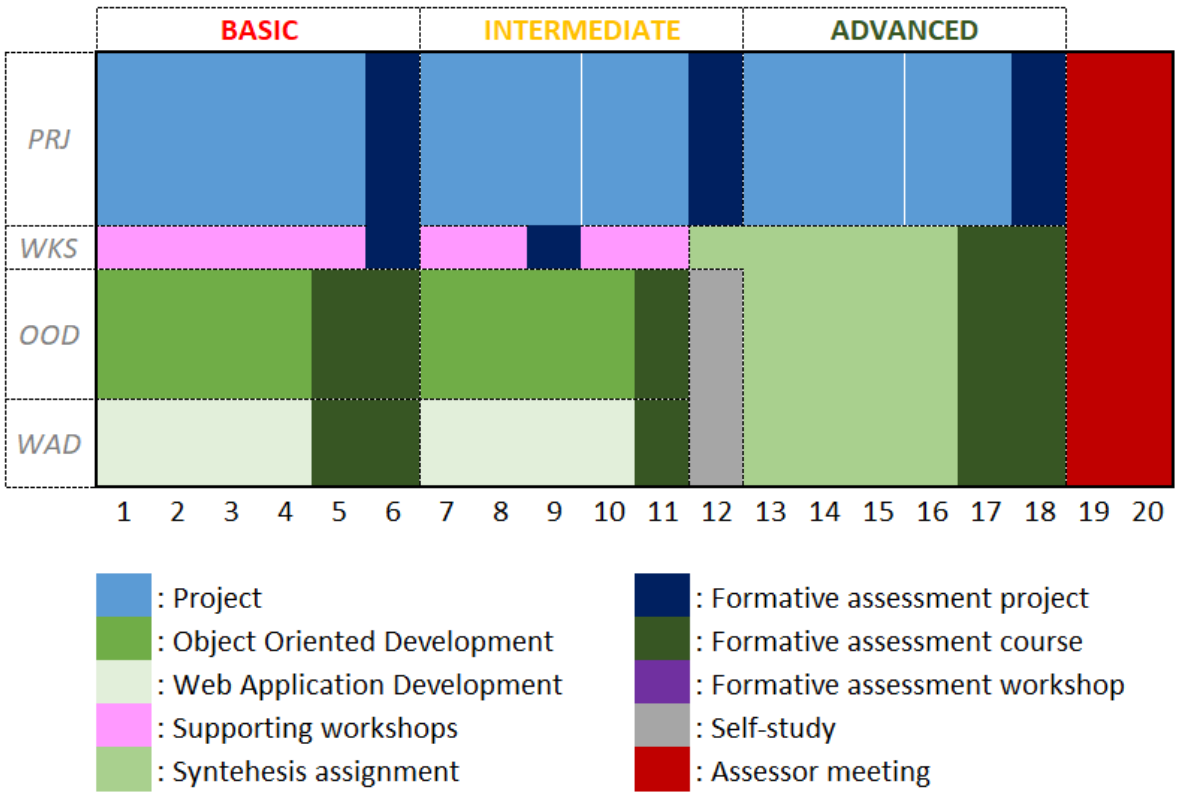
The focus of this semester is on expending your knowledge related to the field of ICT & Software engineering. In doing so, you will also develop professional skills that are relevant to all ICT professionals. During this semester you will participate in four modules:

1 Project in a simulated environment (PRJ)
2 Supporting workshops (WKS)
3 Object oriented development (OOD)
4 Web application development (WAD)

The emphasis of this semester is on analysing, designing and delivering object-oriented software solutions.

Semester overview

The semester itself is composed out of three phases of six weeks, with each next phase increasing the complexity of the learning activities.



The abover figure depicts an abstract overview of the semester; a more detailed overview can be found on Canvas. Below you can find a short summary of the modules.

The module PRJ contains authentic learning activities in a simulated environment where you participate in a group of four students to collaboratively deliver artefacts for a project. These learning activities require you to apply knowledge learned and practices during the other three modules.

The module WKS contains workshops with supportive concepts for the learning activities of the other modules. These concepts are important for the other modules, but also do not warrant a full semester of learning activities.

The OOD & WAD modules are strongly related to each other and consists of theory and individual practice tasks for you. These two modules seemingly start as two stand-alone modules but they are related and cross-references will be made to make you aware about the interconnectivity and transferable knowledge. Especially during the intermediate phase the concepts will start to synthesize with each other.

Quality assurance

Every semester we evaluate our education to continually improve it, and we will organise sessions with you during the semester for this. Your feedback and suggestions are invaluable. We would therefore greatly appreciate you giving us an insight into your experiences while studying with us.

You can always give your feedback to your mentor, your course teacher, or your project tutor. In addition, feel very welcome to share your thoughts and experiences with the ICT & Software Engineering - Semester 2 course-based coordinators (Chung Kuah - c.kuah@fontys.nl or Rafayel Avetyan - r.avetyan@fontys.nl).

Changes for 2021-2022 NJ

Previous cohort students have been requested to submit feedback via the *Spring 2021 education evaluation*. The general consensus about the content of S2-CB is positive and most feedback was related to the logistics to coop with the COVID-19 situation.

The following changes are made as improvements:

Points of attention	**Implementation**
It is unclear what SSS is should be used for and what questions can be asked to a teacher	Supported self-study is now removed and folded into WAD as practical. This way students have scheduled moment to ask questions about OOD or WAD during the practical.
WAD material quite theoretical and the taught practical application of it depends on the teacher.	The WAD has been redeveloped to decrease the cognitive load. Instead, C# is used as the language for semester 2 which also allows for a better synthesis of concepts covered during OOD.
The analyse & design assignment has a high workload over a short time of period and mainly evaluates proficiency of OOD	This assignment is replaced by an individual project spanning 4 weeks require all covered concepts of semester 2 to be applied. A tutor will be assigned to a student to coach the process. In addition, no new concepts are taught and the practical moments can be used to ask questions for feedback of module teachers.

Examination and grading

Examination

At Fontys School of Information and Communication Technology, we use learning outcomes as the base for the integral semester assessment. By the end of semester 2 you need to have demonstrated that you have achieved the learning outcomes. This is done by the end of week 18 with different deliverables produced during your participation in the modules.

Formative indications for the learning outcomes

A formative indication is a development-oriented scale, interim evaluation, that is used as input for the assessor meeting. In this meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes assignments, module deliverables, demo's, teacher feedback, observations, etc.

During semester 2 you will receive formative indications as feedback. The deliverables created for each module will be used to evaluate how you are doing related to each learning outcomes.

Every module deliverable is valuated according to the decision guidelines below. Based on these decision guidelines all learning outcomes will be expressed in terms of the following formative indications: Undefined, Orienting, Beginning, Proficient, Advanced.

Formative inidication	**Explanation**
Advanced	You have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.
Proficient	You have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.
Beginning	You have taken the first steps and carried them out which contribute to demonstrating the learning outcome.
Orienting	You have made a start and explored the possibilities to demonstrate the learning outcome.
Undefined	You have not yet undertaken activities to demonstrate the learning outcome.

Summative, integral semester assessment

Based on the formative indications of the learning outcomes, the assessors (= all involved teachers) decide during the assessor meeting in week 19 on your integral semester assessment result expressed as a letter grade:

Letter grade	**Explanation**

Outstanding (O)	You have demonstrated the learning outcome at an outstanding level. This means that you have shown your development at the level described in the explanation of the learning outcome. And, on top of that you have shown a significantly higher development on several of the assessment criteria.
Good (G)	You have demonstrated the learning outcome at a good level. This means that you have shown your development at the level described in the explanation of the learning outcome.
Satisfactory (S)	You have demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, but that you have shown sufficient level.
Unsatisfactory (U)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing one or more essential aspects in your development.
Poor (P)	You have *not* demonstrated the learning outcome at a satisfactory level. This means that you have *not* shown your development at the level described in the explanation of the learning outcome, and that you are missing many essential aspects in your development.

The guidelines below are used to decide on this result. In well-motivated cases, the assessors can deviate from these guidelines.

Pass (30 EC)	
Outstanding (O) *Good (G)*	At least half the learning outcomes at *advanced* and the remaining at *proficient*
Good (G) *Satisfactory (S)*	All learning outcome at *proficient*
Fail (0 EC)	

Unsatisfactory (U)	Any learning outcome lower than *proficient*

Tools allowed

Within the modules you will receive specific information about permitted tools and aids. You can find general information about this in the 'Exam procedures and fraud policy', available on Student Square (Fontys ICT portal).

Resits and repairs

During the semester you work on learning activities to develop towards and show the expected level on the learning outcomes. You have several opportunities to demonstrate your level and will receive feedback on how your development progresses. As described above, your teachers with valuate your level on the learning outcomes.

In week 6 you receive formative indication, via the module deliverables, about how your progression towards achieving the learning outcome. If any of the indication are lower than *proficient*, you have until and including week 11 to catch up. In week 12 you again receive formative indication, via the module deliverables, about how your progression towards achieving the learning outcome. If any of the indication are lower than *proficient*, you have until and including week 16 to catch up. In week 17/18 you receive your final formative indication, via the module deliverables, about how your progression towards achieving the learning outcome. This also means you do not receive any extra opportunities anymore to develop and demonstrate your level on the learning outcomes.

All the received formative indications are used as input for the integral assessment. If you then fail the semester you will have to retake the whole semester.

Grading

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 3 of the didactical model. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC and are not admitted to semester 3.

Appeal to Examboard In case the grading procedure was not followed correctly or invalid criteria have been used to determine the grade, you can appeal to the Exam Board. In such case, you need to be explicit about which part of the procedure was not followed or which criteria were used for grading. Simply disagreeing with the examiner is not a valid reason to appeal. You can contact your mentor for more information about appeals.

Learning activities

Semester 2 is made up of many different learning activities, which are organised in the modules and three phases. These activities are guided by course teachers, a project tutor or mentor and are scheduled for you. It is expected that you are present during these schedule moments.

Module: Project

Learning activities within this module revolve around group work performed by three students and is scheduled for two day-parts of a week. You go through the process of developing a scheduling system by gathering requirements, designing, implementing and testing the system to-be.

The emphasis of the learning activities is on applying the knowledge gained during the other modules and how to professionally collaborate. During the project students are supported by multiple teachers:

- One teacher as a mentor to provide support and feedback about the process.
- Course/workshop teachers as technical experts to guide for any technical challenges.

You will follow two different software development lifecycles (SDLC) to experience the differences between them. You start with the waterfall methodology (week 1 – 6) and then the iterative-model with

four iterations (week 7 – 18). As a recurring learning activity, you are tasked to reflect what their experience is with both SDLC and then compare them.

Module: Object Oriented Development

The theory and practice within this module are a continuation of what you learned in semester 1 related to application development and is scheduled for two day-parts of a week. Most of the learning activities revolve around object-oriented development to solve less trivial tasks compared to semester 1. The remaining learning activities cover topics such as technical design, 'security', testing, etc.

The programming language C# and the 'windows form application' project-type will be used as the means to explain and practice the theory. The actual goal is to develop knowledge applicable to any programming and project-type environment and this will be made explicit during the OOD and WAD modules.

The main focus is object-oriented (OO) concepts which will be introduced in phase 1 and extended in phase 2 with good practices used in professional environments. During phase 3 you will work on an individual project where you can showcase your proficiency of the covered concepts in OOD, WAD & WKS.

Module: Web Application Development

The theory and practice within this module are a continuation of what you learned in semester 1 related to web development (EDO) and is scheduled for two day-parts of a week; more specifically HTML and CSS.

During phase 1, your knowledge is extended with ASP.NET Core Razor pages to gain basic knowledge about the back-end of web development. During phase 2 you continue with good practices used in professional environments. During phase 3 you will work on an individual project where you can showcase your proficiency of the covered concepts in OOD, WAD & WKS.

Module: Workshops

Workshops are isolated learning activities and are schedule for one day-part of a week during phase 1 & 2:

- *Technical documentation*: A workshop about technical documentation required for the project to document choices regarding user requirements (URS) and to validate them after implementation (test plan and report).
- *Applied databases*: A workshop about incorporating a relational database system (RDBMS) required for the project, OOD and WEB modules. This workshop expands the knowledge you acquired about databases/SQL during semester 1 with practical and more advanced usage of a RDBMS.
- *UML Activity Diagram*: A workshop about visualising an algorithm as a diagram to support you with documenting and explaining an algorithm during the other modules.
- *Feedback*: A workshop about giving and receiving feedback as a professional skill to support you when performing peer-reviews during the project. The aim of this workshop is to create awareness about the difference in cultural background and how to give and receive feedback.
- *Searching and using resources*: A workshop about evaluating resources on a generic as domain specific level. Students are required to search and use resources during the project, OOD and WAD modules. Awareness is created about misinformation and outdated information and tips will be supplied to find and convey correct information.

During phase 3 you will work on an individual project where you can showcase your proficiency of the covered concepts in OOD, WAD & WKS.

Self-study

The remaining time for self-study is not schedules and it is up to your how to spend those. Do note that expected workload of each (regular) week is about 40 hours of work and, if you subtract the scheduled moments, equates to 16 hours of self-study.

Orientation of semester 3

At the end of this semester, and assuming you are going to be placed in semester 3, you have the possibility to change to a different didactical model: *demand-based* or *open*. During the advanced phase you will be informed about what the differences are and, if you want, how you can communicate this change.

Resources

All learning materials are available on the canvas courses.

6.1.2. Information about BA S OE2 Demand Based

Demand Based

6.1.2.1. Information about S OE2 DB Individueel

Introduction

Gedurende het semester werkt iedere student aan een individueel softwareontwikkeltraject waarmee de verschillende leeruitkomsten kunnen worden aangetoond.

Alhoewel er een voorgesteld pad beschikbaar is, de verstandige standaardkeuze, is er continu de mogelijkheid tot herhaling, verdieping en verbreding van de stof.

Examination and grading

Examination

Gedurende het semester wordt tijdens contactmomenten met docenten feedback gegeven ten aanzien van de leerdoelen.

In ieder gesprek wordt feedback, -forward en -up gegeven die door de student zelf dient vast te worden legd.

Daarnaast wordt elke iteratie met een oplevering afgesloten, waarbij gekeken wordt naar de beheersing van de verschillden leeruitkomsten.

Alle deze informatie wordt aan het eind van het semester meegenomen in een integrale beoordeling, waarbij naar het proces en de resultaten van de student gedurende het hele semester wordt gekeken (het portfolio).

Tools allowed

Niet van toepassing.

Resits and repairs

Niet van toepassing.

Grading

Studenten krijgen holistische feedback (=over het geheel aan gemaakt werk en het proces) waarbij de onderbouwing gekoppeld is aan de leeruitkomsten. Aan het eind van het semester wordt een integrale beoordeling gegeven.

De formatieve indicatie bestaat uit een waardering op de USGO-schaal (Unsatisfactory, Satisfactory, Good, Outstanding).

Learning activities

In principe ligt de nadruk op zelfredzaamheid en zelfstandigheid. Studenten zijn eigenaar van hun leerproces en nemen hierin initiatief.

De docenten zullen zich mengen onder de studenten. Hierbij wordt kenbaar gemaakt welke docent op welke momenten beschikbaar is per klas. Bij deze contactmomenten wordt enerzijds bekeken wat er de afgelopen tijd gedaan is, maar ook wat de komende tijd nuttige aandachtspunten zijn. Van de student wordt verwacht dat hij deze afspraken bijhoudt en nakomt. Verder lenen deze contactmomenten zich voor technisch inhoudelijke vragen op het vlak van programmeren, databases of infrastructuur.

Op enkele vaste momenten in de week zullen er daarnaast facultatieve workshops plaatsvinden waarbij uitleg en demonstraties gegeven worden ter ondersteuning van het leerproces.

Resources

Lesmaterialen worden beschikbaar gesteld via de Canvas-omgeving.

6.1.2.2. Information about

Introduction

Vanuit diverse van onze Partners in Education zijn er projecten beschikbaar om aan deel te nemen. Een afvaardiging van het bedrijf fungeert ook als opdrachtgever voor de Proftaak. Je kunt zelf kiezen aan welk project je deel wil nemen (hoewel er voor elk project een beperkt aantal plaatsen te vergeven is).

De PiE's zijn IT-bedrijven, veelal uit de regio, die samen met Fontys werken aan het onderwijs. De opdrachtgeversrol in de proftaak wordt vervuld door een medewerker van zo'n bedrijf en ook de opdracht is vaak relateerd aan een concreet probleem waar dit bedrijf tegenaan loopt. De proftaak heeft de belangrijke pijlers van het vakgebied software engineering zoals programmeren, databases, en infrastructuur als focus.

Examination and grading

Examination

Gedurende het semester wordt tijdens contactmomenten met docenten feedback gegeven ten aanzien van de leerdoelen.

In ieder gesprek wordt feedback, -forward en -up gegeven die door de student zelf dient vast te worden legd.

Daarnaast wordt elke iteratie met een oplevering afgesloten, waarbij gekeken wordt naar de beheersing van de verschillden leeruitkomsten.

Alle deze informatie wordt aan het eind van het semester meegenomen in een integrale beoordeling, waarbij naar het proces en de resultaten van de student gedurende het hele semester wordt gekeken (het portfolio).

Tools allowed

Niet van toepassing.

Resits and repairs

Aangezien dit vakgebied onderdeel is van een praktijkgerelateerde toets, is er geen herkansingsmogelijkheid binnen het semester. Gedurende het semester zal continu de voortgang duidelijk zijn zodat je je te allen tijde bewust bent van je studiestatus.

Grading

Op basis van je individuele inbreng in de groep en de mate waarin je professioneel gedrag hebt laten zien, maar ook op de kwalitiet van het opgeleverde werk zal de proftaak als geheel beoordeeld worden.

De formatieve indicatie bestaat uit een waardering op de USGO-schaal (Unsatisfactory, Satisfactory, Good, Outstanding).

Learning activities

De proftaak is een realistische simulatie van de werkelijkheid. Groepsleden zijn op de geroosterde momenten aanwezig en vindbaar voor de begeleiders. Tenminste een keer per week heb je als groep overleg met de semestercoach over de voortgang van het project.

In de proftaak ga je iteratief, dat wil zeggen in herhalende ontwikkelrondes ("sprints") een opdracht uitvoeren voor een opdrachtgever. Iedere sprint begint met het vaststellen van de werkzaamheden voor de komende weken. Je zult elke 3 weken een demonstratie geven van het gepresteerde werk, waarna de opdrachtgever aangeeft in hoeverre het gerealiseerde product in lijn is met zijn verwachtingen. Vervolgens herhaalt deze cyclus zich, waar je bij de nieuwe planning rekening dient te houden met de opmerkingen van de opdrachtgever. Op het eind van de laatste sprint is er een showcase waarin alle projectgroepen hun werk tentoonstellen.

Resources

Lesmaterialen worden beschikbaar gesteld via de Canvas-omgeving van het individuele traject.

6.2. Information about BA ICT & Software OE3

Entry requirements

You completed the propedeutic phase with semester 2 from Software Engineering. As such, you have proved to have at least the following competence matrix:

	Analyse	Advice	Design	Realise	Manage & Control
User interaction					
Organisation Processes					
Infrastructure					
Software Engineering	1	1	1	1	1
Hardware Interfacing					

Learning Outcomes

Learning outcome 1:

You design and build user-friendly, full-stack web applications. User friendly You apply basic User experience testing and development techniques. Full-stack You design and build a full stack application using commonly accepted front end (Javascript-based framework) and back end techniques (e.g., Object Relational Mapping) choosing and implementing relevant communication protocols and addressing asynchronous communication issues.

Learning outcome 2:

You use software tooling and methodology that continuously monitors and improves the software quality during software development. Tooling and methodology Carry out, monitor and report on unit

integration, regression and system tests, with attention for security and performance aspects, as well as applying static code analysis and code reviews.

Learning outcome 3:

You choose and implement the most suitable agile software development method for your software project. Choose You are aware of the most popular agile methods and their underlying agile principles. Your choice of a method is motivated and based on well-defined selection criteria and context analyses.

Learning outcome 4:

You design and implement a (semi)automated software release process that matches the needs of the project context. Design and implement You design a release process and implement a continuous integration and deployment solution (using e.g. Gitlab CI and Docker).

Learning outcome 5:

You recognize and take into account cultural differences between project stakeholders and ethical aspects in software development. Recognize Recognition is based on theoretically substantiated awareness of cultural differences and ethical aspects in software engineering. Take into account Adapt your communication, working, and behavior styles to reflect project stakeholders from different cultures; Address one of the standard Programming Ethical Guidelines (e.g., ACM Code of Ethics and Professional Conduct) in your work.

Learning outcome 6:

You analyze (non-functional) requirements, elaborate (architectural) designs and validate them using multiple types of test techniques. Multiple types of test techniques You apply user acceptance testing and stakeholder feedback to validate the quality of the requirements. You evaluate the quality of the design (e.g., by testing or prototyping) taking into account the formulated quality properties like security and performance.

Learning outcome 7:

You analyze and describe simple business processes that are related to your project. Simple Involving stakeholders, predominantly sequential processes with one or two alternative paths. Related Business processes during which the software that you are developing will be used (business processes that the software must support by fully or partially automating them). or Business processes needed for the success of your software development project (e.g., product release, market release, financial assurance).

Learning outcome 8:

You act in a professional manner during software development and learning. Professional manner You actively ask and apply feedback from stakeholders and advise them on the most optimal technical and design (architectural) solutions. You choose and substantiate solutions for a given problem.

6.2.1. Information about BA S OE3 Course Based

Introduction

The focus of this semester is on expending your knowledge related to the field of ICT & Software engineering. In doing so, you will also develop professional skills that are relevant to all ICT professionals. During this semester you will participate in two modules:

1 The Individual track software (ITS).
2 The Group project software (GPS).

The emphasis of this semester is on creating a full stack (both front and back-end) application the quality of which has been validated by means of tests and other methods using Agile methodology.

Examination and grading

Examination

Formative assessment

The assessment will be student centered, based on set formative assessment moments after every sprint in both the individual and group project. Input is provided by the non-scheduled moments during sprints, where the students actively ask feedback, feedup and feedforward using Feedpulse as a feedback tool. The student is responsible recording the feedback in Feedpulse. Every sprint also has a hand-in of individual and group products the student has made up to that point. The content and quality of these products are also used as input for the formative assessments.

In the formative assessment the teachers use a development scale to decide the progress or status of all the learning outcomes. This scale looks like this: poor, unsatisfactory, satisfactory, good and outstanding. If a student scores poorly he can improve in his next formative assessment. Students should show progress during the 6 assessment moments where the 6th and last will be final opportunity to score well on the learning outcomes.

Summative assessment

Based on the formative assessments of the learning outcomes, your final assessment will be decided using the following guidelines. If the assessors deviate from these guidelines they will explain why they deviate from this.

Assessment guidelines
A student with any outcome graded below *Proficient* will obtain *Unsatisfactory (U).*
A student with all outcomes graded *Proficient* will obtain *Satisfactory (S)* or *Good (G)*.
A student with one or more outcomes graded *Advanced* will obtain Good (G) or Outstanding (O).

The student creates a portfolio which improves in quality and quantity during the semester. All formative assessment moments are used as input for the summative assessment during the Teachers assessment meeting in week 19, when the summative assessment takes place.

Tools allowed

Not applicable.

Resits and repairs

Since the Group project and Individual track are part of a practice-related test, there is no opportunity to retake within the semester. During the semester, the progress will be continuous so that you are always aware of your study status.

Grading

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 4 of the chosen Specialization profile. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC and are not admitted to semester 4.

Learning activities

Planning

In semester 3, there are at least 18 teaching hours for each class with a teacher every week. The rest of the time you are expected to work and study independently. So be aware that for a successful completion of the semester you will have to invest time in your studies every week on your own initiative.

The semester coordinator is responsible for the organization and implementation (content and didactics) of the units of study for the semester. A semester coordinator can always be addressed about questions in this area. Questions related to the course material or study progress and planning can be addressed to the scheduled teachers. Furthermore, you can ask your semester coach for help on all kinds of topics.

Location

Education will take place at an Onderwijs Innovatie Lab (OIL, Education Innovation lab) in the new build R10. Lectures and workshops will take place in the special workshop rooms. As it is unsure how Corona will affect education it could be that some or most education will take place online using Microsoft Teams.

Resources

Canvas contains the course planning, course guides, exercises, rosters and all other required learning material.

6.2.2. Information about

Introduction

Group Project

In the Group project you work as a group on an assignment. Typically the assignment is provided by a Partner in Education (PIE). Alternatively, you may suggest an own case to your tutors but they need to approve before you can start working on it. In cases of insufficient number of PIEs, a school case will be used. The PIE plays the role of Product owner in your project. The project covers all aspects of a software development. You need to pay attention to person, project and group management aspects. You need to analyze your stakeholders, their requirements and the ethical issues that may be caused by your application. Architecting and designing2 is also part of the project. And of course, developing, testing and releasing are indispensable project elements. A pro-active attitude, good communication skills with fellow students and stakeholders and an investigative mindset is required to successfully complete the project. Although, this is a group project, you have to make sure that you perform individual tasks that allow you to demonstrate your progress on the expected learning outcomes.

Individual project

The Individual project track is where you create your own full stack application, complete with front end, back end, testing, and continuous integration & deployment. Although here are also all aspects of a project present, some of them are much less prominent. Management is only at personal level, analysis and design are much less limited given the project scope. The focus here is on your technical and design skills. The role of the individual project is twofold. First, it serves as a playground for the technical skills required in the group projects – you learn the technologies you need to apply in the group project. Second, it serves to demonstrate your individual skills to the teacher which are much harder to track in a group project.

Examination and grading

Examination

Formative assessment

The assessment approach is based on the following principles:

- **Portfolio-based assessment**. In your study, you elaborate products (software, documents, research reports, designs, management tools), and collect evidences for activities that you perform. Altogether, they form your portfolio. You upload in Canvas these evidences and products whenever you have them.
- Your development is **monitored continuously** during the semester. The teachers observe your development and facilitates it by giving feedback, feedforward, feedup.
- You **review your peers** in the group project in Feedpulse to provide an additional input for teachers on the performance of fellow students.

- The **input for formative assessments** are recorded in a development scale rubric and Feedpulse.

Read carefully the information provided in the canvas courses on the assessment process (at which moments and how can you receive feedback, where is it recorded, and what activities are expected from you). In the formative assessments, the teachers use a development scale (see Table 1) to decide the progress or status of all the learning outcomes. The scale is targeted to indicate your level of development and to indicate further expected efforts from you rather than grade you.

Tools allowed

No restrictions.

Resits and repairs

Since the Group and Individual projects have practice-based assessments, retakes are not applicable. During the semester, the progress will be continuously monitored so that you are always aware of your study achievements. This will allow you to repair and improve initial results when this is needed.

Grading

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Assessments that are Outstanding, Good, and Satisfactory result in the assigning of 30 EC and admittance to semester 4 of the chosen Specialization profile. Unsatisfactory (U) results in doing a retake semester. You receive 0 EC and are not admitted to semester 4.

Learning activities

As this is a DB semester, in discussion with your tutors, you may agree on a planning. You also need to make a more concrete personal plans – when do you want to address which topic. Therefore you will make a personal plan which you will discuss in week 1 with your tutors.

Resources

Canvas courses contain relevant study materials and pointers on where to look for materials. You will have also to search yourself for relevant educational materials on a number of topics

6.3. Information about BA ICT & Software OE6

Entry requirements

Learning Outcomes

Introduction

Examination and grading

Examination

Tools allowed

Resits and repairs

Grading

Learning activities

Resources

7. Information about Bachelor ICT & Technology

7.1. Information about BA ICT & Technology OE2

Entry requirements

To start with this educational unit, you must have completed the start semester of FHICT with an advanced level in Technology.

Learning Outcomes

Leeruitkomst: Embedded systemen

Afkorting	Beschrijving
VI.P.1	Given a research question you areable to analyse, design and imple-ment an embedded system. You will use simple electrical circuits that you have assembled, Je laat zien dat je een onderzoek uitvoert en op basis hiervan een Embedded systeem met actuatoren en sensoren analyseert, ontwerpt en realiseert. Hierbij maak je gebruik van eenvoudige elektrische schakelingen die je samenstelt.

Leeruitkomst toelichting

Research Onderzoek	You use the DOT framework to discover the main research question, sub questions and develop the conclusion of your research Je gebruikt het DOT-framework om tot de juiste hoofdvraag, deelvragen en conclusie van je onderzoek te komen.
Embedded systeem	You are able to combine multiple (micro)processors (e.g. as arduino/raspberry Pi) with different actuators and sensor. You use the correct software to control these devices. Een samenstelling van meerdere (micro)processoren (bv arduino, raspberry PI) met verschillende actuatoren en sensoren en de bijbehorende software.
.	You are able to control and use sensors and actuators by selecting the correct electronic circuits. Om de sensoren en actuatoren toe te kunnen passen dien je in staat te zijn de juiste electronische aansluitschema's te selecteren.
.	You are also able to measure and diagnose hardware to verify correct functioning. Tevens dien je metingen te kunnen verrichten aan deze hardware om te kunnen verifiëren dat deze correct functioneert.
.	**Sensor**: is a device that translates physical quantities in an electric signal. The follow basic sensors can be used: NTC, LDR etc. ***Sensor:*** Een onderdeel dat natuurkundige grootheden omzet in een elektrisch signaal. De volgende eenvoudige sensoren kunnen worden gebruikt: LDR, NTC, etc.

. The are also sensors that supply the measured quantity using a standardised bus (e.g I2C). Examples of this type are temperature sensors, humidity sensors, accelerometer, and shaft encoders.

Tevens zijn er sensoren die de gemeten grootheid aanbieden via een gestandaardiseerde bus (bv I2C). Voorbeelden van dit type zijn: temperatuur sensor, vochtigheidssensor, accelerometer en motorencoder.

. To use these sensors correctly, you have to be able to read and interpret and use the information in the relevat datasheets.

Om deze sensoren correct te kunnen gebruiken moet je in staat zijn om de gegevens uit de bijbehorende datasheet correct te interpreteren en verwerken.

. **Actuator**: A device which translates an electric signal in a physical quantity. The following actuators can be used: LED, DC Motor, Stepper Motors, LCD Screen etc..

Actuator: Een onderdeel welke een elektrisch signaal omzet in een fysieke grootheid. De volgende actuatoren kunnen worden toegepast: LED, DC-motor, Stappenmotor, LCD-scherm etc.

Leeruitkomst: Netwerk van Embedded systemen

Afkorting	Beschrijving
VI.P.2	You are able to analyse, design andrealise a simple network of(sub)systems. Je bent in staat om een eenvoudig netwerk van Embedded (sub)systemen te analyseren, ontwerpen en realiseren.

Leeruitkomst toelichting

Network Netwerk	You build a basic system that uses TCP/IP connections between computers. You can design a protocol and analyse network traffic Je realiseert een eenvoudig systeem dat bestaat uit TCP/IP verbindingen tussen computers. Je kunt hierbij een ontwerp maken van een protocol en het netwerk verkeer analyseren.

Leeruitkomst: Procedural Embedded programmeren

Afkorting	Beschrijving
VI.P.3	You are able to design, develop and test a procedural program for a simple technical system Je bent in staat om voor een eenvoudig technisch systeem procedureel georiënteerde software te ontwerpen, realiseren en testen.

Leeruitkomst toelichting

Design Ontwerpen	You structure your program by separating implementation(C file) from definition(header file). You define unit tests for your implementation. Je brengt structuur aan in je programma door de scheiding van implementatie (C file) en definitie (header file). Hierbij definieer je bijbehorende unittesten.
.	You are able to make two or more systems communicate using an existing bus architecture (e.g. I2C). You extended a protocol and created a state diagram. Je kunt twee of meerdere systemen via een bestaande bus (bijvoorbeeld I2C) met elkaar laten communiceren. Je hebt hierbij een protocol uitgebreid waarbij je gebruik hebt gemaakt van een toestands diagram.
Realiseren	You can implemented given algorithms. You apply pointers, structs, arrays, strings and bit manipulation Je kunt gegeven algoritmes implementeren. Hier pas je pointers, structs, arrays, strings en bitmanipulatie toe.
.	You can convert a state diagram to code. Je kunt een toestandsdiagram vertalen naar code.
.	You demonstrate that you are able use make file to build software. Je laat zien dat je make files kunt gebruiken om je software te bouwen.
Testen	You demonstration that you can write relevant unit tests for your software. Je laat zien dat je voor de gerealiseerde software relevante unittesten kunt realiseren.

Leeruitkomst: Object oriented programmeren

Afkorting	Beschrijving
VI.P.4	You are able to design, develop and test a object oriented program for a simple technical system. Je laat zien dat je voor een eenvoudig systeem object-georiënteerde software kunt ontwerpen, realiseren en testen.

Leeruitkomst toelichting

Object georiënteerd systeem	You demonstrate that you can build OO C# application that are reliable, robust and maintainable. Je laat zien dat je object georiënteerde C# applicaties kunt maken die betrouwbaar en robuust werken, en die tevens onderhoudbaar zijn.
Ontwerp en implementatie	You demonstrate that you can design and develop applications using use-cases and class diagrams. Je laat ook zien dat je met use cases en klassendiagrammen object georiënteerde applicaties kunt ontwerpen en implementeren.

Leeruitkomst: Professionele vaardigheden

Afkorting	Beschrijving
VI.P.5	You are able work on a technical system either individually or in a team. You work and interact goal oriented with stakeholders, keep a future minded outlook and work in a strategic, problem solving style. Your personal leadership demonstrates your growth and learning abilities. Je kan zowel alleen als samen aan een technisch systeem werken waarbij je toekomst- en doelgericht met stakeholders interacteert en je problemen onderzoekend oplost. Je persoonlijke leiderschap stelt je in staat de natuurlijke groei in je leervaardigheden zien.

Leeruitkomst toelichting

Future minded outlook Toekomstgericht organiseren	Exploring the organizational context of ICT projects, considering business interests, sustainability and ethics and other apsects that are part of executing a project. De organisatorische context van ICT-opdrachten verkennen, zakelijke, duurzame én ethische afwegingen maken en alle aspecten van de uitvoering van de opdracht managen.
Strategic, problem solving style	Reviewing ICT projects critically, identify problems and finding an effective strategy for a suitable solution.
Onderzoekend probleemoplossen	ICT-opdrachten kritisch vanuit verschillende perspectieven beschouwen, problemen identificeren, vinden van een effectieve aanpak en komen tot passende oplossingen.
Personal leadership Persoonlijk leiderschap	Being entrepeneurial with respect to ICT project and personal development, keeping in your own learning abilities and future development ambitions. Ondernemend zijn rond ICT-opdrachten en persoonlijke ontwikkeling, daarbij aandacht hebbend voor het eigen leervermogen en voor ogen houdend wat voor ICT-professional en/of welk type functies men ambieert.
Goal oriented interaction Doelgericht interacteren	Device which parters play a part in an ICT project. Work together effectively and constructively, and match communication to achieve the desired impact. Bepalen welke partners een rol spelen bij de ICT-opdracht, constructief met hen samenwerken en passend communiceren gericht op de gewenste impact.

7.1.1. Information about BA T OE2 Course Based

Introduction

Welcome to semester 2 course-based at Fontys ICT. In this semester education is designed according to the principles of course-based learning and 4C/ID. The focus lies on learning in the context of real-life tasks, and on clarity and predictability concerning learning outcomes, educational activities and assessment. At the beginning curriculum is more teacher-driven, Gradually, you will take more

ownership of your own learning process. You will first learn the basics of Embedded Systems within the context of examples and tasks that you will encounter in your later work as an Embedded Software Engineer professional. From this base, you will be stimulated to make well-founded choices about your own learning path.

The learning environment is organised in such a way that you interact closely with your teachers and fellow students. The physical learning environment, also called Open ICT Lab (OIL), consists of classrooms for planned lessons with your class, but also of more general areas for guided self-study, working on assignment & projects, learning and meeting up with fellow-students and teachers.

Enjoy your studies!

Examination and grading

Examination

Assessment

How is semester 2 course-based assessed?

At Fontys School of Information and Communication Technology, we use learning outcomes as the basis for the integral semester assessment. By the end of semester 2 you need to have demonstrated during the course of 18 weeks that you have achieved the learning outcomes.

Progress

The courses and project have assignments and deliverables. Each deliverable will be assessed in accordance with the course criteria and learning outcomes of the semester. Each teacher will keep track of your overall progress during the semester by updating your proficiency in a rubric (development oriented scale). This rubric is a formative indication. A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. Some courses may have diagnostic tests for a specific learning outcome to gauge your level at different times during the semester.

The development oriented scale shows how well you have shown your proficiency of a learning outcome and is defined as follows:

- **Undefined**: you have not yet undertaken activities to demonstrate the learning outcome.
- **Orienting**: you have made a start and explored the possibilities to demonstrate the learning outcome.
- **Beginning**: you have taken the first steps and carried them out which contribute to demonstrating the learning outcome.
- **Proficient**: you have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.
- **Advanced**: you have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.

Summative, integral semester assessment (week 19)

At the end of the semester all the teachers will take a look at your overall development for each of the courses and project and look at the formative results. In this final meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes: all deliverables such as assignments, tests, demo's, teacher feedback, observations, etc.

The below guideline indicates how a grade is established from the formative indicates.

- A student with any outcome graded below Proficient will obtain Unsatisfactory (U).
- A student with all outcomes graded Proficient will obtain Satisfactory (S) or Good (G).
- A student with half or more outcomes graded Advanced will obtain Good (G) or Outstanding (O).

The meaning of Outstanding (O), Good (G), Satisfactory (S), Unsatisfactory (U) can be explained as follows:

- Outstanding (O) : You have demonstrated the learning outcomes at an outstanding level. This means that you have shown your development at the level described in the explanation of the learning outcome. And, on top of that you have shown a significantly higher development on several of the assessment criteria.
- Good (G) : You have demonstrated the learning outcomes at a good level. This means that you have shown your development at the level described in the explanation of the learning outcome.
- Satisfactory (S) : You have demonstrated the learning outcomes at a satisfactory level. This means that you have not shown your development at the level described in the explanation of the learning outcome, but that you have shown sufficient level.
- Unsatisfactory (U) : You have not demonstrated the learning outcomes at a satisfactory level. This means that you have not shown your development at the level described in the explanation of the learning outcome, and that you are missing one or more essential aspects in your development.

Tools allowed

On the FHICT learning management platform you fill find your schedule and all given documents(presentations, exercises, manuals, etc.). You will also find links to Open Educational Resources (OERs) from other institutes.

We expect an explorative attitute from students, which means that we expect you to find relevant, valid and trustful sources yourself and that you indicate what sources you used.

Required hardware

In the Technology domain it is important that you prove that your system works, to do this you do need measuring equipment. We expect you to buy at least a multimeter and a logic analyzer yourself which you can use it throughout the entire Technology curriculum.

You can find our recommendations in the table below, these are devices on which your teachers can give support:

Tool	Required	Alternative/better model
Multimeter	UNI-T UT132D	UNI-T UT139C (adds auto range + 6000 counts display)
Logic Analyzer / signal generator	IKALogic SQ series (SQ25,SQ50)	Analog Devices ADALM2000

The UT139C multimeter is available for borrowing from the ISSD. Note that the ISSD has limited quantity and borrowing is for limited time only, see ISSD rules and regulations on the portal.

Learning Management Platform

In this semester we use Canvas as learning management platform. Specific details about different subjects can be found in their Canvas courses. When a Canvas course deviates from the contents of this study guide, this study guide is leading.

Supported Software Platforms

This semester uses Windows and Linux as the work environment. Linux images can be recommended by your teachers. Virtual Machine software is available through the student portal. You are free to use other software but the teacher may not be able to help with software other than recommended due to different configurations.

For online lessons sessions we will use Microsoft Teams. You are advised to work together in groups to simulate a “day at school”. We have found that this works well to motivate you for your various challenges.

Resits and repairs

During the semester you work on learning activities to develop towards and show the expected level on the learning outcomes. You have several opportunities to demonstrate your level and will receive feedback on how your development progresses. As described above, in week 18 your teachers will evaluate your level on the learning outcomes. No single assessment is decisive. This means that even though you may receive a mark lower than sufficient for an single assessment, it doesn’t mean you automatically fail the semester. There are multiple opportunities to demonstrate the learning outcomes.

If you do fail the semester, you can retake all courses during the following semester. In some cases you get the opportunity to do a tailor-made semester.

Grading

During the assessor meeting in week 19, the summative, integral semester assessment is expressed as: Outstanding (O), Good (G), Satisfactory (S), or Unsatisfactory (U). Outstanding (O), Good (G), and Satisfactory (S) result in the assigning of 30 EC and admittance to semester 3. Unsatisfactory (U) results in having to retake the semester. You receive 0 EC, and are not admitted to semester 3.

In case you do not agree with the grading you have received or how you have been assessed, you are entitled to appeal to the Exam Board. The Exam Board will then inform you about the further procedure. You can contact your mentor for more information about appeals.

Decision on placement in next semester

At the end of the semester, based on the decision taken at the assessor meeting, the exam board will place you in your follow-up semester. This will be one of the following options:

- You have completed the semester: You receive 30 EC and are admitted to semester 3 depending on your own choice of enrolment:
    - Course based semester 3 ICT and Technology profile;
    - Demand based semester 3 ICT and Technology profile;
    - An open semester in which you set your own learning outcomes.

Note: Enrolment information, deadlines and orientation materials for this choice will be made available during the semester. Discuss your choices with your semester coach if you have questions.

- You have not completed the semester: You receive 0 EC and are not admitted to semester 3. During the assessor meeting the decision will be made whether you need to restart semester 2, or whether you are offered the opportunity to do a tailor-made semester.

Learning activities

Semester 2 is made up of different learning activities, organised in courses and a project. The semester is centered around the Industry Project. The project is made up of a large assignment in cooperation with a company and workshops. The workshops and the courses together aim to teach you the skills necessary to complete the project succesfully.

Resources

All the learning materials can be found in the Semester 2 canvas courses.

7.1.2. Information about BA T OE2 Demand Based

Introduction

Welkom bij het profiel ICT & Technology!

In deze handleiding vind je een overzicht van ons onderwijs in S2.

Centraal staat de proftaak waarin je soft- én hardware gebruikt voor een innovatieve toepassing. Om een praktijk situatie zoveel mogelijk te benaderen, vindt de opdracht plaats in de context van een van onze partners in education.

Daarnaast vind je in deze handleiding een beschrijving van de onderwerpen in dit semester. Als extra uitdaging kun je er nog een schepje bovenop doen met Voorbereiding Academische Vorming (TAV2), of extra keuze onderwerpen.

Deze handleiding is bedoeld om je een overzicht te geven. Kleine wijzingen en aanvullingen zijn mogelijk. Deze worden uiteraard zo tijdig en duidelijk mogelijk naar jullie gecommuniceerd.

Namens het docenten team T-S2:

Veel succes en plezier tijdens deze periode! **Overzicht**

Centraal in dit semester staat het analyseren, ontwerpen en realiseren van programmacode ten behoeve van het interfacen met sensoren en actuatoren, van een regelkring en van (eenvoudig) gedrag op een klein embedded systeem. Diverse onderdelen zullen met elkaar en met de buitenwereld communiceren.

Onderwijsvorm

De uitvoering is ingericht met als basis de demand-based leervorm. Binnen deze leervorm kies je voor een flexibele leerweg, waarbij de leeruitkomsten en toetscriteria door de opleiding zijn vastgelegd. Dit betekent dat je zelf je eigen leerproces in handen kunt nemen en zelf keuzes kunt maken in de leerweg naar het aantonen van de leeruitkomsten toe.

Je maakt gedurende het semester in de demand-based leervorm keuzes uit diverse onderwijsactiviteiten en studiematerialen. Je zult worden begeleid door een team van docenten.

Voor elke vakgebied is op vaste momenten in de week begeleiding door een docent met de desbetreffende expertise. Tijdens deze momenten overleg je met de docent wat je leertraject is en laat je zien wat je voortgang is. De vakdocent legt op meerdere momenten gedurende het semester vast welke (onderdelen van) leeruitkomsten je beheerst. Je laat gedurende het semester op meerdere momenten zien dat je een leeruitkomst beheerst. De context waarin je dit laat zien kies je zelf (bijvoorbeeld het maken van practicum opgaven, als onderdeel van groepswerk of een individueel project).

In onderstaande tabel staat een overzicht van de wekelijkse contacturen.

Expertise van docent	Aantal blokken met contacturen per week	Aantal contact-lesuren per week
ES2	1	4
PRC2	1	4
OOP2	1	4
PROF2	1	4
Breed	1	4

Semestercoach

De semestercoach zorgt voor individuele begeleiding en de begeleiding van het groepsproces. Hij is mede verantwoordelijk voor de begeleiding en beoordeling van de leeruitkomst professionele vaardigheden. De semestercoach ondersteunt de student aan de hand van verschillende gesprekken. De semestercoach handelt situationeel, door op het juiste moment de juiste rol en aanpak te kiezen.

Aanspreekpunten

De docenten van dit semester zijn voor jou het eerste aanspreekpunt voor de onderwerpen waar zij verantwoordelijk voor zijn. De blokeigenaar is aanspreekbaar binnen het blok, en de curriculum eigenaar voor blok overstijgende zaken.

De semestercoach is vaak een aanspreekpunt voor het voor persoonlijke gesprekken van bijvoorbeeld privé situaties die invloed hebben op je studie.

Lesruimte en werkplek

Het is **absoluut verboden** om elektrische apparaten zoals waterkokers/tosti-apparaten en/of koffiezetmachines in de lesruimtes te plaatsen. Als de beveiliging deze spullen aantreft dan worden ze weggegooid.

Examencommissie

De officiële publicaties en regelingen van de examencommissie die samenhangen met je studie en je studievoortgang zijn te vinden via de FHICT portal. Hier vind je bijvoorbeeld meer informatie over de Onderwijs- en examenregelingen (OER) en het fraude- en toetsbeleid.

In het fraude beleid vind je bijvoorbeeld dat 'onder fraude wordt verstaan elk handelen (waaronder het plegen van plagiaat), of nalaten, waarvan betrokkene wist of behoorde te weten, dat dit handelen en of nalaten het op de juiste wijze vormen van een oordeel over iemands kennis, inzicht, vaardigheden, competenties, (beroeps)houding, reflectie e.d. geheel of gedeeltelijk onmogelijk maakt.'

Meer informatie is te vinden via de examencommissie pagina: via https://portal.fhict.nl/Studentenplein/Documenten%20rondom%20studievoortgang.

Proftaakgroep

De proftaak wordt bij voorkeur uitgevoerd in teams van minimaal 4 en maximaal 6 studenten. Aanwezigheid op de ingeroosterde dagdelen is verplicht. Kun je onverhoopt niet aanwezig zijn, meld je dan af bij je medestudenten en semestercoach.

Verbeteracties

Om de studenten een beter inzicht te geven in de inhoud van het semester zijn 4 verschillende canvas cursussen samengevoegd in 1 cursus. Deze cursus zal als pilot uitgerold worden in de locatie Tilburg

Examination and grading

Examination

Tijdens dit semester bouw je een portfolio op. Deze kan bijvoorbeeld bestaan uit:

- Basiskennis oefeningen die je hebt gemaakt voor de verschillende vakgebieden.
- Formatieve toets resultaten.
- Jouw bijdrage aan groepswerk.
- Feedback verslagen.
- Studieplanning.
- Presentaties.

- Persoonlijke verbeterplannen met een beschrijving van de uitvoering en een reflectie op de behaalde resultaten.
- Persoonlijke invulling (bijvoorbeeld project(en) en onderzoek).

Niveau leeruitkomsten

Voor elke leeruitkomst wordt een indicatie gegeven op welk niveau de student deze beheerst. Hiervoor zijn 5 niveaus gedefinieerd:

Niveau	Toelichting
Onbepaald	Je hebt nog geen activiteiten ondernomen voor het aantonen van de leeruitkomst.
Oriënterend	Je hebt een begin gemaakt en mogelijkheden verkend om de leeruitkomst aan te gaan tonen.
Beginnend	Je toont aan dat je kennis, inzicht en vaardigheden, passend bij de leeruitkomst, in één situatie toepast.
Geoefend	Je toont aan dat je kennis, inzicht en vaardigheden, passend bij de leeruitkomst, in verschillende situaties toepast.
Gevorderd	Je toont aan dat je kennis, inzicht en vaardigheden, passend bij de leeruitkomst, in verschillende situaties toepast, dat je werkt met de instelling dat het altijd beter kan en actief werkt aan verbeteringen.

Per leeruitkomst zal worden vastgelegd wat het tot dusver behaalde niveau is op de 5-punts schaal.

Tools allowed

Alle beschikbare hulpmiddelen toegestaan.

Resits and repairs

Omdat jouw leerniveau via permanente evaluatie regelmatig en vroegtijdig gemeten wordt, zijn er geen herkansingen om de nog niet aangetoonde leeruitkomsten op het niveau van Geoefend te krijgen.

Grading

Bij de afronding van het semester bepalen alle in dit semester betrokken docenten op basis van het portfolio of de leeruitkomsten zijn behaald of niet (portfolio-beoordeling). Aan de tussentijdse formatieve-feedback en -beoordelingen kunnen geen rechten worden verleend voor de eindbeoordeling. De summatieve beoordeling aan het eind van het semester wordt uitgedrukt in de USGO-schaal (unsatisfactory, sufficient, good, outstanding). Unsatisfactory resulteert in herstart of maatwerk.

De assessoren hanteren daarbij de onderstaande richtlijnen, of leggen uit waarom ze hiervan afwijken:

1 Een student die voor één leeruitkomst de status lager dan 'geoefend' heeft, kan nooit een hogere eindbeoordeling dan 'unsatisfactory' (U) krijgen.
2 Een student die voor alle leeruitkomsten tenminste de status 'geoefend' heeft, krijgt tenminste de eindbeoordeling 'satisfactory' (S).
3 Een student die aan de tweede richtlijn voldoet én voor tenminste één leeruitkomst de status 'gevorderd' heeft, krijgt de eindbeoordeling 'good' (G) of 'outstanding' (O).

Learning activities

Overzicht

Dit semester bestaat uit één onderwijseenheid:

Onderdeel	Credits (EC)
Inleiding technische systemen	30

In dit semester kom je in aanraking met aantal vakgebieden waarin je een aantal basisvaardigheden gaat leren om de leeruitkomsten te kunnen bereiken:

Vakgebied	Afkorting	Leeruikomsten(en)	Aandeel in studiebelasting
Embedded systems	ES2	VI.P.1, VI.P.2, VI.P.5	25%
Procedural Embedded programmeren	PRC2	VI.P.3, VI.P.5	25%
Object oriented programmeren	PRO2	VI.P.4, VI.P.5	25%
Professionele vaardigheden	PROF2	VI.P.5, VI.P.5	25%

De leeruitkomsten die horen bij de professionele vaardigheden zijn op alle vakgebieden van toepassing. Bovenstaande vakgebieden ga je gebruiken binnen zowel een groeps- als individueel project(en).

Resources

Op de elektronische leeromgeving van FHICT vind je het lesrooster en de aangeboden files (presentaties, opdrachten, handleidingen, etc.). Ook vind je daar het gebruikte lesmateriaal waarbij ook gebruik gemaakt kan worden van Open Educational Resources (OERs) van andere instituten.

Wij verwachten van jullie een onderzoekende houding. Dat wil zeggen dat we verwachten dat jullie ook zelf aan de slag gaan met het zoeken van relevante, valide en betrouwbare bronnen en OERs en ook aangeven waar jullie welke informatie vandaan hebben gehaald.

Elektronische Leeromgeving

Binnen dit semester wordt Canvas gebruikt als elektronische leeromgeving. Specifieke details over de vakgebieden zijn te vinden in de Canvas cursus. Indien de canvas cursus inhoudelijk afwijkt van de inhoud van dit blokboek, dan is het blokboek leidend.

Ondersteunde Software Platformen

Binnen het profiel ICT & Technology wordt veel met hardware gewerkt die via de PC te besturen of te programmeren is. Hierbij wordt gebruik gemaakt van drivers. Deze drivers zijn meestal geschikt voor één bepaald Operating System. Het is praktisch niet mogelijk (of alleen met een onevenredig grote inspanning) om de bijbehorende software-componenten voor alle platforms aan te bieden. Daarom is gekozen voor het ondersteunen van een beperkt aantal standaardplatformen met bijbehorende tooling, te weten:

- Linux. Dit platform is als virtuele machine verkrijgbaar.
- Microsoft Windows 10.

Je zult merken dat de docenten zoveel mogelijk andere hardware/software combinatie willen ondersteunen, maar ‘soms gaat dat even niet’. Zorg daarom dat je altijd kunt terugvallen op bovengenoemde configuratie, bijvoorbeeld met een virtuele machine van VMWare.

Lesmaterialen: Embedded systems

Hardware

In het domein Technologie is het belangrijk dat je aantoont dat het systeem werkt. Hiervoor heb je wel meetapparatuur nodig. We verwachten dat je zelf een multimeter en logica-analysator koopt. Deze kan je gebruiken gedurende het hele technologie curriculum.

Onze aanbevelingen vind je in onderstaande tabel, dit zijn apparaten waarop je docenten ondersteuning kunnen geven:

Tool	Required	Alternative/better model
MicroController	Arduino Uno	.
Multimeter	UNI-T UT132D	UNI-T UT139C (adds auto range + 6000 counts display)
Logic Analyzer / signal generator	IKALogic SQ series (SQ25, SQ50, ...)	AnalogDevices ADALM2000 (similar to AnalogDiscovery-2 but a lot cheaper) or: Digilent 410-321 Analog Discovery-2 (also has osciloscope function)

Daarnaast is via ISSD te leen:

- Elektronica ES-kit

Lesmaterialen: Netwerk van embedded systemen

- Sheets + opdrachten
- Virtueel linux image
- Vmware
- Wireshark
- Extra lesmateriaal is per module gespecificeerd
- Computer Networking, 1st edition: http://cnp3bis.info.ucl.ac.be/firstedition.html

Lesmaterialen: Procedural Embedded programmeren

Literatuur

Er worden 2 boeken gebruikt, de beste van de twee is https://www.tutorialspoint.com/cprogramming/c_pdf_version.htm, alleen deze is Engelstalig. Mocht je daar een probleem mee hebben dan is er ook een Nederlandstalig boek beschikbaar: Imperatief Programmeren in C.

De overgang van een Object Georiënteerde taal naar C kan best een schok zijn, om daarbij wat meer context te geven is het raadzaam om af en toe eens een hoofdstuk uit de volgende (Engelstalige) tekst te lezen: The Descent to C: http://www.chiark.greenend.org.uk/~sgtatham/cdescent.

Lesmaterialen: Object oriented programmeren

Het volgende lesmateriaal is verplicht:

- Microsoft Visual Studio.
- Boek “Head First C#, 2nd edition, Andrew Stellman & Jennifer Greene, O'Reilly, ISBN 978-1-449-38034-2
- Boek "Praktisch UML”, 5e editie, Jos Warmer & Anneke Kleppe, ISBN 978-90-430-2055-8.

Additioneel lesmateriaal:

http://www.blackwasp.co.uk: Op deze site staan allerlei programmeerconcepten helder en bondig beschreven. Van basic onderwerpen als ‘Wat is OO’, ‘wat is inheritance’ etc (met code voorbeelden) tot geavanceerde onderwerpen als design patterns en andere design principles.

Lesmaterialen: Professionele vaardigheden

Als lesmateriaal wordt er gebruik gemaakt van:

- Studentenhandleiding proftaken.
- Lesmateriaal van alle vakgebieden in dit blok.

7.2. Information about BA ICT & Technology OE3

Entry requirements

The target group of this semester consists of second-year students who have chosen the technology profile. Students from both EU2 DB and EU2 CB can enter this educational unit. For all students, we require the following competence profile:

Semester 2T	To advise	Analyse	To design	Realise	Manage & Control
User interaction					
Organisational processes					
Infrastructure					
Software			1	1	
Hardware interfacing	1	1	1	1	1

Learning Outcomes

A Cyber Physical System (CPS) is a system of interacting components with physical input and output.

Learning Outcome: Communication within CPS

In a professional way you analyse, design, implement, advise, manage and control communication for a CPS.

Clarification

Body of Knowledge

- Multi-device, multi-processor and multi-threaded communication
  - Synchronisation mechanisms and scheduling
- Serial communication
  - Point-to-point and broadcast networks
  - Layered communication models and how to use them
- IoT communication layers and their protocols
  - Layered communication models and how to use them
- Basic cyber security principles
  - Layered communication models and how to use them

Analysis:

- You perform an analysis yielding suitable communication for the problem domain and justify your choices.

Advice:

- You advise on protocol choices, taking into account resources, performance and security of the component communication.

Design:

- You design communication among multiple components based on an analysis.
- You elaborate on the chosen synchronisation mechanism if multithreading or multiprocessing is used.

Implementation:

- You apply multithreading or multiprocessing and related synchronisation mechanisms.
- You implement serial communication that fully adheres to the design.
- You implement a solution for IoT communication application level protocol that fully adheres to the design.

Manage and Control

- N.A.

Learning Outcome: Software Development for CPS

In a professional way you analyse, design, implement, advise, manage and control software for a CPS.

Clarification

Body of Knowledge

- Design
  - Object Oriented Analysis and Design
  - Modular Design
  - Platform independent design
- Programming in C and C++
  - Software build process
  - Memory management
  - Unit testing with mocks
- Data structures and algorithms with performance analysis

Analysis:

- You analyse the required functionality for a software system.
- You analyse the general performance aspects for a software system.
- You analyse existing components that can contribute to your solution.

Advice:

- You advise your stakeholder about impact of your design alternatives.

Design:

- You create a design for a software system that meets the following design requirements:
    - OS and hardware independence
    - Modularity
    - Testability
    - Performance
    - Memory impact

Implementation:

- You create an implementation that fully adheres to the design.
- You implement your solution according to given quality and coding standards.
- You test your implementation using unit and integration tests.

Manage and Control

- You setup and use version control.
- You use a test framework

Learning Outcome: Embedded Systems in CPS

In a professional way you analyse, design, implement, advise, manage and control hardware interfacing for a CPS.

Clarification

Body of Knowledge

- Low level hardware control
    - Hardware abstraction
    - Computer architecture
    - Embedded software development
    - Verification and validation using lab equipment
- RTOS concepts
    - Using threading, interprocess communication and mutexes
    - Embedded software development
    - Verification and validation using lab equipment
- Closed loop systems
    - Embedded software development
    - Verification and validation using lab equipment

Analysis:

- You analyse datasheets and use these to develop low level software that controls hardware components.
- You analyse signals and protocols with lab equipment.
- You analyse the required functionality for an embedded system.

Advice:

- You offer a technical advice for the hardware and software components of an embedded system.

Design:

- You design an embedded system based on the requirements.
- You design a suitable hardware abstraction layer for your embedded system.

Implementation:

- You create an implementation that fully adheres to the design.
- You implement your solution according to given quality and coding standards using defensive programming practices.
- You test your implementation using unit and integration tests.

Manage and Control

- N.A.

Professional Skills

Note: this applies to all learning outcomes.

Future-oriented Organisation

- You analyse the environment and stakeholders of the assignment.
- You substantiate the added value of a solution.
- You are familiar with ethical standards and involve social ethical issues in the judgements.
- You will independently make an inventory of sub-tasks, plan and monitor time, money, quality and ethics of the execution of the work.
- You recognise opportunities and risks and ensure future-oriented implementation, commissioning and management.

Investigative problem solving

- You determine the direction of the solution for a given problem and choose an appropriate approach.
- You solve problems methodically and creatively.
- You actively look for alternatives.
- You critically go through your own chain of reasoning.

Personal Leadership

- You present yourself professionally.
- You're being independent.
- You take others with you in your own development.
- You actively ask and give feedback.
- You strengthen your learning ability.
- You describe your professional talents, development ambitions and which professional field you aspire to.

Targeted Interaction

- You take into account different stakeholders in the assignment.
- You ensure the desired impact and execution of communication.
- You actively seek enrichment in the assignment.
- You consciously build up trust when working together.
- You work together in such a way that everyone's strengths and learning needs come into their own.
- You consciously take international differences into account.

7.2.1. Information about BA T OE3 Course Based

Introduction

Welcome to semester 3 course-based at Fontys ICT.

In this semester the education is designed according to the principles of course-based learning. The focus lies on learning in the context of real-life tasks, and on clarity and predictability of educational activities and assessments. At the beginning the education is more teacher-driven, and gradually you will take more ownership of your own learning process. You will build on your knowledge from semester 2 to further develop as an Embedded Software Engineer professional by doing more low-level embedded development, learning more about software design but also basics of RTOS, multithreading, IoT Networking and Feedback Control Systems related to the emebedded software engineering.

The learning environment will be blended: it will consist of both instructions, workshops and meetings at Open ICT Lab (OIL) and online study where you can count on the support and guidance of the teaching stuff.

A considerable part of this semester will be executed In practical integrated projects which will grow in complexity. These projects will provide a way to both applying knowledge from Communication,

Software Design and Embedded Systems subjects in projects relevant for the industry and to further developing professional skills.

Examination and grading

Examination

How is semester 3 course-based assessed?

At Fontys School of Information and Communication Technology, we use learning outcomes as the basis for the integral semester assessment. By the end of semester 3 you need to have demonstrated that you have achieved the learning outcomes. By the end of week 18 you demonstrate your learning outcome, based on your overall development during the courses and projects.

Formative indications for the learning outcomes (Week 6, Week 12, week 18)

A formative indication is a development-oriented, interim evaluation, that is used as input for the assessor meeting. In this meeting the assessors use all the formative indications to decide on the summative, integral semester assessment. The formative indications are based on all information that is available about your development during the semester. This includes: assignments, tests, demo's, teacher feedback, observations, growth in your personal skills etc. During semester 3 you will receive the following formative indications in week 6, week 12 and week 18.

You will be judged on each learning outcome, to see how well you master it. The following 5 levels are used:

Level	Explanation
Undefined	You have not shown your development at the level described in the explanation of the learning outcome. Many essential aspects are missing in your development.
Orienting	You have made a start and explored possibilities to demonstrate the learning outcome.
Beginning	You demonstrate that you apply knowledge, insight and skills, corresponding to the learning outcome in at least one simple context.
Proficient	You demonstrate that you apply knowledge, insight and skills, corresponding to the learning outcome, in a different or more complex context.
Advanced	See proficient. Additionally, your work demonstrates excellence in both technical and professional skills.

Tools allowed

Every available source is allowed.

Resits and repairs

Because your mastery of different learning outcomes is being evaluated regularly and early during the semester, there are sufficient possibilities to satisfy learning outcomes at the required end level. To allow longitudinal grading and feedback, it is necessary that you are active during the whole

semester. There are no resits or repairs possible after summative evaluation at the end of the semester.

Grading

At the point of the semester completion, all teachers involved in this semester will determine whether the learning outcomes are met. This will be based on the formative indications received for your portfolio and overall evaluation of your achievements. No rights can be derived from the interim formative feedback. The portfolio assessment at the end of the semester is expressed using the USGO scale (Unsatisfactory, Satisfactory, Good, Outstanding). Unsatisfactory results in a semester restart.

The assessors use the guidelines below:

1 A student that has a lower than proficient level for one learning outcome receives the final grade U (Unsatisfactory)
2 A student who has for all learning outcomes at least proficient level will receive at least the grade S (Satisfactory)
3 A student who meets the second guideline and has advanced level for at least one of the learning outcome will receive the grade G (Good) or O (Outstanding)

Learning activities

Unit	Credits (EC)
Cyber-Physical Systems	30

Semester 3 T CB's Educational Unit

In this semester you study the following subjects that will lead you to mastering the learning outcomes:

Subject	Abbreviation	Study Load
Communication within CPS	COM	20%
Software Development for CPS	SD	20%
Embedded Systems in CPS	ES	20%
Project	PROJ	40%

Resources

All materials will be provided in Canvas courses. The materials will include presentations, exercises, assignments, manuals, videos etc. Some of the materials will include Open Educational Resources (OERs) from other institutes.

We expect an explorative attitude from students, which means that we expect you to find relevant, valid and trustful sources yourself and that you indicate what sources you used.

Required hardware

In the Technology domain it is important that you prove that your system works, to do this you do need measuring equipment. We expect you to buy at least a multimeter and logic analyzer yourself which you can use it througout the entire Technology curriculum.

You can find our recommendations in the table below, these are devices on which your teachers can give support:

Tool	Required	Alternative/better model
Multimeter	UNI-T UT132D	UNI-T UT139C (adds auto range + 6000 counts display)
Logic Analyzer / signal generator	SparcFun LOGIC ANALYZER - 25MHZ/8-CHANNEL (bare minimum)	IKALogic SQ series (SQ25, SQ50, ...) (also has signal generation function) Digilent 410-321 Analog Discovery-2 (also has osciloscope function)

Learning Management Platform

In this semester we use Canvas as learning management platform. Specific details about different subjects can be found in their Canvas courses. When a Canvas course deviates from the contents of this study guide, this study guide is leading.

Supported Software Platforms

This semester uses Linux as work environment. The easiest way to work in the same environment as the expert for your subject, is by using the provided VMWare Linux image. You are ofcourse allowed to work in your own (Linux or something else) environment, as long as you keep in mind that said expert not always has the time or knowledge to solve specific problems in your environment.

Next to Canvas we will use Teams for online activities. You are advised to work together in groups to simulate a "day at school". We have found that this works well to motivate you for your various challenges.

7.2.2. Information about BA T OE3 Demand Based

Introduction

Dear student,

In this study guide you will find an overview of the S3 Demand Based education.

The central part of this semester is an industry project called: Cyber Physical Systems. In this industry project we dare you to find new ideas or solutions for various challenges. Well substantiated ideas can then be made into a concrete product, this tests both your research driven attitute as your entrepreneurism. The industry project is supported by one of our partners in education, who will be your customer and who gives guidance. This guide also explains the different subjects in this semester.

Small changes and additions in this document are possible, when these happen you will be informed as soon as possible.

On behalf of all teachers in T-S3 demand based:

We wish you good luck and a lot of fun!

Overview

Block Execution

This semester follows the demand based learning model. In this model you choose your means towards given goals. During this semester you make choices from various learning activities and educational resources. You will be guided by a team of teachers.

For each subject in this semester, an expert will be available who will help you once a week on a scheduled time. During these scheduled moments you can discuss your plans and progress. You will show your mastery of (parts of) learning outcomes on multiple occasions during the semester, on which an expert will record your results in Canvas. Each subject, including the industry project, has its own Canvas course.

The following table shows the contact hours per week, contact can be offline as well as online:

Role	Number of contact moments per week	Number of contact lesson hours per week
Communication expert	1	3
Software development expert	1	3
Embedded systems expert	1	3
Expert	1	4
Semester coach (Industry Project)	1	2

Semester Coach

Your semester coach will coach you both individually and in your project. In this role the semester coach is in part responsible for grading your professional skills.

Contact Person

If you have an issue, please contact one of the following people:

- Subject related issues: the expert for that subject
- Personal or project related issues: your semester coach
- Semester related issues: the block owner
- Curriculum related issues: the curriculum owner.

Workplace

Your workplace is an OIL that is available for you for 2,5 days per week, how these 2,5 days are scheduled can be seen in your time schedule. Please note that this will likely change due to COVID-19 measures.

It is explicitly forbidden to bring electronic equipment such as a kettle, toaster, coffee maker, etc. into a workplace. Security will remove said equipment without consultation and throw it away.

Each project group can get a project vault (TI-vaults) in which you can store your project stuff. You can borrow a key from the ISSD.

Examination board

Official publications from the examination board that are relevant for your study and study progress can be found on the FHICT portal. E.g. information about the OER (Onderwijs- en ExamenRegelingen), fraud policy and examination rules can be found there.

In the fraud policy you will find: "Fraud is defined as any act (including the commission of plagiarism), or omission, of which the person concerned knew or should have known, that this action and/or omission makes it impossible in whole or in part to form an opinion about someone's knowledge, insight, skills, competencies, (professional) attitude, reflection, etc., in the correct manner."

More information can be found on the examination board page: https://portal.fhict.nl/Studentenplein/Documenten%20rondom%20studievoortgang/Home.aspx.

Industry project team

An industry project is preferrably executed in a team of 4-6 people. Your presence on scheduled project hours is compulsory, please notify your semester coach and team if you have a valid reason not to be there.

Improvement actions

- As a pilot at the Tilburg location: one Canvas course will be provided rather than four, so students get a better semester overview.
- Software quality tool Klocwork can now be used for all S3 Technology students.

Examination and grading

Examination

Portfolio

Students build a portfolio during the semester. A portfolio consists of:

- Exercises that show basic knowledge that you have gained for the different fields,
- Open, individual project,
- Formative feedback,
- Your own contribution to group work,
- Your growth in professional skills

Level of learning outcomes

You will be judged on each learning outcome, to see how well you master it. The following 5 levels are used:

Level	Explanation
Undefined	You have not shown your development at the level described in the explanation of the learning outcome. Many essential aspects are missing in your development.
Orienting	You have made a start and explored possibilities to demonstrate the learning outcome.
Beginning	You demonstrate that you apply knowledge, insight and skills, appropriate to the learning outcome.
Proficient	You demonstrate that you apply knowledge, insight and skills, appropriate to the learning outcome, in a different or more complex context.
Advanced	See proficient. Additionally, your work demonstrates excellence in both technical and professional skills.

Your level of mastery will be recorded for each learning outcome.

Tools allowed

Every available source is allowed.

Resits and repairs

Because your mastery of different learning outcomes is being evaluated regularly and early during the semester, there are no resits. Repairs are done during the course: as long as there are new sprints, you can show that you have mastered parts on which you got feedback.

Grading

At the completion of the semester, all teachers and semester coaches involved in this semester determine based on the portfolio if the learning outcomes are met. No rights can be derived from the interim formative feedback. The portfolio assessment at the end of the semester is expressed using the USGO scale (Unsatisfactory, Satisfactory, Good and Outstanding). Unsatisfactory results in a semester restart.

The assessors use the guidelines below:

1 A student who has a lower than proficient level for one learning outcome receives the final grade unsatisfactory (U).
2 A student who has at least a proficient level for all learning outcomes will at least receive the final grade satisfactory (S).
3 A student who meets the second guideline and has at least an advanced level for one of the learning outcomes will receive a final grade good (G) or outstanding (O).

Learning activities

This semester consists of one educational unit:

Unit	Credits (EC)
Cyber Physical Systems	30

In this semester you touch subjects that will teach you the basics to master the learning outcomes:

Subject	Abbreviation	Studyload
Communication within CPS	COM	25%
Software Development for CPS	SD	25%
Embedded Systems in CPS	ES	25%
Industry Project	PRO	25%

Resources

On the FHICT learning management platform you fill find your schedule and all given documents (presentations, excercises, manuals, etc.). You will also find links to Open Educational Resources (OERs) from other institutes.

We expect an explorative attitute from students, which means that we expect you to find relevant, valid and credible sources yourself and that you indicate what sources you used.

Required hardware

In the Technology domain it is important that you prove that your system works, to do this you do need measuring equipment. We expect you to buy at least a multimeter and logic analyzer yourself which you can use it througout the entire Technology curriculum.

You can find our recommendations in the table below, these are devices on which your teachers can give support:

Tool	Required	Alternative/better model
Multimeter	UNI-T UT132D	UNI-T UT139C

		(adds auto range + 6000 counts display)
Logic Analyzer / signal generator	IKALogic SQ series (SQ25, SQ50, ...)	AnalogDevices ADALM2000 (similar to AnalogDiscovery-2 but a lot cheaper) or: Digilent 410-321 Analog Discovery-2 (also has osciloscope function)

Learning Management Platform

In this semester we use Canvas as learning management platform. Specific details about different subjects can be found in their Canvas courses. When a Canvas course deviates from the contents of this study guide, this study guide is leading.

Supported Software Platforms

This semester uses Linux as work environment. The easiest way to work in the same environment as the expert for your subject, is by using the provided VMWare Linux image. You are ofcourse allowed to work in your own (Linux or something else) environment, as long as you keep in mind that said expert not always has the time or knowledge to solve specific problems in your environment.

Next to Canvas we will use Teams for online activities. You are advised to work together in groups to simulate a "day at school". We have found that this works well to motivate you for your various challenges.

8. Information about ICT & Open Learning

8.1. Information about ICT3-OLPU3 ICT & Personal Unit Of Study 3

Entry requirements

Students who have successfully concluded OE2 CB or DB can start in the OE3 of Open Learning. Starting level would be the learning outcomes output of the OE2. It doesn't matter which OE1 & OE2 students have followed assuming that this has led to a mastered propaedeutic level.

Characteristics of an enrolling Open Learning student could be:

- the entrepreneurial student who likes to take matters into his own hands
- the students who want to cover new or not offered subjects in other tracks.
- the student who wishes to specialize or broaden (faster)
- the student who wants to switch from educational style (CB or DB)
- the student wants to do CB or DB course in an open form
- Any thinkable context, combination or content in IT…

Learning Outcomes

The student builds a competence profile based upon the basic architectural layers (level 1) from OE2, this is taken to the next step at level 2. In addition, a student can deepen or broaden and will touch other architectural layers. These will initially be linked at level 1. Generally speaking the core architectural layer level grows with the phase of the students' study. Phase OE1,OE2 ~ level 1, phase OE3,4,5, ~ level 2 and phase OE6,7,8, ~ level 3.

A balanced competence profile does not have too many competencies (no focus) but also not too little (no widening). At least all activities (9) from the core architectural layers (including professional development) have to be covered on level 2 and there are a minimum of 15 competency indicators in total (covering one or more architectural layers) that need to be graded on the level of "sufficient" as a minimum.

Within Open Learning, students define their own dynamic competence profile per semester (exit level OEx) under supervision. In doing so, they draw up their own criteria for challenges (projects) that contribute to growth within the HBO-i competence framework. A complete competence level is reached by successfully ending a phase. A learning outcome is a partial contribution to a competence step.

Introduction

ICT & Personalized Program is a route where you have a lot of freedom and flexibility to determine your personal focus and structure, within the boundaries of the HBO-I competence framework. In practice, this means that anything within these boundaries potentially can be used in ICT & Personalized Program. This gives great opportunities for starting multi-disciplinary projects. Projects should be IT related, based on relevant questions and developments from the professional field and where possible externally validated.

Lots of freedom, but remember:

"Freedom comes with responsibility"

This large degree of freedom does not mean that there are no obligations. A large amount of autonomy and entrepreneurial behaviour is expected.

Examination and grading

Examination

Right from the start, solid proof will be entered in the personal course of the student where it can be "graded". Students are the owner of their own course, profile and assignments. That means the student has to define the criteria for assignments so that coaches can review and ultimately grade their work. Assignment criteria should be defined at the level "good" instead of "sufficient". This way, coaches and students can have a discussion about a possible "sufficient" in case a student fails to complete every assignment criterion on the level "good". Rubrics should be added to the assignments, containing these criteria and KPI's from the HBO-i framework including professional development.

The progress and process of the student on individual, peer and group level are recorded in the Canvas embedded tool Feedpulse. The student will record agreements, intentions and feedback in feedpulse and reflect on it later. Both student and coach regularly give a Feedpulse (self-) rating, which roughly indicates how things are going (bad, good, fantastic). Feedpulse gives lots of insight on how things are

going, how the student is doing and how the coach thinks it is going. This gives an indication of whether the student is on track to successfully complete ICT & Open Learning.

Actually, this is only an indication of the process progression. The final assessment takes place based upon the competence document which will grow over time. In this competence document, the student will put all KPIs together with a description of how he or she has proven them with links to parts of their own course where the body of proof is available. The Competence Document also contains a reflection on the process. A final assessment is conducted based on this final document.

During the course, several moments are offered during which the coaches can carry out a formative assessment on your Competence Document (including accompanying evidence in the personal course). In consultation with the team of coaches, the moment of the summative assessment (the formal final assessment) is planned. This moment should be chosen in such a way that, if the assessment does not produce enough, there is still room for a repair, this can only be done on the form factor of the competence document (KPIs, links that do not work, reflection missing, etc.), NOT on the content. In practice, this means that the assessment can be scheduled at the latest in week 18 and that the repair must take place before Thursday in week 19.

Open Learning is focused on both the students' professional skills and development. And as we use different ways to measure their progression, the most important is that we look at the integral and longitudinal growth of the individual student.

Tools allowed

Anything

Resits and repairs

All course activities are practise-based and organised around project work. Because of this the OER 2021/2022 states that it is not possible to retake the semester.

Grading

Students are assessed on the learning outcomes formulated by the student himself and approved by the appointed assessors. These criteria are related to the HBO-i model. The advancement is determined on the basis of requirements with regard to the student-related growth according to this model. It's about learning pathway independent assessing.

Feedback, feed-up and feedforward, both task-oriented and process-oriented, occupy an important place in education and together form the implementation of assessment as learning.

Assessment is longitudinally based on the portfolio development and performance of the student. The student determines the components that he will include in the portfolio. The semester is concluded with an integral assessment by several assessors.

Learning activities

The student will determine the general lines of the content in this programme him or herself. Basically everything in IT should be possible. Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchrone, not everybody does the same things, with the same speed, … This means all workshops, presentations, etc., that will provide content, will be planned and scheduled on-demand or when the coaches notice it is necessary.

To facilitate this the student will create his/her own personal profile within the HBO-i Competence Framework, this framework gives a systematic overview of the whole IT landscape including their professional skills. This profile will be created shortly after the start of the semester. Before enrollment, the student will be invited for an intake interview. This interview is about motivation and a possible context to use within open learning. In an intake document, it is outlined which topics the student would like to engage. This usually is a very rough outline. For example, “Artificial intelligence”, “Encryption” or

extreme interaction". The intake interview will be an evaluation to see whether you really understand what open learning is about, so you know what you're up to.

Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchronous, not everybody does the same things, with the same speed, … This means all workshops, lessons, .. that will provide content, will be planned and scheduled on-demand or when the teachers notice it is necessary.

For example, workshops of more general applicability are offered to all students, like Scrum-101, Research, Concept validation, while more specific subjects are offered to a smaller group of students.

Resources

Apart of the Canvas LMS environment, anything which would be applicable can and will be used.

8.2. Information about ICT4-OLPU4 ICT & Personal Unit Of Study 4

Entry requirements

Students who have successfully concluded OE2 CB or DB or students which concluded OE3 can start in the OE4 of ICT & Personalized Program. Starting level would be the learning outcomes output of the OE2 or if students successfully concluded OE3, these learning outcomes become the starting level. It doesn't matter which OE1, OE2 & OE3 students have followed assuming that this has led to a mastered propaedeutic level and possibly passing OE3.

Characteristics of an enrolling Open Learning student could be:

- the entrepreneurial student who likes to take matters into his own hands
- the students who want to cover new or not offered subjects in other tracks.
- the student who wishes to specialize or broaden (faster)
- the student who wants to switch from educational style (CB or DB)
- the student wants to do CB or DB course in an open form
- Any thinkable context, combination or content in IT…

Learning Outcomes

The student builds a competence profile based upon the basic architectural layers (level 1) from OE2, this is taken to the next step at level 2. In addition, a student can deepen or broaden and will touch other architectural layers. These will initially be linked at level 1. Generally speaking the core architectural layer level grows with the phase of the students' study. Phase OE1,OE2 ~ level 1, phase OE3,4,5, ~ level 2 and phase OE6,7,8, ~ level 3.

A balanced competence profile does not have too many competencies (no focus) but also not too little (no widening). At least all activities (9) from the core architectural layers (including professional development) have to be covered on level 2 and there are a minimum of 15 competency indicators in total (covering one or more architectural layers) that need to be graded on the level of "sufficient" as a minimum.

Within Open Learning, students define their own dynamic competence profile per semester (exit level OEx) under supervision. In doing so, they draw up their own criteria for challenges (projects) that contribute to growth within the HBO-i competence framework. A complete competence level is reached by successfully ending a phase. A learning outcome is a partial contribution to a competence step.

Introduction

ICT & Personalized Program is a route where you have a lot of freedom and flexibility to determine your personal focus and structure, within the boundaries of the HBO-I competence framework. In practice, this means that anything within these boundaries potentially can be used in ICT & Personalized Program. This gives great opportunities for starting multi-disciplinary projects. Projects should be IT related, based on relevant questions and developments from the professional field and where possible externally validated.

Lots of freedom, but remember:

“Freedom comes with responsibility”

This large degree of freedom does not mean that there are no obligations. A large amount of autonomy and entrepreneurial behaviour is expected.

Examination and grading

Examination

Open Learning uses a continuous feedback and assessment process that will give you insight into your technical and professional development. Right from the start, a solid proof will be entered in your personal course where it can be “graded”. You’re the owner of your own course, profile and assignments. That means you also have to define the criteria for assignments so that coaches can review and ultimately grade your work. Criteria should be defined at the level "good" instead of "sufficient". This way, we can have a discussion about a possible pass in case you fail to complete every criterion on the level good.

Rubrics should be added, in consultation with your coach, to your assignments, containing these criteria and KPI's from the HBO-i framework and professional development.

Your progress and process are recorded in the Canvas embedded tool Feedpulse. You’ll record agreements, intentions and feedback in feedpulse and reflect on it later. You, your coach and peers regularly give a Feedpulse rating, which roughly indicates how things are going (bad, good, fantastic). Feedpulse gives lots of insight on how things are going, how you’re doing and how your coach thinks it is going. This gives an indication of whether you are on track to successfully complete the ICT & Personalized Program.

Actually, this is only progress. The final assessment takes place on the basis of your competence document which will grow over time. The starting point in the competence document is your competence profile. A balanced competence profile does not have too many competencies (no focus) but also not too little (no widening). At least all activities (9) from the core architectural layers (including professional development) have to be covered on level 2 and there are a minimum of 15 IT competency indicators in total (covering one or more IT architectural layers) that need to be graded on the level of "sufficient" as a minimum. Also in this competence document, you’ll put all KPIs together with a description of how you have proven them with links to parts of your own course where the body of proof is available.

The competence document also contains a reflection on the process. A final assessment is conducted based on this final document.

During the course, several moments are offered during which the coaches can carry out a formative assessment on your competency document (including accompanying evidence in the personal course). In consultation with the team of coaches, the moment of the summative assessment (the formal final assessment) is planned. This moment should be chosen in such a way that, if the assessment does not produce enough, there is still room for a repair. The repair can only be done on the form factor of the competence document (KPIs, links that do not work, reflection missing, etc.), NOT on the content. In practice, this means that the assessment can be scheduled at the latest in week 18 and that the repair must take place before Thursday in week 19.

The ICT & Personalized Program is focussed on both your professional skills and professional development. And as you can see we use different ways to measure your progression.

Most important is that we look at the integral and longitudinal growth of the individual student.

Tools allowed

Anything

Resits and repairs

All course activities are practise-based and organised around project work. Because of this the OER 2021/2022 states that it is not possible to retake the semester.

Grading

Students are assessed on the learning outcomes formulated by the student himself and approved by the appointed assessors. These criteria are related to the HBO-i model. The advancement is determined on the basis of requirements with regard to the student-related growth according to this model. It's about learning pathway independent assessing.

Feedback, feed-up and feedforward, both task-oriented and process-oriented, occupy an important place in education and together form the implementation of assessment as learning.

Assessment is longitudinally based on the portfolio development and performance of the student. The student determines the components that he will include in the portfolio. The semester is concluded with an integral assessment by several assessors.

Learning activities

The student will determine the general lines of the content in this programme him or herself. Basically, everything in IT should be possible. Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchronous, not everybody does the same things, with the same speed, … This means all workshops, presentations, etc., that will provide content, will be planned and scheduled on-demand or when the coaches notice it is necessary.

To facilitate this the student will create his/her own personal profile within the HBO-i Competence Framework, this framework gives a systematic overview of the whole IT landscape including their professional skills. This profile will be created shortly after the start of the semester. Before enrollment, the student will be invited for an intake interview. This interview is about motivation and a possible context to use within open learning. In an intake document, it is outlined which topics the student would like to engage. This usually is a very rough outline. For example, “Artificial intelligence”, “Encryption” or extreme interaction”. The intake interview will be an evaluation to see whether you really understand what open learning is about, so you know what you’re up to.

Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchronous, not everybody does the same things, with the same speed, … This means all workshops, lessons, .. that will provide content, will be planned and scheduled on-demand or when the teachers notice it is necessary.

For example, workshops of more general applicability are offered to all students, like Scrum-101, Research, Concept validation, while more specific subjects are offered to a smaller group of students.

Resources

Apart of the Canvas LMS environment, anything which would be applicable can and will be used.

8.3. Information about ICT6-OLPU6 ICT & Personal Unit Of Study 6

Entry requirements

Students who have successfully concluded OE2, OE3, OE4 and OE5 of CB, DB or OL can start in the OE6* of ICT & Personalized Program. Starting level would be the learning outcomes output of the OE5. It doesn’t matter which OE1, OE2, OE3, OE4 and OE5 students have followed assuming that this has led to a mastered propaedeutic level and the first half of the core phase.

*Students successfully mastered the propaedeutic and corephase level (Semester 1 - Semester 5) of the curriculum prior to 2021 can enrol if they have a formal request approved by the examination board of ICT & Open Learning, their respective graduation profile will be ICT & Open Learning or a specialisation profile.

Characteristics of an enrolling Open Learning student could be:

- the entrepreneurial student who likes to take matters into his own hands
- the students who want to cover new or not offered subjects in other tracks.

- the student who wishes to specialize or broaden (faster)
- the student who wants to switch from educational style (CB or DB)
- the student wants to do CB or DB course in an open form
- Any thinkable context, combination or content in IT…

Learning Outcomes

The output level is based on the achieved growth on the set competence indicators of the students personal competence profile. This should connect and align with the next OE a student is pursuing.

A balanced competence profile does not have too many competencies (no focus) but also not too little (no widening). At least all activities (9) from the core architectural layers (including professional development) have to be covered on level 3 and there are a minimum of 10 IT competency indicators in total (covering one or more IT architectural layers) that need to be graded on the level of "sufficient" as a minimum.

Within Open Learning, students define their own dynamic competence profile per semester (exit level OEx) under supervision. In doing so, they draw up their own criteria for challenges (projects) that contribute to growth within the HBO-i competence framework. A complete competence level is reached by successfully ending a phase. A learning outcome is a partial contribution to a competence step.

Introduction

ICT & Personalized Program is a route where you have a lot of freedom and flexibility to determine your personal focus and structure, within the boundaries of the HBO-I competence framework. In practice, this means that anything within these boundaries potentially can be used in ICT & Personalized Program. This gives great opportunities for starting multi-disciplinary projects. Projects should be IT related, based on relevant questions and developments from the professional field and where possible externally validated.

Lots of freedom, but remember:

“Freedom comes with responsibility”

This large degree of freedom does not mean that there are no obligations. A large amount of autonomy and entrepreneurial behaviour is expected.

Examination and grading

Examination

Open Learning uses a continuous feedback and assessment process that will give you insight in your technical and professional development. Right from the start, solid proof will be entered in your personal course where it can be “graded”. You’re the owner of your own course, profile and assignments. That means you also have to define the criteria for assignments so that coaches can review and ultimately grade your work. Criteria should be defined at the level "good" instead of "sufficient". This way, we can have a discussion about a possible pass in case you fail to complete every criterion on the level good.

Rubrics should be added, in consultation with your coach, to your assignments, containing these criteria and KPI's from the HBO-i framework and professional development.

Your progress and process are recorded in the Canvas embedded tool Feedpulse. You’ll record agreements, intentions and feedback in feedpulse and reflect on it later. You, your coach and peers regularly give a Feedpulse rating, which roughly indicates how things are going (bad, good, fantastic). Feedpulse gives lots of insight on how things are going, how you’re doing and how your coach thinks it is going. This gives an indication of whether you are on track to successfully complete ICT & Personalized Program.

Actually, this is only progress. The final assessment takes place on the basis of your competence document which will grow over time. The starting point in the competence document is your competence profile. A balanced competence profile does not have too many competencies (no focus) but also not too little (no widening). At least all activities (9) from the core architectural layers (including

professional development) have to be covered on level 3 and there are a minimum of 10 IT competency indicators in total (covering one or more IT architectural layers) that need to be graded on the level of "sufficient" as a minimum. Also in this competence document, you'll put all KPIs together with a description of how you have proven them with links to parts of your own course where the body of proof is available.

The competence document also contains a reflection on the process. A final assessment is conducted based on this final document.

During the course, several moments are offered during which the coaches can carry out a formative assessment on your competency document (including accompanying evidence in the personal course). In consultation with the team of coaches, the moment of the summative assessment (the formal final assessment) is planned. This moment should be chosen in such a way that, if the assessment does not produce enough, there is still room for a repair. The repair can only be done on the form factor of the competence document (KPIs, links that do not work, reflection missing, etc.), NOT on the content. In practice, this means that the assessment can be scheduled at the latest in week 18 and that the repair must take place before Thursday in week 19.

The ICT & Personalized Program is focussed on both your professional skills and professional development. And as you can see we use different ways to measure your progression.

Most important is that we look at the integral and longitudinal growth of the individual student.

Tools allowed

Anything

Resits and repairs

All course activities are practise-based and organised around project work. Because of this the OER 2021/2022 states that it is not possible to retake the semester.

Grading

Students are assessed on the learning outcomes formulated by the student himself and approved by the appointed assessors. These criteria are related to the HBO-i model. The advancement is determined on the basis of requirements with regard to the student-related growth according to this model. It's about learning pathway independent assessing.

Feedback, feed-up and feedforward, both task-oriented and process-oriented, occupy an important place in education and together form the implementation of assessment as learning.

Assessment is longitudinally based on the portfolio development and performance of the student. The student determines the components that he will include in the portfolio. The semester is concluded with an integral assessment by several assessors.

Learning activities

The student will determine the general lines of the content in this programme him or herself. Basically everything in IT should be possible. Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchrone, not everybody does the same things, with the same speed, … This means all workshops, presentations, etc., that will provide content, will be planned and scheduled on-demand or when the coaches notice it is necessary.

To facilitate this the student will create his/her own personal profile within the HBO-i Competence Framework, this framework gives a systematic overview of the whole IT landscape including their professional skills. This profile will be created shortly after the start of the semester. Before enrollment, the student will be invited for an intake interview. This interview is about motivation and a possible context to use within open learning. In an intake document, it is outlined which topics the student would like to engage. This usually is a very rough outline. For example, "Artificial intelligence", "Encryption" or extreme interaction". The intake interview will be an evaluation to see whether you really understand what open learning is about, so you know what you're up to.

Because everyone has his own track, it is impossible to plan a curriculum that fits for everyone. Learning happens asynchronous, not everybody does the same things, with the same speed, … This means all workshops, lessons, .. that will provide content, will be planned and scheduled on-demand or when the teachers notice it is necessary.

For example, workshops of more general applicability are offered to all students, like Scrum-101, Research, Concept validation, while more specific subjects are offered to a smaller group of students.

Resources

Apart of the Canvas LMS environment, anything which would be applicable can and will be used.

9. Information about

9.1. Information about AS2 Academic preparation and selection

Content

Het versnelde traject voor Software Engineering leidt op tot een beroepsbekwame bachelor, maar plaveit tevens de weg naar een academische master. De minor wordt gevuld met het schakelprogramma van de verkozen master. De keuze voor de master kun je uitstellen tot het moment dat de minor daadwerkelijk start. De inhoud van zo'n pre-masterschakelprogramma is behoorlijk theoretisch. Daarom ga je je in de eerste twee leerjaren voorbereiden op deze nogal ingewikkelde problematiek. Wiskunde en theoretische informatica spelen daarbij een belangrijke rol.

Het eerste semester omvat de leerstof van

- de onderwijseenheid S2, het tweede semester van het Software Engineeringsprofiel, aangevuld met
- de onderwijseenheid AS2, Academic Preparation and Selection.

In AS2 ga je je oriënteren op de wiskunde en informatica die je voorbereiden op de vakken in het schakelprogramma. Je moet dan ervaren of je het leuk vindt om daarmee bezig te zijn, maar ook zul je moeten laten zien dat deze stof voor jou behapbaar is. In AS2 ga je je daarnaast verder oriënteren op de andere drie profielen: ICT & Business, ICT & Media Design en ICT & Technology.

Learning outcomes

1 De student is vaardig in het toepassen van de basisprincipes van propositielogica, verzamelingenleer en combinatoriek.
2 De student is vaardig in het toepassen van de basisprincipes van lineaire algebra en automatentheorie.
3 De student is vaardig in het toepassen van de basisprincipes van de grafentheorie.
4 De student werkt actief aan een ontwerp van een bedrijfsproces met KPI's en bijbehorend dashboard en toont aan gemaakte keuzes goed te kunnen onderbouwen.
5 De student kan verschillende vormen van gebruikersinteractie en prototyping voor een interactief product benoemen en deze iteratief ontwerpen en ontwikkelen, waarbij keuzes zijn onderbouwd en gedocumenteerd.
6 De student kan een eenvoudig programma in C programmeren voor een embedded platform.

Examination and grading

Examination

De eerste drie leerdoelen worden getoetst door middel van drie afzonderlijke schriftelijke toetsen van elk 90 minuten. Elke toets leidt tot een percentagescore. Het percentage drukt de mate uit dat de student vaardig is in de aangeboden theorie. De toetsresultaten worden opgenomen in het portfolio van AS2.

De leerdoelen 4 t/m 6 leiden ieder tot een praktische opdracht welke worden beoordeeld op de schaal o(utstanding), g(ood), s(ufficient) en u(nsufficient). Ook deze drie beoordelingen hebben het karakter van een formatieve indicatie ten behoeve van de summatieve beoordeling van de onderwijseenheid AS2. De resultaten van de praktische opdrachten worden eveneens opgenomen in het portfolio van AS2.

Tools allowed

Bij de schriftelijke toetsen van de eerste drie leerdoelen mogen alleen die hulpmiddelen worden gebruikt, die in de toets expliciet zijn benoemd.

Resits and repairs

Voor de toetsing van de eerste drie leerdoelen wordt er in week 19 een herkansing aangeboden. Dit is een schriftelijke toets van 120 minuten over de eerste drie leerdoelen gezamelijk. Het resultaat van deze toets wordt aan het portfolio van AS2 toegevoegd.

Grading

De AS2 onderwijseenheid wordt op basis van opgebouwde portfolio als één geheel beoordeeld op de o/g/s/u schaal. Elk van de zes formatieve indicaties (voor elk leerdoel één) moet voldoende zijn. Als één van de zes leerdoelen met een onvoldoende (ofwel 54% of lager, danwel u) is beoordeeld, wordt AS2 sowieso met een U (van Unsatisfying) beoordeeld.

Teaching methods

Bij elk leerdoel wordt een canvasmodule aangeboden.

leerdoel 1 t/m 3:

Voor het zich eigen maken van de eerste drie leerdoelen inclusief de formatieve toetsing worden er steeds 8 lesblokken van 4 lesuren aangeboden. De student wordt gestimuleerd om de theorie van te voren te bestuderen. Kritieke secties worden klassikaal besproken. Ieder lesblok bevat oefeningen om de theorie te kunnen toepassen. Een zorgvuldige uitwerkingen van de oefeningen waarborgt het realiseren van het gestelde leerdoel.

leerdoel 4 t/m 6:

Voor het zich eigen maken van de laatste drie leerdoelen worden er steeds 4 lesblokken van 4 lesuren aangeboden. De student wordt gestimuleerd om de theorie van te voren te bestuderen. Kritieke secties worden klassikaal besproken. Ieder lesblok bevat oefeningen om de theorie te kunnen toepassen. Resultaten worden in de vorm van een digitaal portfolio verzameld.

Resources

Zie Canvas.

9.2. Information about AS3 A3 Preparation for pre-master A

Content

Nowadays, the Fontys ICT bachelor programs include little or no more mathematics. This is not a real problem because all kind of ICT profiles and specializations do not require implicitly mathematics. When needed, it can be taught just in time. Computer science is all about our interaction with information. That information can range from air flight timetables to healthcare applications or virtual games. Computer technology has given us a wealth of new opportunities, but unfortunately, it has also created serious risks. Analyzing algorithms, calculating efficiency, or proving the correctness of program code, has to be done carefully. Mathematical skills are playing a pronouncing role when creating critical applications within the context of data science, cryptography, blockchain technology,

healthcare equipment, machine learning, or automotive etcetera. Therefore, in the field of programming critical applications, a mathematical fundament is important.

AS3 prepares on the pre-master programs of the following master studies:

- Computer Science & Engineering (TU/e)
- Data Science in Engineering (TU/e)
- Data Science & Entrepreneurship (JADS)

AS consists of the following courses which are spread over AS3, AS4 and AS6:

- AUT: Automata
- CSR: Computer Science Research
- DATA: Introduction to Data Science
- EFF: Efficiency and Data Structures
- LOG: Logical Reasoning
- CALC: Calculus
- SEC: Security
- STAT: Statistics

Learning outcomes

Computer Science Research (CSR)

Learning Outcome

You are able to define, to investigate, and to report about a relevant, yet feasible, challenge within the domain of Computer Science.

Explanation of terms with the help of Learning Goals

to investigate:

1. You are able to formulate a suitable research question and associated sub-questions based on a problem statement.

2. You are able to devise and implement suitable research strategies and techniques (for instance, building a proof of concept, doing a literature review, comparing existing or self-invented solutions).

to report:

3. You are able to report research results, draw appropriate conclusions, and, if desired, make appropriate recommendations.

Automata (AUT)

Learning Outcomes

• You are able to design, implement and validate an application for automata.

• You are able to apply the concepts of grammars, parsers, and lexers.

Explanation with the help of Learning Goals

design, implement, investigate:

1. You are able to set up appropriate data structures and algorithms to construct a automaton.

validate:

2. You are able to validate the application via unit tests .

apply the concepts:

3. With the help of a parser generator, you can define a grammar for a given language, and build an interpreter for it.

Logical Reasoning (LOG)

Learning Outcomes

You are able to structure arguments, logical proofs, and computer programs, thus enabling effective, if desired mathematical, communication about them.

Explanation with the help of Learning Goals

1. You are skilled in the use of predicates for problem specification.

Efficiency and Data Structures (EFF)

Learning Outcomes

You use, design, and implement data structures and algorithms to efficiently solve computational problems.

Explanation with the help of Learning Goals

data structures:

1. You understand data structures and apply these in a solution to a computational problem.
2. You choose between data structures to improve the efficiency of computer programs.

algorithms:

3. You understand graph theory and its applications.
4. You apply graph theory into efficient algorithms that solve computational problems.
5. You apply search algorithms to find solutions to computational problems.

efficiently:

6. You analyze systematically performance aspects of solutions to computational problems.
8. You express computational and spatial complexity of algorithms using formal notation.
9. You design and implement optimized solutions to computational problems.

Introduction to Data Science (DATA)

Learning Outcomes

You are able to apply Data Science techniques and methods in real-world use-cases and you can show the sub-skills of posing relevant research questions, importing from local and scraping remote data sources, cleaning data, analyzing data, using machine-learning techniques, visualizing, and reporting/presenting outcomes with the help of a programming language and its relevant libraries.

Explanation with the help of Learning Goals

posing relevant research questions:

1. You are able to define a relevant, yet feasible, challenge within the domain of Data Science, eventually leading to a relevant problem statement.

importing from local data sources:

2. You are able to import datasets in the used programming language or to import from a local file or database (such as MongoDB or ElasticSearch).

scraping remote data sources:

3. You are able to retrieve datasets through provided API's (such as from Google, Facebook, or Twitter) or by directly scraping websites.

cleaning data:

4. You are able to select and use correct solutions for dealing with problems (such as missing or polluted data) in imported datasets.

analyzing data:

5. You are able to use data science techniques in order to analyze data for the purpose of answering posed research questions.

machine learning techniques:

6. You are able to select and use appropriate machine learning (ML) techniques for the analytics goals that were chosen.

visualizing:

7. You are able to create clear and useful visualizations for the products/outcomes of data analyses (through libraries and frameworks such as MatplotLib and Kibana).

reporting/presenting outcomes:

8. You are able to report research results, draw appropriate conclusions, and, if desired, make appropriate recommendations.

Introduction to Calculus (CALC)

Learning Outcomes

You are able to apply the calculus principles (like derivaties, anti-derivatives, limits) on a variety of problems (either by hand or by writing a computer program)

Introduction to Statistics (STAT)

Learning Outcomes

You are able to apply the statistics principles (like (conditional) probability, average, standard deviation, variance, confidence interval, Bayes' theorem) on a variety of problems.

Introduction to Security (SEC)

Learning Outcomes

You are able to apply the security principles (cryptography, key exchange) on a variety of problems.

Examination and grading

Examination

You will get frequent feedback on the deliverables and its draft versions. The feedback is registered with the help of Canvas, FeedPulse or other Technology Enhanced Learning tools. At the end of the course, you get a formative assessment expressed with a grade (O, G, S, U, or NA). The grade is added to the portfolio of the course.

Tools allowed

There are no restrictions on the use of hardware or software accessories.

Resits and repairs

Not applicable

Grading

Since the feedback is given continuously, the learning goals are assessed on the fly. The summative assessment is based on the Canvas and/or Feedpulse feedback and the portfolios of all courses together. The final grading scheme is O, G, S, U, or NA.

Teaching methods

- Flipping the class, if desired
- Theoretical instructions, if desired
- Practical assignments
- Frequent feedback
- Portfolio assessment

Resources

The entire course material is offered through Canvas.

9.3. Information about AS5 A5: Stage ICT & Software Engineering Versneld

Content

In this internship you show in a professional environment that you integrate the required professional and technical developments and that you can apply them autonomously. Moreover, you get the opportunity to work in a company and experience what they can offer you.

Learning outcomes

Learning Outcome

You are able to set up, execute, and report on a software engineering assignment within a realistic practical context.

Explanation of underlined terms with the help of Learning Goals

set up

- You acquire, individually or within a team of fellow students, a feasible assignment that allows you to apply your knowledge and skills as acquired so far, within a realistic practical context.
- You set up, individually or within a team of fellow students, a project plan.

execute

- You collect, select, and analyze relevant information, in accordance with the project plan.
- You realize scheduled deliverables of the project plan.

report

- You communicate and cooperate with fellow students and/or business colleagues.
- You report, verbally and in writing, about deliverables and the assignment as a whole.
- You reflect on your professional growth with respect to the setting up, execution, and communication of this practical assignment.

Examination and grading

Examination

During the internship, the company tutor will supply feedback on a weekly basis. At the final presentation at the end, the university assessors and the company tutor do an integral assessment of the work and the report.

Tools allowed

not applicable

Resits and repairs

During the internship, the student gets enough feedback such that he/she should pass the internship. If the end product is still insufficient, the internship has to be redone.

Grading

In the last week an assessment takes place.

Teaching methods

During the internship, the student is supported by a company tutor and a university tutor.

Resources

On the intranet, there are documents about the research framework and the process flow.

9.4. Information about AS6 A6: Preparation for pre-master B

Content

During the ramp-up phase of Academic Preparations, each cohort has a slightly different order of the AP Courses. To avoid duplicate information, all AS6 content is described in AS3.

Learning outcomes

See AS3

Examination and grading

Examination

You will get frequent feedback on the deliverables and its draft versions. The feedback is registered with the help of Canvas, FeedPulse or other Technology Enhanced Learning tools. At the end of the course, you get a formative assessment expressed with a grade (O, G, S, U, or NA). The grade is added to the portfolio of the course.

Tools allowed

There are no restrictions on the use of hardware or software accessories.

Resits and repairs

Not applicable

Grading

Since the feedback is given continuously, the learning goals are assessed on the fly. The summative assessment is based on the Canvas and/or Feedpulse feedback and the portfolios of all courses together. The final grading scheme is O, G, S, U, or NA.

Teaching methods

- Flipping the class, if desired
- Theoretical instructions, if desired
- Practical assignments
- Frequent feedback
- Portfolio assessment

Resources

The entire course material is offered through Canvas.

10. Information about

10.1. Information about

Entry requirements

For Architecture Layer 'Software', the requirements for the Activities 'Advice', 'Analysis', 'Design', 'Realization', 'Manage & Control' are: Proficiency Level 1.

Learning Outcomes

Learning outcome 1. Analysis

You are able to investigate, analyze and translate real world problems into abstract/mathematical models and solve them methodically and creatively.

Learning outcome 2. Design

You are able to design abstract solutions (like algorithms and data structures) and able to reason about their validity/scope.

Learning outcome 3. Realization

You are able to translate abstract/mathematical solutions into concrete implementations and reason about the correctness of the implementation.

Learning outcome 4. Testing

You are able to design and implement tests on the basis of abstract/mathematical specifications and reason about concepts like the coverage.

Learning outcome 5. Research

You are able to find and compare ideas and solutions from academic sources, such as research papers and are able to translate those abstract models/concepts into sustainable solutions.

Learning outcome 6. Interaction

You are able to effectively interact and communicate with academically trained people on abstract problems and solutions.

Learning outcome 7. Communication and Leadership

You are able to communicate your ideas to other people on an academic level both in presentations and in writing.

Introduction

An academic university usually has a course-based learning didactics. The subjects have a theoretical nature because this reflects the way of working of professional scientists.

This semester prepares the (practical oriented FHICT) students for the academic world, such that the next steps, the pre-master and the master program, can be executed with a better understanding.

This semester should also be interesting for students who are not (yet) pursuing an academic career. The obtained knowledge and skills must also be valid for an ICT career in a commercial company.

Examination and grading

Examination

The teachers will provide the students with formative feedback on deliverables and demonstrations. It is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on analysis, design and technical aspects, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least three formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don't give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade of beginning or orienting.

Tools allowed

Except for paper & pen, and a laptop, no additional equipment is needed.

Resits and repairs

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2019/2020, it is not possible to do a retake for the semester.

Grading

A student's growth is maintained in his portfolio. The student's growth on each learning outcome is registered according to one of the five levels of mastery.

1 undefined,
2 orienting,
3 beginning,
4 proficient,
5 advanced.

After each formative assessment, the level of mastery for all learning outcomes is assessed for the student's deliveries.

At the end of the semester the student will be assessed on his performance of the semester. During the assessment meeting the teacher will use the student's portfolio. The overall grade is based on the shown performance and will be graded as follows:

- Outstanding when all learning of the outcomes are marked as advanced
- Good when more than half of the learning outcomes are marked as advanced
- Satisfactory when all learning outcomes are at least proficient
- Unsatisfactory when one or more learning outcomes are graded lower than proficient

Learning activities

Based on the characteristics of an academic premaster and based on a highly knowledge-based scientific world, the semester is structured according the course-based learning method. It is a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). Education is pre-structured in terms of content, working methods and guidance.

Knowledge, competences and professional skills are further gained and applied in practical assignments, which increase in size, abstraction and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

Depending on the subjects, a variety of side-roads will be offered for in-depth knowledge and broader research.

Resources

All course content is in Canvas and Sharepoint. All software (compilers, IDEs, libraries, tools) is available for free.

10.1.1. Information about

Introduction

For a precise specification of a problem and for efficient communication, logic reasoning is essential. In this module, first you learn the basics (propositions, Boolean algebra, quantifiers), and later you apply it on solving problems and proving program correctness.

This module furthermore introduce the mathematical foundations which will elaborated in other modules, in particular regarding graph theory and automata.

Some specific problems, such as optimization or scheduling problems, require another way of reasoning and specific tools that can help in solving them. In this module you learn how to analyze a given problem by extracting the relevant information about constraints that a solution needs to satisfy and make a model based on this analysis that can be given as an input to a tool that can solve it, e.i. SAT or STM solver.

The covered subjects are:

- propositions, Boolean algebra, quantifiers
- linear algebra: equation and vector representation for lines and planes, cross product, dot product
- automata: regular languages, regular expressions, powerset construction
- graph theory: BFS, DFS, Dijkstra, Huffman, spanning tree

Examination and grading

Examination

The teachers will provide the students with formative feedback on deliverables and demonstrations. It is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on analysis, design and technical aspects, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least three formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don’t give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade of beginning or orienting.

Tools allowed

Except for paper & pen, and a laptop, no additional equipment is needed.

Resits and repairs

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2019/2020, it is not possible to do a retake for the semester.

Grading

A student's growth is maintained in his portfolio. The student's growth on each learning outcome is registered according to one of the five levels of mastery.

1 undefined,
2 orienting,
3 beginning,
4 proficient,
5 advanced.

After each formative assessment, the level of mastery for all learning outcomes is assessed for the student's deliveries.

At the end of the semester the student will be assessed on his performance of the semester. During the assessment meeting the teacher will use the student's portfolio. The overall grade is based on the shown performance and will be graded as follows:

- Outstanding when all learning of the outcomes are marked as advanced
- Good when more than half of the learning outcomes are marked as advanced
- Satisfactory when all learning outcomes are at least proficient
- Unsatisfactory when one or more learning outcomes are graded lower than proficient

Learning activities

Based on the characteristics of an academic premaster and based on a highly knowledge-based scientific world, the semester is structured according the course-based learning method. It is a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). Education is pre-structured in terms of content, working methods and guidance.

Knowledge, competences and professional skills are further gained and applied in practical assignments, which increase in size, abstraction and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

Depending on the subjects, a variety of side-roads will be offered for in-depth knowledge and broader research.

Resources

All course content is in Canvas and Sharepoint. All software (compilers, IDEs, libraries, tools) is available for free.

10.1.2. Information about

Introduction

Algorithms are at the heart of any computer application solving non-trivial problems in transportation, healthcare, education, social media etc. Writing efficient algorithms (because nobody likes slow apps and stack overflows..) requires patience, analytical talent, abstract thinking and creativity!

This course will help you train these skills by examining several classic algorithms for sorting, searching and optimization problems. You will learn to reason about algorithm complexity with measures like the big-Oh notation, and to use efficient data structures like hashtables, trees etc. Examples of optimization strategies discussed are greedy, backtracking, dynamic programming.

Compilers systematically translate high-level languages designed for humans into a program written in low-level assembly more suited to machines or to another language. In this module you learn about the essential components of each compiler: lexical analysis and parsing. You learn how to describe a language (programming language or a domain specific language) by grammars and how to use them in combination with a parser generator, to parse a character sequence (program) into a parse tree.

Topics in this module are:

- Data Structures & Algorithms
  - space & time complexity
  - sorting algorithms
  - binary trees & searching
  - optimization: greedy & backtracking
  - dynamic programming
- Program complexity
  - P vs. NP
  - the class of NP-complete problems
  - reduction of one NP-complete problem into another
  - reduction from SAT to e.g. Vertex Cover, Independent Set or Clique
  - investigation of approximations with their upper bounds
- Automata II
  - the ANTLR eco-system
  - lexers and parsers

Examination and grading

Examination

The teachers will provide the students with formative feedback on deliverables and demonstrations. It is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on analysis, design and technical aspects, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least three formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don't give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade of beginning or orienting.

Tools allowed

Except for paper & pen, and a laptop, no additional equipment is needed.

Resits and repairs

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2019/2020, it is not possible to do a retake for the semester.

Grading

A student's growth is maintained in his portfolio. The student's growth on each learning outcome is registered according to one of the five levels of mastery.

1 undefined,
2 orienting,
3 beginning,
4 proficient,
5 advanced.

After each formative assessment, the level of mastery for all learning outcomes is assessed for the student's deliveries.

At the end of the semester the student will be assessed on his performance of the semester. During the assessment meeting the teacher will use the student's portfolio. The overall grade is based on the shown performance and will be graded as follows:

- Outstanding when all learning of the outcomes are marked as advanced
- Good when more than half of the learning outcomes are marked as advanced
- Satisfactory when all learning outcomes are at least proficient
- Unsatisfactory when one or more learning outcomes are graded lower than proficient

Learning activities

Based on the characteristics of an academic premaster and based on a highly knowledge-based scientific world, the semester is structured according the course-based learning method. It is a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). Education is pre-structured in terms of content, working methods and guidance.

Knowledge, competences and professional skills are further gained and applied in practical assignments, which increase in size, abstraction and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

Depending on the subjects, a variety of side-roads will be offered for in-depth knowledge and broader research.

Resources

All course content is in Canvas and Sharepoint. All software (compilers, IDEs, libraries, tools) is available for free.

10.1.3. Information about

Introduction

Statistics is about collecting and interpreting data using mathematical instruments, domain knowledge and common sense. Although mostly not explicitly stated, statistics plays a role in a wide variety of fields: news, sports, medicine, politics, scientific research etc. It is also a key building block for more advanced topics like decision theory or data science.

In this introductory course, you will first learn how to summarize data using meaningful plots and numbers (*descriptive statistics*). Then you will learn how to setup simple statistical studies and use techniques like hypothesis testing to draw general conclusions from a limited amount of data (*inferential statistics*). Along the way, you will also train your ability to recognize statistical traps and not misuse the statistical tools.

Topics in this module are:

- Statistics:
  - basics like variance, standard deviation, normal distribution
  - confidence intervals, hypothesis testing
  - observations versus experiments
  - Bayes theorem
  - Simpson paradox
  - and applying them on external data and your own-collected/generated data
- Decision Theory:
  - maximizing reward
  - Markov decision processes
  - states, actions, transitions
  - rewards, policies
  - temporal credit problem
  - utility functions

Examination and grading

Examination

The teachers will provide the students with formative feedback on deliverables and demonstrations. It is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on analysis, design and technical aspects, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least three formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don't give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade of beginning or orienting.

Tools allowed

Except for paper & pen, and a laptop, no additional equipment is needed.

Resits and repairs

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2019/2020, it is not possible to do a retake for the semester.

Grading

A student's growth is maintained in his portfolio. The student's growth on each learning outcome is registered according to one of the five levels of mastery.

1 undefined,
2 orienting,
3 beginning,
4 proficient,
5 advanced.

After each formative assessment, the level of mastery for all learning outcomes is assessed for the student's deliveries.

At the end of the semester the student will be assessed on his performance of the semester. During the assessment meeting the teacher will use the student's portfolio. The overall grade is based on the shown performance and will be graded as follows:

- Outstanding when all learning of the outcomes are marked as advanced
- Good when more than half of the learning outcomes are marked as advanced
- Satisfactory when all learning outcomes are at least proficient
- Unsatisfactory when one or more learning outcomes are graded lower than proficient

Learning activities

Based on the characteristics of an academic premaster and based on a highly knowledge-based scientific world, the semester is structured according the course-based learning method. It is a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). Education is pre-structured in terms of content, working methods and guidance.

Knowledge, competences and professional skills are further gained and applied in practical assignments, which increase in size, abstraction and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

Depending on the subjects, a variety of side-roads will be offered for in-depth knowledge and broader research.

Resources

All course content is in Canvas and Sharepoint. All software (compilers, IDEs, libraries, tools) is available for free.

10.1.4. Information about

Introduction

Functional Programming is a programming style where mathematical functions (that is, expressions with input parameters and an output result) are fundamental and running a program basically means evaluating a complex function. When compared to traditional imperative and OO programming styles, FP is much faster to develop and easier to test/debug, and is also very suitable for parallel applications. Lisp, Haskell, Scala, Elm are examples of purely functional programming languages very much used today.

This course aims at exposing you to the functional way of thinking and introducing FP concepts and techniques that have been proven useful in practice, like list comprehensions, generators, map, filter, reduce. To facilitate the comparison between programming paradigms and to encourage assimilation of the FP style in your programming practice, “mixed” languages like F# and Python can be investigated.

Data Science, responsible for transforming (big) data into useful information, has become an unmissable link in almost every industry, from entertainment to healthcare. Personalized recommendations, identifying disease in medical scans, detecting fraud, comprehensive covid19 visualizations.. are just some examples of data science applications.

This short course covers the basics steps of data cleaning and exploration, then gives an overview of the machine learning landscape. You will gain hands-on experience with several simple machine learning algorithms like decision trees, KNN, linear regression.

The topics in this module are:

- Functional programming:
  - its paradigms
  - the differences with regular (imperative & object-oriented) programming
  - the usage within larger software applications
- Data Science
  - its life cycle: data collection, cleaning, exploiting, modelling, interpreting
  - supervised vs. non-supervised learning
  - strengths and weaknesses of various algorithms
- Parallel programming
  - the communication & synchronization between parallel threads
  - in depth study of critical sections, mutual exclusion, deadlock, starvation
  - usage of synchronization primitives like mutexes, semaphores and condition variables
  - proving correctness or flaws in classical problems and own-defined problems

Examination and grading

Examination

The teachers will provide the students with formative feedback on deliverables and demonstrations. It is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on analysis, design and technical aspects, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least three formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don't give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade of beginning or orienting.

Tools allowed

Except for paper & pen, and a laptop, no additional equipment is needed.

Resits and repairs

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2019/2020, it is not possible to do a retake for the semester.

Grading

At the end of the semester the student will be assessed on his performance of the semester. During the assessment meeting the teacher will use the student's portfolio. The overall grade is based on the shown performance and will be graded as follows:

- Outstanding when all learning of the outcomes are marked as advanced
- Good when more than half of the learning outcomes are marked as advanced
- Satisfactory when all learning outcomes are at least proficient
- Unsatisfactory when one or more learning outcomes are graded lower than proficient

Learning activities

Based on the characteristics of an academic premaster and based on a highly knowledge-based scientific world, the semester is structured according the course-based learning method. It is a structured and predictable learning path, in which the learning outcomes and assessment criteria are determined by the study program.

The education is designed according to the principles of the 4C/ID model (four-component instructional design model). Education is pre-structured in terms of content, working methods and guidance.

Knowledge, competences and professional skills are further gained and applied in practical assignments, which increase in size, abstraction and complexity during the study program. The student gets more and more choice in a pre-sorted set of learning tasks that are designed according to 4C/ID.

Depending on the subjects, a variety of side-roads will be offered for in-depth knowledge and broader research.

Resources

All course content is in Canvas and Sharepoint. All software (compilers, IDEs, libraries, tools) is available for free.

11. Information about

11.1. Information about Semester 4 Artificial Intelligence

Entry requirements

To start this specialisation, you must have successfully finished the first two semesters and have at least attempted semester 3 on Bachelor level.

Learning Outcomes

During the semester students should demonstrate proficiency in the following learning outcomes, all of which can be found in Canvas as well.

Learning outcome 1. Data preparation

You are able to **prepare** and **store** a given dataset in such a way that it can be used in your data analysis and/or modelling.

Clarification **Preparing a dataset** consists of extending it with additional data and cleaning the data according to theories of data quality, in such a way that the process of cleaning and preparing those data is repeatable, transparent to others, and the results are suitable for data analysis and/or modelling. **Storing a dataset** includes investigating cloud solutions and arguing whether they should be used.

Learning outcome 2. Data analysis & model engineering

You are able to **apply** supervised machine learning algorithms and **other data analysis techniques** to a prepared dataset.

Clarification **Applying** consists optimising the training of a model using model tuning and grid search, and evaluating the results with respect to recall, precision, accuracy, cross-validation, etc. **Other data analysis techniques** are for example: descriptive statistics, derived columns, forecasting, trend analysis, clustering, etc.

Learning outcome 3. Reliability and transparency

You are able to address **reliability** and **transparency** aspects during data analysis and/or modelling.

Clarification
Reliable means that conclusions are supported by methodologically acquired and evaluated results, recommendations make sense in regards to the domain knowledge, and used sources are referenced appropriately. **Transparent** refers to the process being clear to such a degree that it is reproducible, results being explainable to humans and based on decision making that is considered fair, whilst eliminating bias.

Learning outcome 4. Targeted Interaction

You use **appropriate communication** to address your audience considering your role, your audience and the medium to convey your message regarding the **approach** and **results** of your data analysis and/or modelling.

Clarification **Appropriate communication** means reporting and/or presenting the approach, process or outcomes of a data analysis in a methodologically sound way. You can reflect on the effect of your communication and based on that reflection you define steppingstones ahead on the task, on the role and on the projected results. Interaction about data analysis is based on a systematic **approach** (such as the IBM Data Science Methodology) and comprises 4 phases/components: 1) project proposal 2) data preparation 3) data analysis/modelling and evaluation 4) results and deployment. Based on your message, your position and the person(s) you address, you choose the right channel and format to communicate **results**, including appropriate data visualizations (such as data stories, infographics, or (a set of) static or interactive plot(s)).

Learning outcome 5. Future orientation

You are able to **assess the context** of data analysis and/or modelling from **multiple perspectives** in order to pursue this project in a sustainable manner.

Clarification **Assess the context** means the organizational and societal environment in which the data analysis project takes place. You show that you can identify the hallmarks and roles of the environment of the assignment and have a keen eye for a future-oriented, sustainable embedding of your work in an organization and society. **Multiple perspectives** include social and ethical considerations, law compliance, organizational data maturity, alignment with sustainable development goals, recognizing

own boundaries and those of others and acting accordingly. Reflecting on ethics and governance of AI-based automated decision-making will be an important and integral part of your learning process.

Learning outcome 6. Investigative problem solving

You are able to critically consider a data analysis and/or modelling project from various perspectives, **identifying problems**, finding an **effective approach** and coming up with appropriate solutions.

Clarification **Identifying the problem** means you can formulate a clear hypothesis and research question in order to determine the aim of solution using an inquiring mindset. **Effective approach** means you are using pragmatic and critical approach based on verifiable sources. Being able to methodically and creatively solve problems, finding alternatives and critically analysing your own and others' line of reasoning **Effective approach** means you compose and pursue applied research methods (such as the DOT framework) and approaches based on reliable and verifiable sources. You are able to methodically and creatively find answers to applied research questions, considering alternatives and critically analysing your own and others' line of reasoning.

Learning outcome 7. Personal leadership

You show an **entrepreneurial mindset** regarding the data analysis and/or modelling project and your personal development, while being aware of your own **learning capacity** and keeping in mind your **professional ambitions** in the field of Artificial Intelligence.

Clarification **Entrepreneurial mindset** includes being aware, seeing opportunities and seizing them, motivating oneself and others, being able to profile oneself, a team and others. **Learning capacity** means guiding your own development and study progress, showing leadership and taking responsibility, enhancing ones' own learning capacity, demanding and giving active feedback, all with respect to the learning outcomes. **Professional ambitions** means you are examining what type of professional you want to be in the long term, which field and type of position you aspire to and how you can stand out from others in field of AI/data.

Introduction

In recent years, "intelligent software" has become part of our daily lives. Think of chatbots that answer questions, self-driving cars, apps that give personal advice about our health, etc. For end users it seems that these changes have gradually occurred, but for the software engineer this is a revolution. In the traditional way of making software, you divide a problem into parts, which you then solve with a rules-based approach. Software with AI uses algorithms that you can train with data to learn the rules yourself.

During your studies at Fontys you have already made several choices. Before even starting you have made a choice between demand-based and course-based and of your preferred language to study in. More recently you chose your specialisation to be Artificial Intelligence, and with that we will have a diverse group of students based on these previous choices. In specialisations all students from different backgrounds will join into one class. To facilitate all students, the working language is English.

During the development of this specialisation, we kept this diverse group in mind without making a compromise on the content we want you to learn. We will probably approach things differently comparing to your previously followed education at given times, but we will give you a soft landing and great opportunities to learn and grow as a professional.

Examination and grading

Examination

Progress evaluation exists in the form of 3 diagnostic evaluations with a formative nature, in which the assessor provides feedback, feedforward and feed-up, on a student composed personal development report, that addresses the learning outcomes. The student organises the moment of evaluation together with the semester coach. The semester coach uses a marking rubric aimed at providing progress

feedback on a scale of progressively increasing states: Undefined, Orienting, Beginning, Proficient, Advanced.

Tools allowed

All material offered in the Canvas course may be used during evaluations. You are also free to use other tools and software, so long as you can support your choices of method and application.

Resits and repairs

If, during any evaluation before the final evaluation, the student was unable to display sufficient proficiency in the learning outcomes, the remaining time of the semester up until the final evaluation can be used to make improvements. Due to the formative nature of integral evaluations and feedback, there is no such thing as a formal retake. The retaking of content is incorporated in the regular process of iterating evolutions throughout the semester.

If the final grade of Unsatisfactory is given, the semester is considered failed.

Grading

At the end of the semester, after the final evaluation, the teacher team translates the evaluation results based on the Personal Development Report into one final grade for the semester. The final grade is a letter out of the set U, S, G, O meaning Unsatisfactory, Satisfactory, Good, Outstanding, where Satisfactory defines the minimum in order to successfully pass the semester.

Any student who can demonstrate and support an integral learning progression beyond the before mentioned learning outcomes will receive a mark closer to Outstanding.

Final grades are given at the end of the semester during the assessor meeting. All formative feedback (PDR evaluations) is considered. The decision of final mark will follow the process below, however in motivated circumstances the assessors may decide differently.

- ‘Outstanding’ or ‘Good’ if 4 or more (out of 7) learning outcomes are marked Advanced and all the other learning outcomes are marked Proficient; else
- ‘Good’ or ‘Satisfactory’ if 3 or less (out of 7) learning outcomes are marked Advanced and all the other learning outcomes are marked Proficient; else
- ‘Unsatisfactory’.

Learning activities

Students are expected to individually prepare study materials before attending any session, (workshops, instructions, 1-on-1-feedback, etc.), as teachers will not by default conduct a centrally organised transfer of theory. This preparation may be done at a location of the student’s choice, for example at home, but should finalise before the associated sessions starts. Initial study material for such preparation will be available in the Canvas course. It is possible, and sometimes likely, that such materials include links to external sources or expect the student to go beyond the offered materials to prepare more thoroughly. During sessions, focus will be on applying the knowledge that was acquired in the preparation, and teachers will assist and coach students where relevant. In case the teacher team finds that a centrally organised transfer of theory is in place, they may do so at their own discretion. However, this will never fully replace student’s preparations and in all cases the responsibility for acquiring theoretical knowledge remains with the student.

Resources

A Canvas course including modules with (self) study materials, inspiration sessions and external sources is available.

11.2. Information about

12. Information about Specialisation Creative Technology (CA2020)

12.1. Information about Semester 4 Creative Technology

Entry requirements

To be able to start this specialisation you must have successfully finished the first two semesters and have at least attempted semester 3 on Bachelor level.

Learning Outcomes

Learning outcome 1. Vision

You express your own vision on future scenarios through research of the evolution of mankind's relationship with technology.

- Vision on future scenarios = your well-informed perspective on possible future scenarios, based on the way you view, value and judge any issues that may arise in its context
- Evolution = development throughout past, present and future
- Relationship with technology = interplay, both physically and mentally, i.e., "how does technology change the world / yourself?"

Your vision is expressed in the concepts, subsequent deliverables and products you produce. During the semester your vision will develop, i.e., by changing direction or reinforcing its basis.

Learning outcome 2. Innovative concept

You discover and define an innovative concept using creative thinking techniques combined with research of technology, context and human.

- Discover = gain insights through preliminary research (also see 'Research of …')
- Define = critical evaluation of a variety of concepts
- Innovative = featuring something new, different and/or better

- Concept = a clear statement, vision and strategy, i.e., on a potential application of a certain technology
- Using creative thinking techniques = critical and creative thinking as a process towards innovation
- Research of…
    - technology = explore distinctive threats & opportunities, failures & success, i.e. from literature, through experiments, etc.
    - context = understand chances and limits, i.e., spatial, temporal, physical, cultural, societal, ethical, etc.
    - human = understand cognitive mechanisms in relation to human behaviour, decision making and needs"

Learning outcome 3. Interactive user experience

You design an experimental interactive user experience that investigates a technology's potential and its mutual effect on people.

- Design = create an iteratively improved visual overview of the concept's physical and technological variables based on a predetermined effect or goal, i.e., (animated) 2D/3D-renders, (moving) storyboards, concept video, lo-fi prototypes, technical drawings, architecture diagram. Designs are frequently iterated upon, based on proactively acquired feedback.
- Interactive user experience = an installation or media product which can be experienced physically, i.e., appealing to multiple senses."

Learning outcome 4. Prototypes

You collaboratively realize and test a series of prototypes and its potential, for both users and stakeholders, in real-world application.

- Realize = combine hardware and software based on functional and user requirements, i.e., using appropriate sensors, actuators, logic components, computing platform, protocols, software libraries, etc. resulting in your own software running on your own hardware setup
- Series of prototypes = a number of iteratively improved prototypes, from low towards high fidelity. Iterations are substantiated from acquired feedback.
- Test = check whether a prototype achieves the intended effects, both from a user's, a stakeholder's and a technical perspective, using appropriate methods, like usability tests and unit tests, and iterating on test results and feedback.

Learning outcome 5. Present

You present your research outcomes, prototypes and reflections in relation to your research, concept and vision, to stakeholders, peers and potential future employers.

- Present = showing a visually appealing summary of your work, i.e., in an exhibition and/or showcase portfolio
- Research outcomes = consolidated experiments and their results, i.e., in a video, poster presentation, essay and/or 2-page-paper
- Reflections = review of your own experience of and development during the semester, both from a personal and professional point of view

Learning outcome 6. Personal Growth

You articulate your professional ambitions and focus and demonstrate your efforts and growth within the roles you fulfil in your projects.

- articulate professional ambitions and focus = proactively research the professional potential of your interests, knowledge and skills, in accordance with your vision, resulting in a set of personal learning goals

demonstrate efforts and growth = research, apply and transfer relevant knowledge and skills, which you have acquired during this semester (=efforts) and how this has helped you develop in your preferred field of expertise (=growth)

Introduction

Welcome to semester 4 Creative Technology!

We are very happy you chose this new specialisation. After the startsemester and two semesters in your chosen profile you will now explore your own creativity and the possibilities of technology. After this specialisation you will finish your second year and will be halfway of your study at Fontys School of ICT.

Background of this new specialisation

The rapid pace of technological progress and the immense possibilities of new technologies require adaptive professionals with a broad outlook. Not only on the (future) possibilities of technology, but also on the effects on people and society. In addition, these developments require a great deal of creative ability, or creative power. Developing new unusual applications for existing or future issues, exploring the boundaries of technology and thus responding to the society of the future. This creative ability is an essential skill when it comes to future and innovation.

Technology has taken up a primary place in our society. The smartphone and wearables have become an extension of the human body. Recently we have seen the 'corona app' being developed in many countries. A good example, where the starting point is that everyone carries their smartphone with them all the time, everywhere. In this example technology is used for a social issue, however, ethical issues also play a role here, which can't be ignored.

These aspects of technology, both the social added value and the ethical issues, are becoming increasingly important. The Creative Technologist will play an important role in this.

On behalf of the teaching staff of this specialisation, we wish you lots of fun during this semester!

Teaching methods

During your study ICT you have already made several choices. Before even starting you made a choice between demand based and course based and made a decision of your preferred language to follow your study. During startsemester you picked your preferred profile and made a decision between bachelor and associate degree. Recently you choose this specialisation and with that we will have a diverse group of students based on these previously made choices.

In the specialisation routes all students from different teaching methods and profiles will join together into one class. To enable all students, the lectures and workshops will be given in English. If possible, tutors can coach students individually or in small groups in Dutch as well as long as all attending students are able to follow the feedback and discussions.

In Canvas a good structure will be provided with a clear overview of lectures, workshops, assignments and deadlines. There will still be room to follow your own path (demand based).

During the development of this specialisation, we kept this diverse group into mind without making a compromise on the content we want you to learn. We know for sure we will approach things differently comparing to you previously followed education, but we will give you a soft landing and great opportunities to learn and grow as a professional.

Student feedback

The semester will have a quality assessment during every run to collect student feedback. This feedback will be used to improve the content as well as the organisation of the semester. However, we encourage you to give feedback at any time during the semester and whenever possible we try to follow up immediately.

Improvents based on student feedback

On Friday April 23rd 2021 we held our semester evaluation (online). Although we felt most of the issues mentioned were largely caused by the situation of online education due to Covid-19, we believe things can always be improved and we take all feedback seriously.

These are the most important, immediate improvements:

- **How to deal with intermediate feedback (FeedPulse)** Students experience inconsistent use of FeedPulse. It seems there is no consensus on how (often) students are supposed to log their feedback in FeedPulse. Also, the fact that we are working most of the times in MS Teams (during covid-19 lockdown) makes Canvas a much less visited and

therefore less visible tool. Action: before the start of the fall semester, coordinators will come up with a plan for a consistent way of processing and/or logging feedback on student work.

- **Social connectedness (or a lack thereof)** Most students spent a lot time alone in their rooms, having contact with only a few students and teachers throughout the week. A suggestion of organizing informal social events (Game night, Friday afternoon drink), even when online, was welcomed with enthusiasm. In the coming semester we hope to be able to organize lots of field trips, which fulfill an important social aspect as well.
- **Portfolio guidelines** As coordinators we noticed that the freedom of choice considering the form of the learner portfolio caused quite a delay for the portfolios to contain what we thought to be important contents. To speed up the process, we will update the first portfolio workshop to include a list of required items for the free-form portfolio.
- **Motivation (working from home)** Some students struggled with their motivation, working almost entirely from home. We expect this will be solved as soon as we will be able to execute our didactics as we intented in our semester design process. This includes a.o. working on location, sharing a lot of inspiration, experience and knowledge between everyone involved.

Examination and grading

Examination

Portfolio

During the semester, you will collect intermediate (partial) products in a portfolio that, in terms of form, matches your preference or the nature of the project being worked on. This can be, for example, a physical dummy / folder, a website, blog / vlog, YouTube channel, etc.

For the purpose of testing and safeguarding, the portfolio is digitized and uploaded in Canvas prior to at least the final assessment. In the case of online content, it must be submitted in an offline readable form.

Formative assessments

During the semester you will present and discuss your portfolio with your tutors. Your portfolio will be used to assess your progress in regards of the learning outcomes.

During the entire semester – so not just around the assessments mentioned below – you are encouraged to gather feedback from your coaches, which will allow you to iteratively improve your portfolio contents up to the final assessment in week 19.

These are the formally planned formative assessments:

Week 5 – Individual project

Almost at the end of your individual project in week 4 you will submit your portfolio in Canvas for your tutors. This might be a link to an online source of your portfolio. In case of a physical dummy, you can scan all the pages to make sure multiple tutors can read your portfolio at the same time.

Week 11 – Duo project

Almost at the end of your duo project in week 10 you will submit your portfolio in Canvas for your tutors.

Week 15 – Halfway Client Project

During the client project in week 14 you will submit your portfolio for the third time for your last formative assessment.

Week 19 – Final assessment

At the end of the client project, you will submit your final version of your portfolio. This version needs to be fully digitalized and in an offline readable form.

Tools allowed

N/A

Resits and repairs

Retakes

If, during any evaluation before the final evaluation, the student was unable to display sufficient proficiency in the learning outcomes, the remaining time of the semester up until the final evaluation can be used to make improvements. Due to the formative nature of integral evaluations and feedback, there is no such thing as a formal retake. The retaking of content is incorporated in the regular process of iterating evolutions throughout the semester.

If the final grade of Unsatisfactory is given, the semester is considered failed.

Grading

Feedback scale

Fontys School of ICT uses learning outcomes to define and determine your learning progress. During and at the end of the semester you will need to prove whether you have accomplished these outcomes. Each learning outcome will be graded using the following scale, to provide insights of your learning progress in those moments.

Level	Explanation
Undefined	You have not yet undertaken activities to demonstrate the learning outcome.
Orienting	you have made a start and explored the possibilities to demonstrate the learning outcome.
Beginning	you have taken the first steps and carried them out which contribute to demonstrating the learning outcome.
Proficient	you have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.
Advanced	you have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.

Final semester grade

All learning outcomes will be graded per individual during the semester. Based on this, the final semester grade will be decided upon in consultation with all assessors during the assessors meeting in week 19. The final semester grade will be based on your portfolio, FeedPulse, all given feedback and interim assessments.

The assessors will be using the following guidelines.

- A student with any outcome graded below Proficient will obtain Unsatisfactory (U).
- A student with all outcomes graded Proficient will obtain Satisfactory (S) or Good (G).
- A student with half or more outcomes graded Advanced will obtain Good (G) or Outstanding (O).

You have passed the semester after scoring Outstanding (O), Good (G) or Satisfactory (S). This means you will earn this semester's 30 ECTS.

Learning activities

Structure

After kicking off with an introduction week, this semester is based on three major projects: The Individual Project, The Duo Project and the Client Project (NL 'proftaak').

Introduction week

During this week you will get lectures, workshops, inspiration sessions and a guest lecture to get inspired about Creative Technology. The main goal is that you will understand the broad possibilities of Creative Technology and you will get inspiration where you want to work on.

Individual project

After the introduction week you'll discover your own interests and will start a project by yourself. Of course, there will be tutors to coach and help you and there are also several subjects and challenges available to pick from if you have a hard time already define a project for yourself. The main goal for the individual project is to explore your interests and dive into subjects you find most interesting.

During these weeks there will be (guest) lectures and workshops with a diversity of subjects to support your project and to broaden your knowledge and skills.

Duo project

After your first individual project we will start a new project in duos. We will try to match each student based on similar interest, complimentary skill sets or adjective skill sets.

During the duo project you can further developing one of the individual projects or start a new one. You will choose an utopian or dystopian approach.

Of course, also during the duo project stages you will receive lectures and workshops to help you with your project and broaden your knowledge and skills.

Client project

Halfway the semester you will start with the client project. You can indicate your preference for the given assignments made by our Partners in Education. You will apply all learned knowledge and skills into this new project and will frequently be in contact with the client. At the last week of the project, you will deliver and present your MLP (Minimum Lovable Product) during the Expo.

Subjects

Vision

By looking at the past, analyse the present, use trend watching, you will be able to develop your own vision of the relation of mankind with technology. Where will we be in the future? What are the opportunities and threats? Using this vision in your projects will help you to define and develop solutions with impact.

Emerging Technology

You will dive into emerging technology and will learn how to use them, make good prototypes and proof of concepts.

Crafting Technology

After making prototypes you will learn how to make products with impact. You will use methodology and tools to design, make and test your products.

Creative Thinking

Creativity is 5% talent and 94% hard work and 1% luck. With workshops and lectures you will focus on hard working and you will use different techniques to create lots of ideas. You will learn how to filter this ideas and craft them into great solutions.

Design for Humanity

How does technology change you and the world around you? You will learn how to become part of creative thinkers and makers who can create impact with your solutions. You will learn ethnical thinking to have a view on this impact and possible consequences.

Professional Development

On top of the topics mentioned above, you will be working on your own professional development. You will develop more specialistic skills as a professional and you will show your iterative process, by presenting your proceedings in a professional manner. You will deliver all of your work in a professional way and of professional quality to your stakeholders.

Resources

All learning materials can be found in the canvas course starting with "CT4-...".

13. Information about

13.1. Information about ICT & Game Design and Technology S4

Entry requirements

Please note that the entry requirement for this specialisation is a successfully completed propaedeutic year as well as a first attempt at a third semester at Fontys ICT.

Learning Outcomes

Learning Outcomes

The learning outcomes will be individually assessed on all projects.

The following learning outcomes have been defined

L1 Game Design

Learning Outcome Game Design	You show that you can design a game in an **analytical** way **using existing frameworks, theories and models**. You are able to **present** and **validate** game systems for both functional/technical and aesthetic requirements using **industry standard methods** and **deliverables**.
Explanation	**Analytical** means that you work in a structured and analytical way. You support your design choices with sources such as: Target User Research, Existing products analysis, available technology research, stakeholder analysis etc.

	With **using existing frameworks theories and models** we mean frameworks such as: UML, ERD, Design Patterns, MDA framework and Self Determination Theory as well as concept development methods such as diverging/converging, brainstorms etc. With **present** we mean that you communicate with the relevant stakeholders in an appropriate way. This includes written reporting and pitch presentations. You **validate** your designed game systems in an early stage using efficient and quick prototyping methods such as paper prototyping, roleplaying and wizard of Oz and use the results to refine your design. Common **deliverables** are: Game Design document, Tech design document consisting of elements such as UML diagrams and software architecture diagram and prototypes such as paper prototypes, mockups and user tests.
Competences	GI.AN.2.2 GI.AN.2.3, GI.AD.2.1, GI.AD.2.2, GI.AD.2.3, SO.ON.2.1. SO.ON.2.2. SO.ON.2.3 SO.ON.2.4 SO.ON.2.5 GI.ON.2.1 GI.ON2.2

L2 Game Technology

Learning Outcome **Game Technology**	You show that you can **develop** and **validateprototypes** in an **analytical** and **methodical** way **based on designs** using **innovative and relevanttechnology** adhering to **quality criteria** in a **complex context**.
Explanation	With **develop** we mean that you are able to create new technical prototypes. You are able to **validate** these **prototypes** to verify the quality of the product using for example User Tests and Peer Reviews. **Analytical** means that you are structured in your approach and that your insights are well supported using the DOT research methods. **Methodical** means that you use relevant tooling to optimize the development process such as version control and project management. With **based on designs** we mean that the prototypes are based on prior designs. You use **innovative and relevanttechnology** that suit your needs such as VR headsets, Mobile devices, Game Controllers, Industry Standard Game Engines etc.

	With **quality criteria** we mean predefined elements such as performance, security, stability etc. A **Complex Context** means that real-world factors play an important role such as: actual users, stakeholders and actual hardware.
Competences	GI.RE.2.1 GI.RE.2.2 GI.RE.2.3 SO.RE.2.1 SO.RE.2.2, SO.MC2.1 SO.MC2.2

L3 Applied Game Aesthetics

Learning Outcome **Applied Game Aesthetics**	You show that you can **create, find and/or adaptaudiovisual and narrative assets** based on a **design**. You **use these in your technical prototypes** using **industry standards**. You understand the **basics of audiovisual and narrative design theory** by **validating the quality** of your assets in accordance with your design. You **use available hardware** to **increase the user experiencebased on theory**.
Explanation	With **create, find and/or adapt** we mean that you can create basic assets, but more realistically will find existing assets and alter them to suit your aesthetic and technical needs. The goal is that you seek out a balance in creating assets from scratch and finding existing work. With **audiovisual and narrative assets,** we mean all 'art' assets of your games such as: 2d art, 3d art, synthesized and/or recorded sound effects, (dynamic) music, story, scripts (dialogue) etc. With **inbased on a design** we mean that all assets you use are based on your previously designed aesthetics. The graphics, sound and narrative components should all increase the overall aesthetic experience. With **industry standard tooling and processes** we mean that you can use a broad range of relevant and fitting tools in an optimized and well-structured way such as: 3d authoring tools, Audio Editing tools, Graphics editing tools etc. With **basics of audiovisual and narrative design theory** we mean theory as covered in the workshops and available references. **Validating the quality** means that we expect you to methodically validate your aesthetics by user testing your products with relevant users.

	With **use available hardware** we mean all manners of input and/or output that the hardware offers. With **increase the user experiencebased on theory** we mean that you can use, optimize and adapt the usage of your hardware based on relevant user experience theories such as Game Feel.
Competences	GI.AN.2.2 GI.AD.2.2 GI.ON.2.1, GI.RE.2.1 GI.MC.2.1

L4 Industry Awareness

Learning Outcome **Industry Awareness**	You show an understanding of **trends and developments** within the game industry and show that you can **apply these insights** in your Game Design. You can **choose and justify a role** which helps you become an expert in accordance with your personal development goals.
Explanation	**trends and developments** You are up to date with new trends and developments within the game industry such as: software algorithms, engines, game genres, new hardware, business models etc. **apply these insights** You know the advantages and disadvantages of trends/developments and know when and how to use these in your products such as user research, hardware choices etc. **choose and justify a role** You choose a role that exists within the game industry to specialize in and become aware of the required skills for that role. You can justify why this role is a good fit for you as a professional. Roles are for example: tool developer, game designer, level designer, indie developer, etc. With **prepare for an internship** we mean that you are able to chose a suitable internship location that suits your personal development goals in a structured way. This means that you explore possible internship positions, establish communication with the correct parties and are able to analyse and define the scope of your internship assignment.

Competences	GI.AN.2.1

L5 Professional Development

Learning Outcome **Professional Development**	You demonstrate your professionalism as a Game Design specialist by the manner in which you perform during authentic IT professional tasks and the professional standard of resulting products. Process and products show your awareness of methodical problem solving, proactive project validation and quality monitoring and are self-explaining and transferrable. You show and demonstrate you're fit to work in a **future-oriented** organization and know what's expected of you within such an organization. You are able to **prepare for yourinternship**.
Explanation	Being a **future-oriented** professional means that you: - are skilled and have the necessary emphatic ability to analyze a game design context including the (target) user's needs and stakeholder's expectations/requirements. - have the necessary communication skills to inform and advice stakeholders within the project - act according to ethical standards and show responsibility whenever ethical standards are at stake - are able to define the project's need for information and are able to design a straightforward methodology to address this need using the DOT framework, method cards and method chaining. - are proactive in describing and monitoring the quality of your work by incorporating validation and document your work effectively. As a result your work is reproducible and transparent. And your outcomes can be used by others (hand-over) - You can **prepare for your internship** by finding and choosing a suitable internship location that suits your personal development goals in a structured way. This means that you explore possible internship positions, establish communication with the correct parties and are able to analyze and define the scope of your internship assignment.
Competences	TO2, PL2, DI2, OP2

Introduction

Preface

The Dutch gaming industry is predominantly characterised by a number of smaller players and just a few major studios. So chances are you'll be working in a small team later. This means that you will be expected to show initiative, that you will have to be a team player, know the tricks of the trade and that you can think out of the box of your own discipline every now and then. Additionally, we see opportunities for start-ups in this field, combining creativity with technology.

The Dutch gaming industry is growing and it is one of the top sectors, as indicated by the government. Because there is a general belief in the application of games, the industry is being supported in various ways. This means that the demand for fresh graduates with experience in making games will continue to increase.

The market needs:

• creative gameplay programmers

• media designers with knowledge of games. Media and marketing bureaus increasingly use games

• (technical) game and level designers

. Experience with Gamification and serious games.

In this semester you will start with a 4 week pressure cooker where you will learn the basics of gamedevelopment. The next project will be a Duo Project where you partner up with a student and design and develop your own game. In the last part of the semester you will work with an industry partner in a group project to create a prototype for a stakeholder.

Introduction

The text that lies before you is a specific manual for the 2nd year specialization ICT & Game Design and technology semester 4.

In this manual you will find all information necessary for this semester, including a description of the educational activities.

Changes since last semester:

This is first time the semester is being performed therefore there are no specific changes to mention. We did develop the semester with the following goals in mind:

- Modified Crash Course Workshops and lessened pressure by reducing assignments
- Stronger focus on milestones and deliverables for group projects
- Coaching roles more prominent in feedback cycle

Entrance level

Please note that the entry requirement for this specialization is a successfully completed propaedeutic year as well as a first attempt at a third semester at Fontys ICT.

Projects

The semester is split up in roughly three projects:

- Crash Course (Game Pie)
- Your Own Game
- Industry Project

Partners

There are multiple partners in education involved, such as:

Game Solutions Lab, Embedded fitness, Night of the Nerds/Futurebites, Garage2020.

Learning Outcomes

You will learn the skills required to create your own game. These skills are expected to also be applied to the industry project.

The skills have been organized in the following categories:

- Game Design
- Game Technology
- Applied Game Aesthetics
- Industry Awareness
- Professional Skills

To support development of these skills, these five categories have been used to construct four main learning outcomes, recurring in all projects.

What will you learn

Pressure Cooker (Game Pie)

The Game Pie is a course within Semester 4 of Game Design & Technology. This course will act as an introduction to the field of game design to teach students the tools they will need for creating games. In these 4 weeks students will go through a pressure cooker that will introduce to them game analysis, game design & prototyping. Students will work in groups of 5 on a base project. They will be challenged to make an addition to this existing base project using the learnings from game analysis, design and prototyping. To learn how to communicate ideas, handover existing work and letting go of your ideas this course will have a swap event. Every Thursday the groups products will be swapped with another groups products and they will continue to work on the products they have received.

Learning objectives

During the project, the students will learn to:

- Iteratively analyse design and build a game concept/mechanic.
- Communicate and present the game products
- Hand over/receive design created by others and expand upon existing work.

Deliverables

	Description
Daily Progress Report	During the Pressure cooker students are expected to hand in a concise daily progress report.

Game Presentation	The final game adaptation will be presented to teachers and your peers.

Your Own Game

To help you create Your Own Game there are workshops and coach sessions to teach you about the theory and practice that is required to create an engaging game. At the end of a workshop you will always end up with a concrete deliverable. Ideally this deliverable is in line, or part of your own game, but sometimes it might be standalone deliverable. Eventually however, you are expected to apply the learning goals of the workshop to your own game.

Besides the workshops there are coach sessions where you will have a chance to discuss and show progress to your coach. You are expected to process this feedback in FeedPulse.

Learning objectives

During the project, the students will learn to:

Methodically define, design and create a game by going through a complete game development cycle.

Define your personal learning goal within the domain of Game Development and apply this within your project.

Deliverables

	Description
Game Pitch	The Design Pitch is used to methodically communicate your intended game and display the quality of the intended game in a persuasive way. The Game Pitch Is substantiated by giving insight in the underlying process.
Low Fidelity Prototype	The low fidelity prototype serves to validate game mechanics using a tech-demo and user tests.
High Fidelity Prototype	The high fidelity prototype serves to convey designed aesthetics and show a polished/finished vertical slice of the game.
Devlog	The Devlog gives insight in your methodical approach and process of the creation of your game and your reflection on this process.

Industry Project

During the Industry Project you will apply all your game development skills to create a product for an external stakeholder, in a multidisciplinary team.

The Industry Project is based on the five phases of a Design Oriented Research:

(1) problem analysis, (2) diagnosis, (3) design, (4) intervention and (5) evaluation.

The outcome of the professional assignment will be a working prototype that is based on a methodology described in the DOT framework providing insights about the quality of process and product.

The Industry Project is organized in three sprints (concept, first playable and polishing/validation)

Learning objectives

During the Industry Project, the students will learn to:

Apply the design research steps methodologically and integrate the design research cycle to their work. (Problem analysis, concept design, development, evaluation)

Demonstrate professional attitude during the work with client, coaches and team members.

Industry Project final demonstration

Student groups will demonstrate and (user) test their end product and will receive feedback from peers during peer assessments, experts during expert reviews and clients during demonstrations. The students will gather this information in order to provide the assessors complete and methodically correctly obtained information and insight about the quality of the process and product.

Deliverables

	Description
Game Pitch	The Design Pitch is used to methodically communicate your intended game and display the quality of the intended game in a persuasive way. The Game Pitch Is substantiated by giving insight in the underlying process.
Game Prototype	The game is a polished and user tested demonstrator. A vertical slice of the game concept conveying both technical impressions as well as aesthetic refinements.
Sprint Report	Every sprint progress is recorded. It reflects on the previous sprint and defines concrete action points for the next sprint.

Devlog and Game Trailer	The Devlog gives insight in your methodical approach and process of the creation of your game and your reflection on this process. The Game Trailer is a short polished trailer showcasing highlights of your game.

Examination and grading

Examination

Assessment

The teachers will provide the students with formative feedback on deliverables and demonstrations. The student is expected to record their feedback in FeedPulse and it is expected that this feedback will be processed in further deliverables, within reason.

The student shows the work, alone or in a group context, but will be given feedback on an individual base.

The student work will be assessed on the set learning outcomes, where the student will be informed whether the learning goals are met concerning the criteria. Besides the continuous feedback, there are at least 4 formal formative assessments scheduled.

At these assessments the learning outcomes are determined based on state of the deliverables at that point. Ideally the learning outcomes are proficient at these assessments. This grade is a formative indicator of mastery of learning goals at that moment and don't give any guarantee for further assessments. It is expected that the student keeps on progressing on the learning outcomes, not doing so might lead to a lower grade at the next formative assessments such as beginning or orienting.

Tools allowed

Laptop and/or diverse gaming peripherals and/or hardware.

Resits and repairs

Retake and/or repair

During the semester students are facilitated to process formative feedback on their learning goals in their deliverables and activities that are to be recorded in their portfolio (Canvas). All learning activities are related to the professional assignment. Therefore, according to OER2020/2021, it is not possible to do a retake for the semester.

Grading

How does final grading take place?

Your growth is tracked in CANVAS. Your growth on each performance indicator is registered according to one of the five levels of mastery. Each learning outcome will be graded by the following levels of mastery

Undefined	You have not yet undertaken activities to demonstrate the learning outcomes.
Orienting	You have made a start and explored the possibilities to demonstrate the learning outcome.
Beginning	You have taken the first steps and carried them out which contribute to demonstrating the learning outcome.

Proficient	You have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.
Advanced	You have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.

Assessment guidelines

At the end of the semester, during the summative final assessment, we use the following guidelines to determine the final grade for this semester:

- A student with any outcome graded below Proficient will be graded Unsatisfactory (U).
- A student with all outcomes graded Proficient will obtain Satisfactory (S) or Good (G).
- A student with half or more outcomes graded Advanced will obtain Good (G) or Outstanding (O).

The scale is an integral measure of the student's progress. In general, at the end of the semester a student should be able to demonstrate at least the level of "Proficient' at all learning outcomes. Of course, in the case of an integral summative final assessment there is always room for the professionalism of the assessors to deviate from this, provided that this is substantiated by feedback. The discerning factors between Satisfactory, Good and Outstanding are based on your portfolio input.

Learning activities

Way of working

During the semester lectures and practicals will be offered in the form of workshops. These workshops will deal with subjects related to technology and design and students will work on a special case or, preferably, their own concept. Students will report to a dedicated coach/teacher to present and discuss progress on a regular basis.

Teachers will provide students with feedback on their work. Students are expected to record and process this feedback. For the Industry Project Assignment, there will be a weekly tutor meeting to discuss the group progress. During this meeting, the professional development and group processes are also discussed. The student is expected to demonstrate Industry Project progress to the client at set intervals.

Resources

Course material is available on Canvas.

14. Information about Specialisation ICT & Cyber Security (CA2020)

14.1. Information about BSc ICT & Cyber Security OE4

Entry requirements

Both demand-based (DB) and course-based (CB) students will join semester 4 OE4 together. All students must be able to attend the course in the English language, and at least the following competence profile, considering **Personal Development**skills (https://www.hbo-i.nl/publicaties-domeinbeschrijving) is assumed:

Bachelor HBO-I	**Level**
Personal leadership	1
Solving research problem	1
Future-oriented organizing	1
Target-oriented interact	1

Considering **Professional Duties**, we have deal with a mixture of all five proficiency-level 1 architectural layers *(user interaction, organizational processes, infrastructure, software, hardware interfacing)* and all five activities *(analysis, advise, design, realization, manage & control)*, depending on the student's profile. This is taken into account by supporting students that need some extra training, and by challenging students that already have some basic level for specific learning outcomes. Especially when it is about network technology, it can be expected that ICT & Media Design and ICT & Business students need extra training while ICT & Infrastructure students will be challenged differently based on their input level.

Learning Outcomes

Learning outcomes describe visible functioning and contain the explanation and description of this semesters intended result of the learning process.

LO1 Ethical Hacker

You analyze the security of diverse IT environments, such as a business environment, a consumer product, or a technology, according to a common method of pen-testing.

- **Analyze the security:** A pen-test or penetration test is a vulnerability assessment or security analysis. In a security analysis all layers of an IT-environment can be analyzed: the physical environment, the network layer, the system layers, the application software layer, procedural/human layer.
- **Diverse IT environments:** A business environment can be analyzed by means of a pen-test or red teaming. Security of a consumer product or a technology can be referred to as vulnerability analysis, where having a formal client could be replaced by following a responsible disclosure model to be able to account for a responsible and ethical approach. Technology can be IT, IoT or OT (industrial).
- **Common method of pen-testing:** Each student must show for at least 2 different types of security analysis, one of which has an actual client to align with and deliver to. The process part of security testing is part of the learning goals: determining the type and scope a pen-test, confidentiality contract, pen-test plan, pen-test report, and the presentation and delivery of findings and advice to the client.

LO2 Risk Consultant

You analyze security threats and resulting business risks according to a common risk analysis method and advise a client on security improvements of an IT environment on a physical, technical and organizational level.

- **Security threats** come from threat actors such as cyber criminals, script kiddies, frauds and can be caused by user errors or calamities
- **Business risks** indicate the impact of the threat to the business continuity of a customer in the case the threat really happens

- **Common risk analysis method** has to be at least a qualitative method of risk analysis that groups the risk in categories low - medium – high
- **Advice on security improvements** to mitigate the threats and risks must be based on standards, best-practices, and security principles. Security controls based on the security incident cycle security controls can be preventive, detective, repressive or corrective. Security controls based on layers in an IT environment, can be physical, technical (on network, system, application and software level) or organizational (procedural, human, legal).

LO3 Security Engineer

You realize a secure IT infrastructure environment, considering functional requirements as well as the following non-functional requirements: security, monitoring, ethics, compliance, usability.

- **Realize:** Translate requirements into an infrastructure design and implement this design
- **Secure IT infrastructure environment**: IT components, interacting and communicating over a network, with connection to the internet
- **Functional & non-functional requirements**: Determine (analyze) the need of the client with respect to security, monitoring, ethics, compliance, usability

LO4 CSIRT Security Analyst

You realize procedural response for security incidents and analyze these in an efficient and methodical way.

- **Procedural response:** Incident response is a structured methodology for handling security incidents, breaches, and cyber threats. A well-defined incident response plan allows you to effectively identify, minimize the damage, and reduce the cost of a cyber-attack, while finding and fixing the cause to prevent future attacks.
- **Security incidents:** A computer security incident is a violation or imminent threat of violation of computer security policies, acceptable use policies, or standard security practices. Examples: DDOS attack, Ransomware attack, Phishing, Data breach, Malware infection, etc.
- **Analyze in an efficient and methodical way:** It should address the following response phases as defined by NIST: Preparation, Detection & Analysis, Containment Eradication & Discovery, Post-Incident Activity.

LO5 Security Professional

You demonstrate your professional development as a cyber security specialist in the form of authentic IT professional tasks in which both the process and the results are visible.

- **Professional development** as defined in the HBO-i domain model:
    - (FOO) Future-oriented organization: The organizational context of ICT assignments explores making corporate, sustainable and ethical considerations and managing all aspects of carrying out the assignment.
    - (IPB) Investigative problem solving: Critically consider ICT assignments from various perspectives, identify problems, finding an effective approach and coming up with appropriate solutions.
    - (PL) Personal Leadership being entrepreneurial in regard to the ICT assignments and personal development, while being aware of own learning capacity and keeping in mind what ambitions drive ICT professionals and/or which types of positions.
    - (TI) Targeted interaction Determine which partners play a role in the ICT assignment, constructively collaborate and fitting communication aimed at achieving the desired impact.
- **Authentic tasks** are tasks that an IT professional would do in everyday life

Introduction

IT Security is about protecting computer environments from security threats such as cyber criminals, hackers, malware, but also fraud. Network security aspects (like cryptography in communication and storage, intrusion detection, firewalls) are an important part of this protection, but also non-technical actions, controls and considerations such as risk analysis, user awareness, security organization, governance/compliance, privacy, security by design, business continuity management.

To determine if an IT-environment is secure enough, security tests can be performed. The environment is checked as if a real hacker would try to break in. This is called "Ethical Hacking". Also, an ethical hacker needs to have a lot of detailed knowledge of technologies that are common in ICT. These will include at least network technology, web technology and system technology. Just having the knowledge is not enough; the large diversity of systems makes it necessary for the student to be skillful enough to also apply this knowledge in practical situations.

Hacking is illegal, and therefore punishable by law. You are only allowed to apply hacking techniques to a client's environment if this client has given you formal permission to do so. Only in that case we're talking about "Ethical" Hacking, meaning ethically responsible hacking. To behave ethically, it is important to have some knowledge about law, legislation and responsible disclosure.

All above-mentioned technologies and knowledge areas will be part of this semesters project and learning activities.

Examination and grading

Examination

For Cyber Security we use an Integral assessment based on a development portfolio. This means the student maintains one semester portfolio in which the learning outcomes are demonstrated.

All learning outcomes can be demonstrated by evidence from the defined learning tasks. A formative assessment process is used where students are assessed throughout the semester on all their work by monitoring the progress on the Learning Outcomes. A student can ask for feedback if needed, and the goal is to request and provide feedback at least every two weeks. This way of assessing is also known as practice-based assessment.

Tools allowed

No restrictions

Resits and repairs

Since the Group and Individual projects have practice-based assessments, retakes are not applicable. During the semester, the progress will be continuously monitored so that you are always aware of your study achievements. This will allow you to repair and improve initial results when this is needed.

Grading

For the formative measurement moments during the semester the UOBPA scale is used for all learning outcomes. Following table explains this scale (levels of mastery):

Undefined	The portfolio does not (yet) show any progress towards the learning outcome, or the demonstration is not clear enough for the teachers. You can best start your step towards Orienting by researching and analyzing existing theories and works related with the project.
Orienting	You have set up exploratory actions to understand what the learning outcome is about. You looked for theories that might match your goals and you have tried to apply a few things at a basic level. This is a first step in preparation to start with your deliverables. The next step is in applying your knowledge by creating concrete deliverables.
Beginning	You produced and showed more complex work and made attempts to show that you master the learning outcome. You have created concrete deliverables mostly based on exploring or enhancing existing work such as tutorials. This is a good step towards Proficient. You now should focus on applying these skills on your own deliverables.
Proficient	You have convincingly demonstrated that you master the learning outcome by showing most elements as described in the Learning Outcome explanation. The teacher has confirmed this by giving positive feedback. Further improvements can be made mostly in

	enhancing the quality of your work and making sure you can substantiate your process and decisions in a clear and methodical way.
Advanced	You show that you master the Learning Outcome in multiple different situations and created new deliverables that includes or exceeds all elements as described in the Learning Outcome explanation. The teacher has confirmed this by giving positive feedback.

Table: UOBPA-scale explained

After each formative assessment, the level of mastery for all learning outcomes is assessed for both individual projects as well as group contributions. A student's growth is tracked in CANVAS. The student's growth on each performance indicator is registered per learning outcome according to one of the five levels of mastery.

To pass the semester, all learning outcomes should be at least at the level "proficient". By showing Body of Knowledge subjects only, at maximum the level "Beginning" can be reached for a certain Learning Outcome, so application of these subjects in the project or other professional context is required to reach the "Proficient" or "Advanced level.

In week 19 or 20, an assessors meeting will determine the total summative grade and convert the formative scale UOBPA Learning Outcomes to one USGO-scale grade as shown in below table:

Result	**Score**	**Criteria**
Passed	Outstanding (**O**)	Most learning outcomes at the mastery level "Advanced"
Passed	Good (**G**)	Multiple outcomes at the mastery level "Advanced". The other learning outcomes at the level "Proficient"
Passed	Satisfactory (**S**)	All learning outcomes at least at the mastery level "Proficient"
Failed	Unsatisfactory (**U**)	One or more learning outcomes at a mastery level lower than "Proficient"

Table: From UOBPA-scale to USGO grade

Learning activities

The learning activities and corresponding learning tasks help the student in showing the Learning Outcomes.

The project will function as the overall authentic task for the semester. In this project, students will be looking for vulnerabilities in ICT environments and try to detect them and protect the environment against attacks. To be able to execute the project, the student has to acquire and train basic knowledge and skills with regard to the needed techniques first. The student has to prove and show sufficient knowledge, and application of knowledge, for the basic knowledge subjects as mentioned in the section.

Learning Tasks have been defined to realize the project, and thus show the learning outcomes. The number of days per week to spend at the project learning task(s) will gradually increase during the semester from 1 day per week (weeks 1-5), via 2 days per week (weeks 6-12) to 3 days per week (weeks 13-18).

The learning tasks are:

1. Work out a project plan (FOO)(LO5):

- Interviewing client and stakeholders (experts, teachers, users).
- Describe and verify the interview outcomes. Evaluate your approach.
- Learn and investigate ethical norms and aspects, future proofness / durability
- Discuss and work out a talent-based task division.

2. Do a security assessment, also known as penetration test, or "pentest", of the ICT-environment at a real external company that has to be contracted by the project group itself. This can be a partner in Education, and eventually a FHICT or other Fontys client (e.g. a teacher or department). (LO1)

3. Perform a Risk Analysis for a customer or practical case (LO2)

4. Design, implement and test a secure product or environment where you defend a customer against Cyber Security Threats based on analyzing and elaborating the security requirements (LO3)

5. Evaluate and report about the incident response procedure for a customer (include testing this procedure and proposing improvements) and execute a table-top exercise (LO4)

6. Test, and report about, the actual security of your developed IT environment or solution (LO3,5)

7. Learn and train problem solving (IPB)(LO5):

- Define questions, analyze alternatives, describe and evaluate outcomes.
- Learn and select research strategies and methods for a research assignment.
- Learn and apply problem solving techniques in problem analysis and technical analysis

8. Develop your personal leadership (PL)(LO5):

- Define talents, learning wishes and learning planning.
- Be aware of, discuss with a coach, ask for feedback and evaluate your pro-active attitude in learning new knowledge and skills.
- Be aware of, discuss with a coach, ask for feedback and evaluate your professional attitude and personal presentation
- Plan learning activities and evaluating and reflecting on the learning outcomes.

9. Develop your interaction skills (TI)(LO5):

- Discuss a good approach to contact a client and other stakeholders.
- Plan meetings with e.g. client, stakeholders, project team, teachers, customers, experts.
- Learn and practice interviewing techniques
- Learn and practice presentation techniques
- Learn and practice writing skills in professional products (pen-test plan, pen-test report, project plan, research report, etc.)
- Learn and practice giving advice to client, group members, etc.
- Intercultural training: Being aware of and taking into account: personal and international and intercultural norms and values.

Resources

The Canvas course contains the relevant study materials and references to and ideas about where to look for materials. You are expected to also look for relevant educational materials on a number of topics yourself.

14.2. Information about BSc ICT & Cyber Security OE7

Entry requirements

Dit semester wordt in het voorjaar van 2022 ontwikkeld.

Learning Outcomes

Introduction

Examination and grading

Examination

Tools allowed

Resits and repairs

Grading

Learning activities

Resources

15. Information about Specialisation ICT & Smart Mobile (CA 2020)

15.1. Information about SM4 Smart Mobile semester 4

Entry requirements

Students arrive from different fields of study. This means that there are at least five different intake levels. Students have fully demonstrated at least level 1 of one architectural layer in their propaedeutic phase and are in the process of developing one of the architectural layer levels to level 2.

Students coming from Open Learning have varying profiles. However, also for the students applies that there is at least development on all activities on level 2, in at least one architectural layer. Some students of open learning may have worked in the context of mobile development.

Learning Outcomes

Problem definition / Concepting

*You show you can **convert** a problem or opportunity into multiple smart **mobile concepts** based on thorough **analysis**.*

Analysis: You use common research methods to analyse a problem, trends in the market and relevant stakeholder interests.

Convert: Generate ideas using ideation methods and crystallize them into appealing and engaging mobile challenges.

Mobile Concepts: A crystallized idea based on a problem description with a distinguishable research component.

Mobile User Experience / Interaction Design

*You **translate** concepts into **user friendly** designs and validate these **designs** through user tested iterations.*

Translate: Using design theory and methodology, you are capable of designing engaging solutions.

User friendly: The designs meets usability and UCD quality standards

Designs: Products that describe the problem, target audience, interaction narrative and user interface

Mobile Software

*You implement **high qualityapplications** using designs and **programming languages** on both (mobile) client and **server side**.*

High quality: You secure that your application meets functional and non-functional requirements, considering aspects such as security, privacy, code quality and maintainability by performing tests.

Applications: You implement Proof of Concepts and complex prototypes.

Programming languages: You advise and use both native programming languages (Kotlin and Swift) and hybrid languages/frameworks (like PWA or Flutter) based upon research and own experience

Server side: You implement or use a backend solution the mobile application can communicate with.

Mobile Hardware

*You employ **relevant** mobile **hardware**.*

Relevant: You enrich the mobile experience by collecting and using data

Hardware: Internal and or external sensors

Professional Skills

*You demonstrate your professional development as a mobile developer in the form of **authentic, professional** IT tasks in which both the process and the result are **visible**.*

Authentic and professional: In a context, resembling the actual industry, you show a professional attitude towards *future-oriented organisation*, *investigative problem solving*, *personal Leadership* and *targeted interaction*.

In general, students take charge of --their development, involve stakeholders and are able to organise their efforts in a structured manner.

Visible: You show your work in a portfolio

Introduction

Mobile App Development Trends 2021

There are various technologies that are set to impact the mobile app development industry in 2021, let's take a deep dive into some of the biggest trends.

In an epoch when the world is heading towards digitization, mobile apps are gaining incredible traction in all spheres of life and are becoming an indispensable part of the digital ecosystem. A huge investment in the mobile app development industry by a lot of tech giants has been witnessed in the past few years. Small businesses are also gradually realizing the importance of mobile apps and are incorporating them into business processes.

The mobile app development industry has been significantly impacted by the advent of advanced technologies — the Internet of Things, Chatbots, Artificial Intelligence, Machine Learning, Blockchain, Augmented and Virtual Reality, etc. These technologies have to continue taking the mobile app development by storm in 2020.

Let's discuss in detail how 2020 looks like for mobile app development.

Blockchain

Blockchain has disrupted and reformed the mobile app development and can be implemented in mobile apps for enhancing security, tracking, and quality controls. A lot of payment apps are already using this technology for ensuring secure and faster transactions. Blockchain will stay in craze in 2020 and ahead.

Looking to hire blockchain developer?

Internet of Things

Internet of Things is a vast network of interconnected digital, mechanical, and computing devices that enable the exchange and transfer of data and information. The use of IoT in mobile apps helps remotely control smart gadgets via Smartphone's. Moreover, mobile apps powered by IoT enable to connect bands, wristwatches, and other wearable to Smartphone.

Augmented Reality vs. Virtual Reality

After the release of ARKit by Apple and ARCore by Google, iOS and Android app development have gained immense momentum. The stipulate for VR and AR applications is picking up pace in every industry — be it retail, healthcare, education, travel, etc. Mobile apps utilizing these technologies are creating amazing experiences for mobile users and helping businesses increase sales.

Artificial Intelligence and Chatbots

Artificial Intelligence (AI) and Machine Learning have changed the entire face of mobile app development and is expected to take it to a new level in 2020. The integration of AI with mobile apps not only saves a lot of money for businesses but also improves user engagement.

AI-powered chatbots have changed the way businesses interact with customers via mobile phones. Mobile apps with services like cab services, food delivery, and online shopping are integrating chatbots to respond to customers' query quickly.

Cloud-based Mobile Apps

Cloud technology helps organizations store a massive amount of data. This technology, when integrated with mobile apps, enhances the storage capabilities of the applications and increases productivity and collaboration. Further, most of the mobile applications with bigger databases use the Amazon Web Service (AWS) as their cloud computing backup. This trend will boom in the upcoming years.

M-Commerce

With more and more people converging towards mobile purchasing, the future of m-commerce looks promising. Apple Pay and Google Wallet have encouraged customers to shop via smartphones instead of their debit or credit cards. Retail & ecommerce businesses nowadays wish apps that let their customers shop easily and make transactions without cash or physical cards.

Cross-Platform Mobile App Development

Cross-platform mobile app development means the development of applications that can be run on multiple mobile platforms. It reduces time-to-market and growth cost of the organizations and drives their business in the realm of tough competition. This movement will go mainstream in 2020 and years ahead.

Low Code Development

Low code developments get rid of the need for a large amount of manual coding, thus reducing the complexity of development. Low-code platforms also allow you scale your applications as your business grows. Out Systems, Appian, Google App Builder, Kissflow, Zoho Creator, etc. are some of the low-code app development tools that will grow much popularity in 2020.

5G Wireless Technology

5G wireless service is not just one of the top technology trends in mobile app development but also highly significant in the forthcoming 2020.

Without doubt, the 5G network's speed will be 100 times faster than the 4G network. The industry professionals expect a transition from presently used 4G services to the 5G wireless network by the end of 2020.

Apart from the high speed, the 5G wireless services also serve other functionalities like:

- 3D Gaming
- Augmented Reality
- Data Security

Since the 5G services offer a wide range of opportunities, the mobile app developers should design the apps appropriately, so that all users can enjoy faster network speed for enhanced performance.

(https://medium.com/@sathik/top-10-mobile-app-development-trends-2020-d36966069133)

In the SM semester Introduction in Mobile development you will work on a wide variety of developing techniques to make (native) apps for mobile platforms. You will work on both the concept, design and the interaction design, as well as a native prototype demonstrator of your app.

The idea is to apply the basic knowledge you acquired by independently creating a design based on your own idea, to turn it into a testable prototype with a (natively or web-based) programmed proof-of-concept with a minimal set of requirements.

A new development, following demands and suggestions from the Mobile Development community, allows for either broadening and/or deepening of technical and design skills among students towards becoming a T-shaped professional. We therefore offer workshops and assignments based upon a students' choice. The platform for which we develop is chosen based upon a students' own preference and on the requirements of the prototype, however it is mandatory to show technical skills on both the Android and iOS platforms on at least a basic level, as well as progressive web technologies. This level should be demonstrated through a (natively) programmed app running on a mobile device, accompanied by a design portfolio. The student should involve the teachers in the learning process via weekly talks and 4 formative portfolio assessments. The feedback and conclusions are noted and curated by the student and added to their portfolio to reflect on.

For the Industry Project you will work on an app for an external commissioning party, preferably one of our PIEs (dCentralize, Peercode etc), together with other students. Initially it is essential that you know how to come up with a strong concept within the framework/themes of the clients and that you convince this client of its feasibility. Of course the idea is to come up with an app as impressive as possible. First of all this means you make optimal use of everything a mobile device has to offer, such as GPS, Camera, web services, compass etc. Additionally, don't forget to think outside 'the App'. The concept may be grand in its setup, with an App as the proof of concept. The knowledge and skills acquired in the workshops should be clearly applied in the prof assignment. There is a research element taking place simultaneously with the prof assignment. Students will carry out research for the prof assignment in duos.

There will be a focus on either:

- descriptive ethics and target group analysis, or,
- a proof of concept of an innovative feature that contributes to the group project.

Changes since fall 2021:

The design of a new Semester 4 is driven by the introduction of a new curriculum architecture. The main changes in the new architecture are:

- Study load is now 30 EC
- semester 3 and 4 of the specialization route are merged in semester 4 (full week education)
- introduction of a hybrid variant of three learning forms – demand based, course based and open learning.
- The explicit introduction of an additional architectural layer (Infrastructure)
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More collaboration between students and student groups to intensify the communication, involvement and learning abilities among students

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More common goals (in the form of projects) to facilitate the former point

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Some more focus on either demand based or course based style of coaching, in consultation with the assigned semester coach

Examination and grading

Examination

- The development of the students is assessed continuously throughout the semester and in a holistic way. There are no predefined tests taken in predefined moments. The teachers observe student development and facilitates that by giving feedback, feedforward and feed-up on the learning process of the student. The student collects this information, and it is part of the "evidences" for his/her achievements. Feedback given by teachers will be entered by the students in Canvas (FeedPulse).
- Peer-reviews between students will be used in group projects and will be entered in the Canvas LMS using the FeedPulse peer review functionality. The reviews must part of the portfolio.
- Products like documents are being handed in by students in Canvas and will be graded by teachers. Students may refer (link) to this grades/Canvas feedback from within their portfolio.
- Code will be in git and will be feedbacked and graded (formative) by teachers.
- Portfolio-based assessment. The evidences collected by the student together with all software & design products, software & design documents, research reports, designs, test reports, minutes of meetings, management tools, and evidences for activities form the student portfolio. They need to be grouped together in a single, accessible, well maintained portfolio.
- End grade: USGO. The formative indication USGO will be prepared by teachers in Canvas. This formative grade will be determined by two teachers. The input for this grade is the portfolio of the student, code and commit behaviour in git, FeedPulse and an end-talk between the student and the two teachers. At the end of the semester a summative grading will be made by the teachers meeting (all teachers) based on the portfolio, end-talk outcome, code and commit behaviour in git and feedback in FeedPulse.

Tools allowed

Laptop, web cam, network, means of presentation, additional hard- and software.

Resits and repairs

The assessments are formative, which means that students can present their work for feedback throughout the semester to validate the quality of the work. Learning Outcomes for which the student has shown no or insufficient growth can be re-assessed at the set formative assessments during the semester to show growth on that learning outcome.

The last formal assessment will take place in week 18. This is the last possibility to provide evidence for sufficient growth on a Learning Outcome. There will be no retakes.

Grading

All performance indicators at advanced mastery automatically means that a student passed the semester at the level of "Outstanding". The final verdict "Satisfactory", "Good" or "Outstanding" will be determined in the assessors meeting during week 19.

In **weeks 5, 9, 13 and 18**, the learning outcomes will be individually assessed based upon the following development-oriented scale: *Undefined/Orienting/Beginning/Proficient/Advanced*.

All learning outcomes should be at least at the level 'Proficient', not doing so will result in a final grade of 'Unsatisfactory'

Learning activities

There are three "learning streams":

Workshops: a series of optional, interactive sessions are offered on topics that students need to complete the learning outcomes. Students can practice with a number of relevant techniques like programming, UX, IXD. Students work here individually or in smaller groups.

Create a "duo-app": work together with a student to create an app. All learning outcomes are touched during this work. This phase is completed in three tiers, for each of the offered technologies and design philosophies.

The Project: a group project for groups of 4-6 students with a client. The project is performed 'agile' i.e. in sprints. The subject of this professional task will be offered by a Partner in Education (PiE). In this professional assignment, a PiE can be the client or perform the role of expert and/or consultant. All learning outcomes are touched during this work too, only the context is different than with the "duo-app".

Resources

We offer a range of workshop materials, readings, pre-defines personas, cases, links to tutorials and accompanying assignments. All material is made accessible through the Canvas course.

16. Information about Specialization ICT & Smart Industry (CA2020)

16.1. Information about SI4-RB Introduction to Smart Industry

Entry requirements

The entry requirement for this specialisation is a successfully completed propaedeutic year.

Learning Outcomes

During the semester students should demonstrate proficiency in the following learning outcomes.

Learning outcome 1 - Analysis

You analyze problems, processes and/or challenges of an (existing) Industry 4.0 or Cyber Physical System or part thereof. You advise stakeholders on improvements, possible solutions and extensions based on information from analyzed data from said system.

Clarification You perform an analysis on a problem, process and/or system in which you conduct a research within the domain and come up with solutions that are presented to the stakeholders in an advisory report. You use techniques, like internet of things, cloud, process design, process improvement, data analysis, transformation data into information. You consider quality aspects like

usability, safety, security, robustness, testability, extendibility and maintainability aspects within your solution are met.

Learning outcome 2 – Design and implement

You design and implement improvements, possible solutions and extensions based on the given advice.

Clarification You design and implement a number of agreed solutions. These solutions consist of a mixture of software, infrastructure and/or embedded components. It enables production, distribution, processing and visualization of (real-time) data that serve further optimization of the system. You design and/or enhance user system interaction in an iterative way that explores the technology potential and human factors. You show that quality aspects, like usability, safety, security, robustness, testability, extendibility and maintainability are met.

Learning outcome 3 – Future orientation

You assess the context of outcomes of smart industries from multiple perspectives in order to pursue this project in a sustainable manner.

Clarification Assessing the context means the organizational and societal environment in which the project takes place. You show that you can identify the hallmarks and roles of the environment of the assignment and have a keen eye for a future-oriented, sustainable embedding of your work in an organization and society. Multiple perspectives include social and ethical considerations, law compliance, organizational data maturity, alignment with sustainable development goals, recognizing own boundaries and those of others and acting accordingly. Reflecting on ethics and governance of smart systems will be an important and integral part of your learning process.

Learning outcome 4 – Investigative problem solving

You consider a smart industry project from various perspectives, identifying problems, finding an effective and balanced approach coming up with appropriate solutions.

Clarification Identifying the problem means you can formulate a clear research question with an appropriate hypothesis in order to determine the extent to which the solution will solve that problem. An effective and balanced approach means you compose and pursue applied research methods (such as the DOT framework), based on reliable and verifiable sources. You methodically and creatively find answers to applied research questions, considering alternatives and critically analyzing your own and others' line of reasoning.

Learning outcome 5 – Personal leadership

You show an entrepreneurial mindset regarding the smart industry project and your personal development. You are aware of your own learning capacity. You keep your own professional ambitions within this field in the mind.

Clarification Entrepreneurial mindset includes being aware of opportunities, seeing and seizing them. You motivate and profile yourself, your team and others. Learning capacity means guiding your own development and study progress, showing leadership and taking responsibility, enhancing your own learning capacity, demanding and giving active feedback, all with respect to the learning outcomes. Professional ambitions mean you examine what type of professional you want to be in the long term, which field and type of position you aspire to and how to excel in this field.

Learning outcome 6 – Targeted interaction

You address your audience using appropriate communication. You consider your own role, your audience and the medium to convey your message.

Clarification Appropriate communication means reporting and/or presenting the approach, deliverables of a smart industry project in a methodologically sound way. You reflect on the effect of your communication. You plan ahead. You discuss achieved results.

Introduction

This is a semester guide is for the Specialization Smart Industry SI4. In this document you find a short introduction of the domain of Smart Industry, you will read about the content of the Smart Industry specialization, learning activities and assessment.

The domain of "Smart Industry" (also known as Industry 4.0) is booming. It is the further automation of the traditional manufacturing and process industry in which the most modern technologies, such as large-scale machine-to-machine communication, the Internet of Things (IoT), cloud computing, cognitive computing, and artificial intelligence are being integrated. These new technologies allow for further automation, better communication, increasing autonomy (self-monitoring) and production of smart machines that can analyze and diagnose without human intervention.

The fourth industrial revolution is about the “smart factory”, with a modular structure in which cyber physical systems (CPS) monitor physical processes, make a virtual copy of the physical world and make decentralized decisions based on the collected and analysed data. Through the Internet of Things (IoT), “cyber physical systems” communicate and cooperate with each other and with people in synchronous timing, both internally and across organizational services offered and used by the participants in the “value chain”.

The industry and business community currently have a very large and growing demand for professionals who not only understand the context, but also know what is needed in the 4th industrial revolution and can translate this into smart solutions in which all these technologies are applied. However, the domain is so large that professionals within this domain must not only be able to operate as a generalist, but also must be able to specialize. This means that they not only have a general overview of the domain and its possibilities, but also have a focus and expertise in a specific sub-area. This duality of their role is necessary because the projects and systems are multidisciplinary and so these professionals need to thrive within multidisciplinary programs and projects, have strong research skills and are able to come up with smart solutions for problems which are not not completely known or clearly formulated.

The central part of this semester is an industry project in which you research the problem domain methodologically, research and apply knowledge, weigh alternate solutions, perform analysis, formulate advice as well as design, realize and showcase the results for the project. External partners will provide input, may define the project, can act as a product owner and advice during the evaluations for the authentic project and their solutions.

The learning content of semester 4 ICT 4 & Smart Industry is roughly divided into the following parts:

· Intelligent management and digitalization - how to monitor all of your assets, enable value chain analytics, and can optimize production processes and life using the collected data from

· (Realtime) Data analysis and prediction – how to collected data from different parts of an Industry 4.0 system, how to prepare them, analyse and finally use for improving efficiency of the industrial system.

· IoT communication and infrastructure – how autonomous cyber-physical systems are connected to each other with various (IoT) protocols and how the collected data are to be stored in a cloud storage.

· Human machine Interaction and control - how does humans relate to a smart production process. Dashboards, Web content, presentation of data and progress, UI impact, Mobile monitoring and presentation.

- Machine-to-machine interaction and Industrial automation - how to programming automation control, and how machines communicate with each other via data buses

The above topics are offered in the first 4 weeks and as on-demand workshops during the semester to support the realization of the project. Practice (specialization) challenges are part of these workshops.

On behalf of all teachers in Smart Industry Semester 4, we wish you good luck and a lot of fun!

Block Performance

This semester follows the research-based learning model. In this model you choose your means towards given goals. You are expected to take a research driven approach i.e. to be able to find a solution to the challenge or the industry project you will need to use a methodolically approach. You will find that in some area's you will need additional explanation or find realiable (open) resources or follow a workshop to gain the knowledge that is needed. You will be guided by a team of coaches (teachers) that are experts in their fields.

Semester Coach

Your semester coach will coach you both individually and in your project. In this role the semester coach is in part responsible for assessing you professional skills. Do note that you will be assessed by all the teachers in this semester on both your professional skills and your mastery of the subjects within this semester.

Contact Person

If you have an issue, please contect one of the following people:

- Subject related issues: the expert for that subject
- Personal of project related issues: your semester coach
- Semester related issues: the block owner (project lead of this educational unit)
- Curriculum related issues: the programme manager (curriculum owner)

Workplace

Your workplace is an OIL that is available for you for 2,5 days per week, how these 2,5 days are scheduled can be seen in your time schedule. Please note that this will likely change due to COVID-19 measures.

It is explicitly forbidden to bring electronic equipment such as a kettle, toaster, coffee maker, etc. into a workplace. Security will remove said equipment without consultation and throw it away.

Each project group can get a project vault (TI-vaults) in which you can store your project stuff. You can borrow a key from the ISSD.

Examination board

Official publications from the examination board that are relevant for your study and study progress can be found on the FHICT portal. E.g. information about the OER (Onderwijs- en ExamenRegelingen), fraud policy and examination rules can be found there.

In the fraud policy you will find: "Fraud is defined as any act (including the commission of plagiarism), or omission, of which the person concerned knew or should have known, that this action and/or omission makes it impossible in whole or in part to form an opinion about someone's knowledge, insight, skills, competencies, (professional) attitude, reflection, etc., in the correct manner."

More information can be found on the examination board page: https://portal.fhict.nl/Studentenplein/Documenten%20rondom%20studievoortgang/Home.aspx.

Industry project team

An industry project is preferrably executed in a team of 4-6 people. Your presence on scheduled project hours is compulsory, please notify your semester coach and team if you have a valid reason not to be there.

Examination and grading

Examination

Assessment exists out of 3 diagnostic evaluations with a formative nature, in which the assessors (all involved teachers) assess the level of mastery for all learning outcomes by looking at the performances and personal development of the student in different contexts (challeges and project). The assessors also provide feedback, feedforward and feed-up. A student's growth and feedback is registered in Canvas and is registered according to one of the five levels of the UOBPA scale: Undefined, Orienting, Beginning, Proficient, Advanced.

Tools allowed

All material offered and suggested in Canvas course may be used during the assessment. You are also free to use other sources, tools and software, as long as you can support your choices of methods and their applications.

Resits and repairs

If, during any assessment before the final evaluation, the student was unable to demonstrate proficiency in all learning outcomes, the remaining time of the semester up until the final evaluation can be used to make improvements. Due to the formative and integral nature of the assessment and feedback, there is no such thing as a formal retake. If the final grade of Unsatisfactory is given, the semester is considered failed.

Grading

At the end of the semester, after the final evaluation, the teachers team translates the assessment results along the semester into one final grade for the semester.This is done at the assessors meeting. The final grade is a letter out of the set U, S, G, O meaning Unsatisfactory, Satisfactory, Good, Outstanding, where Satisfactory defines the minimum in order to successfully pass the semester. The decision of final mark is according to the description below, however in motivated circumstances the assessors may decide differently.

- ‘Outstanding’ if 3 or more learning outcomes (out of 6) are at the level "Advanced” and all the other learning outcomes are marked Proficient;
- ‘Good’ or ‘Satisfactory’ if 3 or less (out of 6) learning outcomes are marked at the level Advanced and all the other learning outcomes are marked as Proficient;
- ‘Unsatisfactory’. if one or more learning outcomes at the level lower than "Proficient"

Learning activities

Both DB (Demand Based) and CB (Course Based) students participate in a specialization semester where CB and DB will be combined into a mixed learning style that is both project based and task-based. This means that authentic questions, challenges or problems from professional practice are the basis for all learning activities and learning tasks will be defined to facilitate learning in smaller steps.

In SI4 the following semester structure is used. The semester comprises 18 substantive weeks and in week 19 the final assessment is determined at the assessors' meeting.

The 18 weeks are divided into an Orientation phase and a Specialization phase. The orientation phase is from week 1 till week 4. During these weeks the student is working on the Orientation challenges. These challenges are intended to immerse the students in the Smart Industry domain so that the basic understanding of this domain is more or less the same for all students. In week 4 the student chooses at least 2 modules from the 5 modules that are offered (as described earlier) in which he/she wants to specialize during the Specialization phase

The Specialization phase starts in week 5. In this phase a project is introduced by a 'partner in education'. The work on the project is done in multidisciplinary project groups. The student contributes to the project withing the modules he/she has chosen. While working on the project, there is a decreasing form of individual support through: specialization challenges.

These challenges help the student to learn methods and techniques with which he/she has little experience and which are relevant and applicable in the project. This can stand alone, but it can also be a part of the project. The project is an authentic research assignment provided by a PiE.

Coaching and guidance gradually change from teacher-driven to a more student-driven approach during the semester and is offered whenever needed and relevant. Learning content is offered when required or requested in a form of instructions, workshops, or 1-to-1 feedback session. In this way, differentiation in style, speed and level is possible. It is expected that students prepared themselves for a session with teachers or experts by studying the provided study material. During the session focus will be on clarifying the details of the theory and on applying the knowledge in a relevant context.

Partners in Education

In this specialization, Partners in Education fulfil mainly the customer or client role. In addition they will provide their expertise in a form of workshop. Within the region we have a number of PiE that are using on the Smart Industry and related technologies, as for instance Actemium, Bosch Rexroth, etc.

Resources

A Canvas course including modules with (self) study materials, inspiration sessions and external sources is available.