HAMK
Hämeen ammatti-
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NEW INNOVATIONS THROUGH DESIGN-BASED EDUCATION

A CASE STUDY FOR HAMK DESIGN FACTORY

Bachelor's thesis

Mechanical engineering

Spring, 2024

Milla Räty

HAMK
Hämeen ammatti-
korkeakoulu

Konetekniikan koulutusohjelma **Tiivistelmä**
Tekijä **Milla Räty** **Vuosi 2024**
Työn nimi **New innovations through design-based education – A case study for HAMK Design Factory**
Ohjaaja Sanna-Maaria Siintoharju, HAMK Design Factory

Euroopan työmarkkinoiden ja samalla myös eurooppalaisten korkeakoulujen kasvava osaamisvaje korostaa, että tarvitaan kipeästi innovatiivisia lähestymistapoja akateemisen oppimisen ja tosielämän vaatimusten välisen epäsuhdan korjaamiseksi. Perinteiset koulutusmallit eivät useinkaan riitä antamaan opiskelijoille nykypäivän toimialoilla vaadittavia käytännön taitoja. Vastauksena tähän haasteeseen suunnittelupohjainen koulutus (DBE) on lupaava ratkaisu. Kokemukselliseen ja yhteistoiminnalliseen oppimiseen perustuva muotoilupohjainen koulutus ylittää perinteiset opetusmenetelmät ja edistää luovuutta, ongelmanratkaisua ja mukautumiskykyä.

Tässä opinnäytetyössä tarkastellaan muotoilupohjaisen koulutuksen keskeistä roolia eurooppalaisen korkeakoulutuksen osaamisvajeen lieventämisessä. Tarkastelemalla sen periaatteita, toteutusta ja tuloksia, tämä tutkimus pyrkii antamaan arvokasta tietoa käynnissä olevaan keskusteluun koulutuksen nykyaikaistamisesta ja opiskelijoiden valmentamisesta työelämän dynaamisiin vaatimuksiin.

Opinnäytetyötä varten tehtiin tapaustutkimus HAMKin Design Factorylle, jolla pyrittiin selvittämään millaisia taitoja opiskelijat pitävät tärkeinä tulevaisuuden kannalta ja millainen rooli korkeakouluilla on näiden taitojen opettamisessa. Haastatellut opiskelijat osallistuivat HAMK DF:n ja inno.space Mannheimin yhteistyöprojektiin nimeltä iPdP. Tapaustutkimus toteutettiin osallistuvien opiskelijoiden yksilöhaastatteluina. Kysymykset jaettiin kahteen osaan sijoittuen kurssin alkuun ja loppuun. Kysymysten teemat käsittelivät sekä opiskelijoiden odotuksia kurssista että heidän näkökulmaansa tulevaisuuden taidoista ja korkeakoulujen roolista näiden opettamisessa.

Avainsanat **korkeakoulutus, muotoilulähtöinen koulutus, tulevaisuuden taidot, HAMK Design Factory**
Sivut **31 sivua ja liitteitä 1 sivu**

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Mechanicak engineering **Abstract**
Author **Milla Räty** **Year 2024**
Subject **New innovations through design-based education – a case study for HAMK Design Factory**
Supervisors Sanna-Maaria Siintoharju, HAMK Design Factory

The escalating skills gap within European labor market and thus far within European higher education institutions underscores a critical need for innovative approaches to address the disparity between academic learning and real-world demands. Traditional educational paradigms often fall short in equipping students with the practical skills required by contemporary industries. In response to this challenge, design-based education emerges as a promising solution. Rooted in experiential and collaborative learning, design-based education transcends conventional methods, fostering creativity, problem-solving, and adaptability.

This thesis delves into the pivotal role of design-based education in mitigating the skills gap in European higher education. By exploring its principles, implementation, and outcomes, this research aims to contribute valuable insights to the ongoing discourse on modernizing education and preparing students for the dynamic demands of the professional landscape.

At the same time, the research that was done for the thesis sought to find out what kind of skills students consider important for the future and what kind of role HEIs play in teaching these skills. The research was carried out as a case study for the HAMK Design Factory. The students interviewed took part in the cooperation project of HAMK DF and inno.space Mannheim called International Product Development Project. The case study was conducted as individual interviews for the participating students. The questions were divided into two parts - at the beginning and at the end of the course. The themes of the questions revolved around both the students' expectations of the course and their future skills.

Keywords **higher education, design-based education, future skills, HAMK Design Factory**
Pages **31 pages and appendices 1 page**

Acknowledgements

I would like to thank HAMK Design Factory and inno.space Mannheim for allowing me to conduct the interviews and follow the course. Of course, a huge thank you to all the interviewed students, this research would not been possible without their participation.

The following people from HAMK Design Factory have allowed me to innovate, have motivated me and for that I extend my deepest gratitude to:

Jari Jussila, Director of HAMK Design Factory – for taking a leap of faith with me by giving me a chance to conduct this research and write my thesis.

Sanna-Maaria Siintoharju, Head of Valkeakoski Design Factory at HAMK – for agreeing to be my thesis instructor and making me think outside the box.

Jali Närhi, Project coordinator at HAMK Design Factory – for suggesting I could write my thesis for HAMK DF, without you this wouldn't have happened. And all the interesting discussions during the first iPdP I was a part of – it truly made a difference.

Markku Mikkonen, Technical expert at HAMK Design Factory – for allowing me to help and observe the iPdP students during their stay in Finland before the final gala. I am extremely grateful for your empathy, willingness to spar things around and your support when needed.

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1 Introduction

STEM students usually focus more on theoretical skills in both their studies and work. STEM is an acronym that stands for Science, Technology, Engineering, and Mathematics. It represents a broad range of academic disciplines and professional fields that are interconnected and rely on the principles of these core subjects. Here is a brief overview of each field within STEM:

- Science encompasses various branches such as biology, chemistry, physics, astronomy, geology, and environmental science. Scientists conduct research, perform experiments, and analyse data to expand our knowledge and understanding of the natural world.
- Technology refers to the practical application of scientific knowledge for various purposes. This includes computer science, information technology, software engineering, telecommunications, electronics, and robotics. Technologists develop and utilize tools, devices, and systems to solve problems and improve efficiency.
- Engineering involves the application of scientific and mathematical principles to design, develop, and construct structures, machines, systems, and processes. There are many branches of engineering, including civil, mechanical, electrical, chemical, aerospace, biomedical, and environmental engineering. Engineers work on projects ranging from infrastructure and transportation to electronics and medical devices.
- Mathematics is a fundamental discipline that deals with the study of numbers, quantities, shapes, structures, and patterns. It has diverse branches such as algebra, geometry, calculus, statistics, and theoretical mathematics. Mathematicians analyse and develop mathematical models and theories that are applied in various scientific and technological fields. (Van Tuijl & van der Molen, 2016; Griffith, 2010)

Within these fields, there are numerous career opportunities and areas of specialization. STEM professionals play a vital role in driving innovation, solving complex problems, and contributing to advancements in various industries such as healthcare, energy, telecommunications, transportation, aerospace, and more. To be able to succeed in the future, one must know how to think outside of the box, innovate. That is something that design thinking helps with. In the evolving World it is important to stay on top of the game and find alternative paths to help to achieve things. (Van Tuijl & van der Molen, 2016; Griffith, 2010)

Regarding the European Commission, year 2023 is the Year of Skills and there is a lot of talk about the skills gap happening already. It is more and more important to find these courses that give students the extra push. And design thinking does exactly that, it gives the extra push towards creativity and innovative thinking. The surrounding world is everchanging and that might cause a turmoil within the students. This type of projects with real life companies as a sponsor prepare them for the real world. These projects also give the students the possibility to fail in a safe environment, and that is important.

This thesis is set out to determine whether this type of studying has a positive impact on one's studies regardless of their study field. It also helps to see if international product development project and similar courses can reduce the skills gap. The thesis is done as a case study for HAMK Design Factory about an international product development project in 2023. All the material from the students were collected through a set of interviews and those answers were joined together with the theoretical frameworks.

1.1 The objective of the thesis

The objective of this thesis is to find out how courses like international product development project (iPdP) can help students upgrade their skills that are needed later in job market and in life. It also sets out to determine whether the design-based education that for example HAMK has taken into practise as an educational method lately, is able to give the necessary start in students' future careers. Design thinking as a topic and learning tool fits right into its description.

Also, when the students were asked about the future skills they think are needed, can this thesis be used in designing future courses for degree programs.

The interviews are conducted in two parts, the first part in the early stages of the course and the second part close to the end. The reason behind this is to compare the answers and see the development in the students' mind. There are currently three design factories in Finland, HAMK being one of them. As HAMK has seven campuses on seven different locations, it is crucial to spread the word about design thinking and Design Factory's opportunities to students on all campuses. To get more students involved in these projects one must gain some visibility on the campuses and among the students.

International product development project is not the only course that HAMK Design Factory has to offer. HAMK DF has offered different courses surrounding design thinking to HAMK's

students since 2020. The one thing all these courses have in common with each other are the highly motivated students that wish to have some multidisciplinary experience within innovative surroundings.

1.2 HAMK Design Factory

This thesis is written for and in close contact with HAMK's Design Factory. HAMK Design Factory (Häme University of Applied Sciences Design Factory) is an innovation and co-creation platform located in Hämeenlinna, Finland. Other HAMK locations have their own Design Factories as well, but the main office is in Hämeenlinna. HAMK Design Factory is a part of Design Factory Global Network (DFGN), which includes 37 innovation hubs around the world from five different continents. Design Factory is a concept developed by Aalto University that has spread all over the world and HAMK Design Factory is Finland's second Design Factory. Aalto DF used to be a research project that was focusing on creating the most perfect environment for researchers and product developers. (Aalto DF, n.d.) HAMK DF was founded in 2019. The purpose of the community is to create change in teaching and research through a culture based on passion and effective problem-solving methods and to create a community between Design Factories (HAMK, n.d -a.; HAMK, n.d. -b.; Mikkonen, 2021; Jussila et al., 2022).

HAMK Design Factory serves as a multidisciplinary hub where students, researchers, and industry professionals collaborate on various projects, fostering entrepreneurship and innovative thinking. The facility provides a physical space equipped with tools, materials, and technology necessary for design and prototyping. (DFGN, n.d.)

The Design Factory concept promotes a hands-on and user-centric approach to problem-solving, encouraging participants to work in interdisciplinary teams to tackle real-world challenges. It aims to bridge the gap between academia and industry by promoting collaboration and knowledge sharing. (DFGN, n.d.)

Within HAMK Design Factory, participants engage in design thinking methodologies, rapid prototyping, and user testing to develop innovative solutions. The environment encourages creativity, experimentation, and risk-taking, fostering an entrepreneurial mindset among participants. (DFGN, n.d.)

HAMK Design Factory also offers a range of programs and services, including workshops, courses, and events related to design, entrepreneurship, and innovation. These initiatives provide opportunities for networking, learning, and gaining practical experience. (DFGN, n.d.)

Overall, HAMK Design Factory is a vibrant and collaborative space that promotes innovation, creativity, and entrepreneurship, providing a platform for individuals to develop their ideas and bring them to life in a supportive and dynamic environment. (DFGN, n.d.)

Within the Design Factory Global Network an international Design Factory Week is organized every year. The event brings together Design Factories from all over the world to come up with ideas, share ideas, solve challenges, and create community. Each year, a different DFGN community member university acts as the organizer, which organizes the practical arrangements of the event and acts as the host of the week. (DFGN, n.d.)

2 Theoretical framework

Higher education institutions (HEIs) have several responsibilities towards their students, faculty, and society. Among those are the challenge and responsibility to educate good professionals (Collado ym, 2022). Even though the primary responsibility of higher education institutions is to provide quality education and ensure that students receive a rigorous and comprehensive academic experience, it has been recognized in European Union that education and training programmes need to be increasingly dynamic and develop innovative ways to incorporate new capabilities and skills. All this is to meet the ever evolving and ever-growing labour market needs (Renda et al., 2023).

HEIs also play a crucial role in advancing knowledge and driving innovation. They have a responsibility to conduct research, promote scholarly activities, and foster a culture of intellectual curiosity. By engaging in research, higher education institutions contribute to the creation of new knowledge, technological advancements, and societal progress, as well as support the holistic development of their students. This includes providing guidance and counselling services, promoting student well-being, and fostering a supportive and inclusive learning environment. Institutions should also offer opportunities for extracurricular activities, leadership development, and career services to help students transition successfully into the workforce (Arbo & Benneworth, 2007; Piterou & Birch, 2016).

On top of this HEIs should be committed to ongoing self-assessment and improvement. They should regularly evaluate their programs, teaching methods, and institutional practices to

ensure that they are meeting the evolving needs of students and society. This includes gathering feedback from students, faculty, and stakeholders, and using that feedback to inform decision-making and drive positive change. Yet, there are very few studies (Collado et al., 2022; Figueiredo et al., 2022; Lahdenperä et al., 2023) that directly address students' skill development in interdisciplinary product development projects for companies.

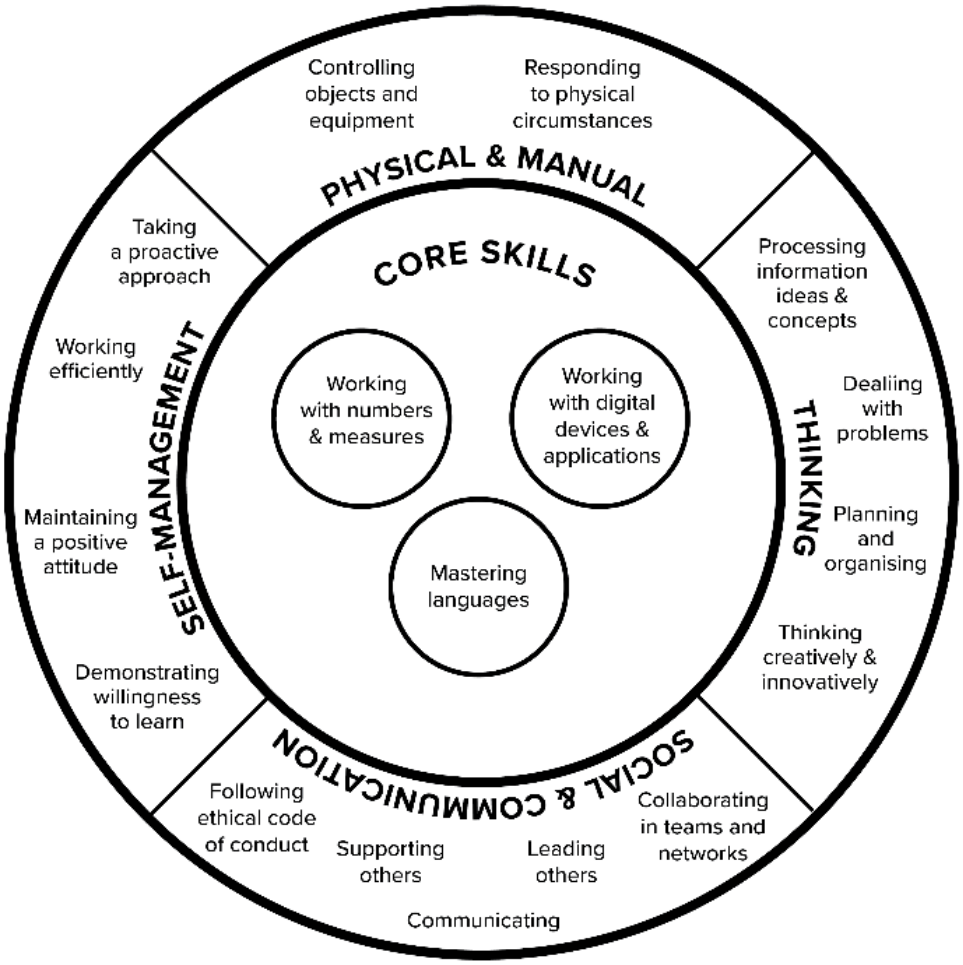
Overall, higher education institutions have a multifaceted responsibility that encompasses providing quality education, fostering research and innovation, supporting student development, promoting ethical conduct, advancing accessibility and equity, engaging with the community, and striving for continuous improvement. By fulfilling these responsibilities, institutions can contribute to the intellectual, social, and economic development of individuals and society at large (Halvorsen & Nyhagen, 2011; Eskola, 2017).

A well-known framework for identifying essential skills is the 21st Century Skills. These skills are considered crucial for young people or students to balance and succeed in their academic and professional lives. The core of these skills is divided into three categories:

1. Learning and Innovation Skills: These skills focus on areas such as critical thinking and creativity.
2. Life and Career Skills: These skills encompass leadership and social skills.
3. Literacy Skills: These skills include information or media literacy.
   (Rotterham & Willingham, 2010; Gonzáles-Peréz & Ramírez-Montoya, 2022; Fandino, 2013).

The Learning and Innovation Skills category encompasses several skills, including critical thinking, creativity, communication, and collaboration. These skills are often referred to as the 4C's. A similar framework is the Transversal Skills and Competences Model prepared by the ESCO Expert Group. This model visualizes the transition from internal to external, from core skills and competences that define individuals to skills embedded in a broader social context as illustrated in Figure 1 (Hart et al., 2021).

Figure 1 - Transversal skills and competences (modified from Hart et al., 2021).



When comparing the 4C's model with the Transversal Skills and Competences Model, it can be observed that communication and collaboration are represented in the latter by social and communication skills, while creativity and critical thinking are represented by thinking skills. Additionally, the model includes self-management and physical and manual skills. (Fisher & Newton, 2014; Tynjälä, 1999).

It has been found that the development of critical thinking, collaboration, communication, and other soft skills is challenging to achieve in traditional teacher-centred learning environments. (Fisher & Newton, 2014; Tynjälä, 1999).

Skills such as critical thinking, collaboration, communication, and other soft skills cannot be acquired solely by reading textbooks or listening to lectures. These skills require practical experience and hands-on learning (Tynjälä, 2008). According to Tynjälä (1999), one of the most significant challenges in university pedagogy is developing teaching methods that

integrate formal, theoretical knowledge with informal, practical knowledge. This integration is essential for the development of meta-cognitive and self-regulative knowledge, which can be achieved through approaches such as problem-based learning.

Intensive engagement in the collaborative solution of authentic problems, such as product development problems, has been found to foster student learning outcomes of the highest order. These outcomes include improved problem-solving abilities, enhanced communication and thinking skills, and continuing intellectual curiosity and creativity (Herrington, et al. 2010; Rule, 2006). Student-centred approaches have been found beneficial for soft skills development (Vogler, et al. 2018). These student-centred approaches include, for instance, problem-based learning, project-based learning, challenge-based innovation, and design-based education (Figueiredo et al., 2022; Lahdenperä et al., 2022; Joore et al., 2022; Vignoli et al., 2021; Tynjälä, 1999).

Based on previous studies, there have been investigations into students' skills development in product development project courses organized at Aalto Design Factory, UPV Design Factory, and HAMK Design Factory. These studies have adopted student-centred approaches to enhance students' learning experiences and skill development. (Mikkonen et al., 2018 ; Collado et al., 2022 ; Figueiredo et al., 2022 ; Lahdenperä et al., 2023).

In a previous study on product development projects at Aalto Design Factory, students perceived the significance of socio-behavioural interpersonal skills, in which teamwork, multidisciplinary, and communication skills formed the largest categories of student-reported learning outcomes (Mikkonen, et al. 2018). In a recent survey on product development project students, communication with multidisciplinary teams was identified as the most prominent skill that students considered developing during the course (Figueiredo et al., 2022).

According to a study conducted at the UPV Design Factory, students who participated in Design Factory projects perceived that they developed the following soft skills the most:

- Teamwork and leadership
- Time planning
- Analysis and problem solving
- Application and practical thinking
- Effective communication
- Innovation, creativity, and entrepreneurship (Collado et al., 2022).

The UPV Design Factory is a program launched by the Universitat Politècnica de València (UPV) in 2014. It aims to support students' extracurricular activities, contribute to their comprehensive development, and facilitate the acquisition of transversal skills. The program encourages students to put their knowledge into practice, improve their soft skills, interact with peers from other disciplines, and participate in events and competitions. It has been highly regarded by students, with more than 2,000 participants in over 60 teams during the current academic year (Collado et al., 2022).

A previous study on HAMK Design Factory product development projects indicated that students could develop their innovation capabilities in a relatively short period of time, specifically within an eight-week course. This finding highlights the effectiveness of the program in fostering students' innovation skills and providing them with valuable hands-on experience in real-life product development challenges. (Lahdenperä et al., 2023). The results of Lahdenperä's study indicate that working in interdisciplinary teams and solving authentic product development challenges have several benefits for students. These include:

- **Constructing and applying knowledge**: By working on real-world projects, students could apply the knowledge they have acquired in their studies and gain practical experience.
- **Collaboration and communication**: Interdisciplinary teamwork fosters collaboration and communication skills as students learn to work effectively with peers from different backgrounds and areas of expertise.

These findings highlight the value of interdisciplinary collaboration and problem-solving in educational settings. By engaging in such activities, students can enhance their learning experience, develop important soft skills, and gain a deeper understanding of complex challenges (Lahdenperä et al., 2023).

This research focuses on exploring students' expectations and perceptions of skills development in the context of an international product development project organized by two Design Factories, namely inno.space Design Factory Mannheim and HAMK Design Factory. The aim is to gain insights into how students' approach and experience these projects, particularly in terms of their expectations and the skills they perceive to be developed. On top of that, this research tries to figure out whether the question about future skills is relevant and could iPdP with similar courses offer the tools to gain these future skills. The research questions are as follows:

1. What are students' expectations for the international product development project?

This question seeks to understand what students anticipate and hope to gain from participating in an international product development project. Expectations could encompass various aspects, such as learning outcomes, skill development, project outcomes, cross-cultural experiences, networking opportunities, and personal growth.

2. How do the students perceive skills development during the international product development project?

This question aims to explore how students perceive the acquisition and enhancement of skills because of their participation in the project. This could encompass technical skills, design skills, communication skills, teamwork and collaboration skills, problem-solving skills, adaptability, intercultural competencies, and more.

3. What are the future skills, and could international product development project be a part of developing the needed skills?

The first part of the question seeks to identify the skills that are predicted to be crucial in the future job market. These skills could encompass a range of competencies, including technical skills related to specific industries, as well as soft skills like adaptability, communication, problem-solving, and leadership.

The second part of the question is focused on whether international product development projects have the potential to help individuals develop the skills that are expected to be important in the future. In other words, could participating in these cross-cultural and complex projects contribute to the acquisition of the skills identified earlier?

Overall, the research question aims to investigate the connection between the skills needed for future workforce and the experiences gained through international product development projects. It examines whether these projects serve as a practical platform for individuals to cultivate the skills that will be valuable in their future careers.

2.1 European Year of Skills and the European Skills Gap

The European Year of Skills is an initiative by the European Union (EU) to promote and raise awareness about the importance of skills development and lifelong learning. It aims to address the skills challenges faced by individuals and societies in the rapidly changing world of work. After the digital revolution new technologies are emerging at a faster pace and countries with relative abundance of skills are being left behind (O'Rourke et al., 2013). Courses like international product development project are crucial for students to gain these future skills. As Von der Leyen has said in her speech about European Year of Skills and the European Skills Gap, this topic is very much up to date.

> We need much more focus in our investment on professional education and upskilling. We need better cooperation with companies because they know best what they need. And we need to match these needs with people's aspirations. But we also have to attract the right skills to our continent, skills that help companies and strengthen Europe's growth. (Von der Leyen., 2022)

To make sure that nobody is left behind and that everyone in Europe have workforce with the needed skills European Commission has decided to call 2023 as the European Year of Skills. It is important because here are more than three quarters of companies within the EU that state the fact that they are lacking workforce with the necessary skills. During this year, all through Europe there are investments happening in training and upskilling people also making sure that the skills that are taught are relevant for the need in labour market. Skills development and lifelong learning are essential aspects of the EU's policy agenda. The EU recognizes that individuals need to continually update and acquire new skills to adapt to evolving job market requirements, technological advancements, and societal changes. The EU invests in various initiatives to support skills development, such as funding programs for vocational education and training, promoting digital skills, and encouraging the recognition and validation of skills acquired through non-formal and informal learning. (Nuyts et al., 2022)

2.2 Design-based education

Design-based education (DBE), also known as design-based learning or design thinking in education, is an approach to teaching and learning that focuses on fostering creative problem-solving skills, critical thinking, and innovation through the application of design principles. It emphasizes a student-centred and hands-on learning experience, where

students are actively engaged in identifying and solving real-world problems using a design-oriented process. It involves using a human-centred, iterative, and collaborative process to solve problems, enhance learning experiences, and foster innovation in educational settings. DBE encourages students, teachers, and administrators to think creatively and empathetically, and to approach challenges with a mindset of experimentation and continuous improvement. (Lor, 2017)

In the heart of it all is the identification of real-world problems or challenges that students can work on. These problems are often open-ended and complex, requiring students to engage in in-depth analysis and research. Students follow a structured design process, which typically includes stages like empathizing with users, defining the problem, ideating potential solutions, prototyping, testing, and refining. This iterative process encourages students to experiment, learn from failures, and continuously improve their solutions. Design-based education often involves collaboration between students with diverse skills and backgrounds. It integrates knowledge and techniques from various disciplines, allowing students to approach problems from different angles. Students are encouraged to empathize with the end users or stakeholders for whom they are designing solutions. Understanding user needs, preferences, and pain points is crucial for creating effective and meaningful designs. (Lor, 2017)

Design-based education places a strong emphasis on creativity and coming up with novel solutions. It encourages students to think outside the box, explore unconventional ideas, and challenge the status quo all in a safe environment. Students engage in practical, hands-on activities such as brainstorming, sketching, building prototypes, and testing their designs. This active participation enhances their understanding of concepts and their ability to apply theoretical knowledge to real-world situations. Throughout the design process, students reflect on their decisions, outcomes, and lessons learned. Peer and instructor feedback play a crucial role in refining their ideas and solutions. The solutions that students create are often aimed at addressing real-world problems, which can enhance their sense of purpose and motivation for learning. (Lor, 2017)

As already mentioned, the students follow a structured path while working towards innovative solutions. Here is a more detailed example on how they might proceed (Lor, 2017):

- **Empathize:** Everything starts with empathizing with the needs, perspectives, and challenges of students, teachers, and other stakeholders. This involves observing and

engaging with the target audience to understand their experiences, motivations, and pain points.

- **Define:** When one has gathered insights through empathy, the next step is to define the problem or opportunity they want to address. This involves reframing the challenge into a clear and actionable problem statement.
- **Ideate:** In the ideation phase, a wide range of possible solutions is generated to the defined problem. Encourage brainstorming and creative thinking techniques to generate diverse ideas. Emphasize quantity over quality at this stage and defer judgment.
- **Prototype:** Select the most promising ideas from the ideation phase and create prototypes or mock-ups to represent potential solutions. Prototypes can be physical models, digital simulations, storyboards, or any other form that helps bring the ideas to life.
- **Test:** Test the prototypes with the intended users or stakeholders to gather feedback and insights. This step involves collecting data, observing user interactions, and conducting interviews or surveys to understand how well the prototypes meet user needs and expectations.
- **Iterate:** Based on the feedback gathered during testing, refine, and improve the prototypes. Iterate the design process by repeating the ideation, prototyping, and testing steps to continuously refine and enhance the solution.

Design-based education can be implemented across various educational levels, from primary schools to higher education. It can be integrated into different subjects, including science, technology, engineering, mathematics, arts, and even humanities. Additionally, this approach aligns well with the development of 21st-century skills, such as collaboration, communication, critical thinking, and adaptability. Overall, design-based education not only equips students with practical problem-solving skills but also nurtures their ability to approach challenges with creativity and empathy, which are essential qualities for success in a rapidly changing world. (Lor, 2017)

2.3 International product development project

International product development project is a collaboration between two Design Factories, HAMK DF and inno.space (HSMA). This project brings together 24 students from these two higher education institutions, to solve different challenges provided by real life companies based either in Finland or Germany.

This international product development project was organised from February to June 2023. The students worked in international and interdisciplinary teams to solve product development challenges provided by industry partners. There were four challenges provided companies in Finland and Germany. Each team included three students from HAMK and three students from HSMA. The project started with 24 students in total, 6 students working for each challenge. From HAMK all the students were in the Bachelor level, whereas from HSMA three (3) were Bachelor level students and the other nine (9) were studying their Masters. This made the teams even more multidisciplinary and versatile.

As someone who has experienced iPdP twice, first as a participant and then as an observer and interviewer, I must say that there is a great difference whether the project is started face-to-face or online. The first part of iPdP was self-studying via MOOC (Massive Open Online Course) but right after all the students met in Germany. Usually, HAMK students travel to Mannheim and spend a little under a week there on a bootcamp getting to know each other and the basics of design thinking. Similarly, in 2023 inno.space pioneers Kristin Kohler and Manuel Walter oversaw the first bootcamp making sure that the students were well prepared for the following months.

The time between the bootcamp in Germany and the final gala in Finland is spent online study. It is up to the teams to organise their work so that everything gets done in time. They are assigned a coach from the teaching team, and they are also meant to be in touch with the sponsor. A huge amount of work is put into this stage where the teams must decide which direction to take with their project and which ideas are just not going to make it. They innovate, build, and test their ideas before choosing one to stick with. This idea will then be finalized for the final gala.

After about four months the students meet again, this time in Finland for the final part of the course. Final gala states sort of an ending to iPdP but afterwards the students still must reflect their journey and write a report. This final week is intense including last minute changes and peptalks from the coaches. They must prepare a short video, a poster and a full presentation that includes everyone on the team. Sometimes the whole approach for the project could even change in these last days before the presentations.

During the iPdP the students learn how to schedule their weeks to be able to have something to present at the final gala. They learn how to solve problems regarding the team project and the communication with their teammates. Design thinking as a process begins to open and

even their presentation as well language skills are improving. From the analysis of the interview questions, this and more can be seen.

3 Research methodology

Research methodology refers to the systematic approach or framework used by researchers to conduct a study or investigation. It involves a set of principles, procedures, and techniques that guide the collection, analysis, and interpretation of data to answer research questions or achieve research objectives. The choice of research methodology depends on the nature of the research problem, the research questions, and the available resources. (Kirsch, 2012)

There are different methodologies used, for example Experimental Research, Survey Research, Observational Research, Qualitative Research, Quantitative Research, Mixed-Methods Research, Action Research and Case Study Research, which is used as the base of this thesis. The selection of a research methodology depends on various factors, including the research objectives, the nature of the research problem, the available resources, and the researcher's expertise. (Kirsch, 2012)

3.1 Strategy

Aalto University has already done research about the long-term value of industry project-based courses back in 2018. This study gathered and analysed alumni reflections from two decades of Aalto University’s Product Development Project. (Mikkonen et al., 2018)

Other than that, there has been little to no research made towards problem-based learning and its effectiveness towards professional aspect of students. Even though students give feedback about the courses they have attended, it is often only “the course was okay”, “nothing to mention”. There is also the problem of giving the feedback directly to the teacher or the professor giving the course/lectures. That means the given feedback might not be so truthful.

This is why the research that was made about iPdP is so valuable. It shows how different type of approach to teaching (DBE) really does make a difference in the educational field. Also, when the students must think about the gained skills and experiences, they will more probably let others know about these courses and even more students can benefit from them.

3.2 Case study

Case study as a method is no different than other methods, but it is still considered to be a bit more challenging than a regular study. The researcher needs to have an insight on different study methods to get the most out of case study. (Kananen, 2013)

When starting a thesis and deciding on a method such as case study, the subject of a thesis is everything. And because it is called a case study the writer should know the case that is studied. The first stage of a study is to determine the problem and to define it, after this one must look for the solutions and go from there. (Kananen, 2013)

A theoretical case study is an in-depth analysis of a hypothetical scenario or situation that is used to examine and explore theoretical concepts, principles, or frameworks. It involves applying theoretical knowledge to a fictional or hypothetical case to understand how the concepts or principles would play out in a real-world context. (Kananen, 2013)

The primary purpose of a theoretical case study is to enhance understanding and application of theoretical concepts, theories, or models in a practical setting. It allows researchers or students to explore the potential outcomes, implications, or limitations of a theory by examining its application in a specific case. (Kananen, 2013)

In a theoretical case study, the case is usually constructed based on realistic assumptions, but it is not an actual event or situation. It is designed to stimulate critical thinking, problem-solving, and analysis, enabling individuals to test and evaluate theoretical ideas, concepts, or models. (Kananen, 2013)

Theoretical case studies can be used in various fields such as business, social sciences, education, psychology, and healthcare, among others. They provide a way to bridge the gap between theory and practice, fostering a deeper understanding of how theoretical frameworks can be applied to real-world scenarios. (Kananen, 2013)

When conducting a theoretical case study, researchers typically gather information, analyse data, and draw conclusions based on the theoretical framework being explored. The findings of a theoretical case study can contribute to the refinement or development of theories, as well as provide insights for practical applications in relevant fields. (Kananen, 2013)

3.3 Data collection

The data was collected by interviewing the students participating in international product development organised by inno.space Design Factory Mannheim (HSMA), Germany and HAMK Design Factory (HAMK), Finland.

Interviews are a commonly used method in various fields to gather information and insights from individuals. Whether it's for research purposes, job applications, or investigative purposes, interviews allow for direct communication and exchange of information between the interviewer and the interviewee. This time the purpose of the interviews was clear: to gather data and get to know the students' take on things.

These interviews were done in two parts, where in the first part, at the very beginning of the iPdP, the students were asked about their expectations towards the course. In the second interview the questions were set to determine whether their expectations were met and if they learned something new during the course. Also a few questions about the future skills were implemented into the questions.

The interviews were done mostly face-to-face and via Zoom. All recordings were transferred into anonymous excel before analysing any data. A research permit was granted by Häme University of Applied Sciences' board for research permits and all students also signed interview consents. This iPdP had 24 students that started the course. At the first stage of this interview, in Spring 2023, I interviewed all 24 students. Later, some were not able to continue the course. Before and during the Final Gala, in Summer 2023, I got to interview 23 students out of 24.

Overall, interviews provide a valuable method for gathering information, understanding perspectives, and gaining insights from individuals. By employing effective interviewing techniques and considering ethical considerations, interviews can be a powerful tool in various domains. (Monday, 2019; Jamshed, 2014; McNamara, 2006)

3.3.1 Interview questions

The first set of questions were the following:

1. How do you choose the extra courses that you add to your degree?
2. How did you find about this year's international product development project?

3. Why did you choose iPdP?
4. What are your expectations towards iPdP?
5. How familiar you are with the term design thinking? From 0-5, where 0 is “not at all” and 5 “I’m an expert”.
6. How would you describe the term design thinking to someone who knows nothing about it?

The purpose behind these questions were to discover the reason why students pick courses like International Product Development Project and if they already know about design thinking. The first interview round was made in during the start of the course, in Spring 2023 and the students had had only a few lessons related to the theory of design thinking. As the answers will show, some of them already had a fairly good idea about what design thinking might be.

The second interview took place in the end of the iPdP, Summer 2023, and the questions were following:

1. Now after the course is ending, has your take on design thinking evolved?
2. Name three (3) things you feel like have improved by attending iPdP
3. Would you participate again if given a chance?
4. How were your expectations towards the course met? (At this point a reminder for the interviewees answers from earlier interview)
5. Did you learn something you didn’t expect during the course?
6. What kind of skills need to be taught in the future?
7. How could this course (iPdP) develop the needed skills?
8. What else could support the development of the future skills?

At the end of the course the interview questions were meant to ask the students how their journey had been. Did they learn something new and were their expectations met? Also a few questions were pointed directly towards the future skills. The future is rapidly changing and as HAMK is leaning towards design-based education, student feedback has a huge role in developing the future courses. The competition in “real world” is brutal and every higher education institution wants to offer something extra.

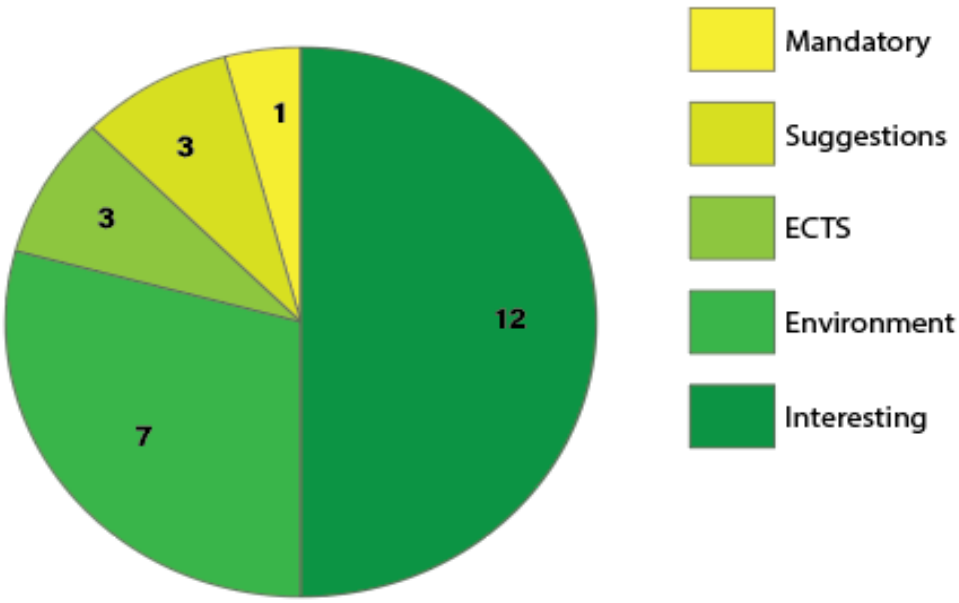
4 Results

The iPdP is a crash course into design thinking. It forces the students to step out of their comfort zones without the fear of failing. By interviewing the students that participate iPdP it is investigated how this type of course benefits all students, regardless of their study field. As a course, iPdP helps to acknowledge the fact that design-based thinking as a part of higher education studies broadens students' spectrum and allows students to innovate over borders. As stated, earlies, design-based education is a teaching method that has been taken into practise lately in Häme University of Applied Sciences.

From the first round of interviews, it is seen that the term design thinking is somewhat familiar to students who want to participate in an international product development project. They also show that the greatest motivations for doing a course like this are simple recommendations either from teachers or other students.

In Table 1 is shown how the students decide what kind of courses they attend to. In higher education institution degrees students have some mandatory courses and some courses they can choose themselves. Half of the iPdP students chose this course because it sounded interesting and therefore offered value to their studies.

Table 1: How do you choose your extra courses?



Different methods of promoting these extra courses are always considered. For this iPdP course most of the students got the info straight from the staff by email as can be seen in the Table 2.

Table 2: How did you find out about the international product development project?

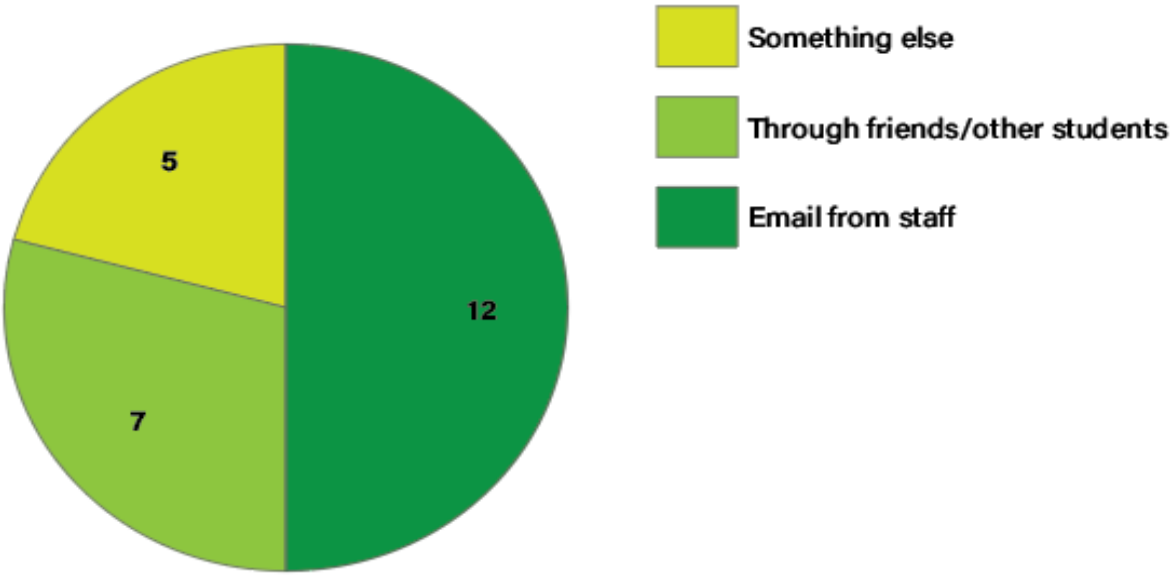


Table 3 shows the main reasons why the students chose this iPdp course. The responses are categorised based the frequency of certain expressions recurring in the interviews. The most responses were related to internationality, for example a trip to Finland or Germany was high in the responses. The second most responses were related to attractiveness of the course. There were responses like “I’ve never experienced anything like this before.”, “Sounds cool”, “DF and the previous work = wow factor”. The third most frequent category was to choose courses that supports studies. This category included responses like: “thesis opportunity”, wanted to improve my technical thinking skills more”, and “opportunity to learn about prototyping”.

Table 3: Why did you choose this course?

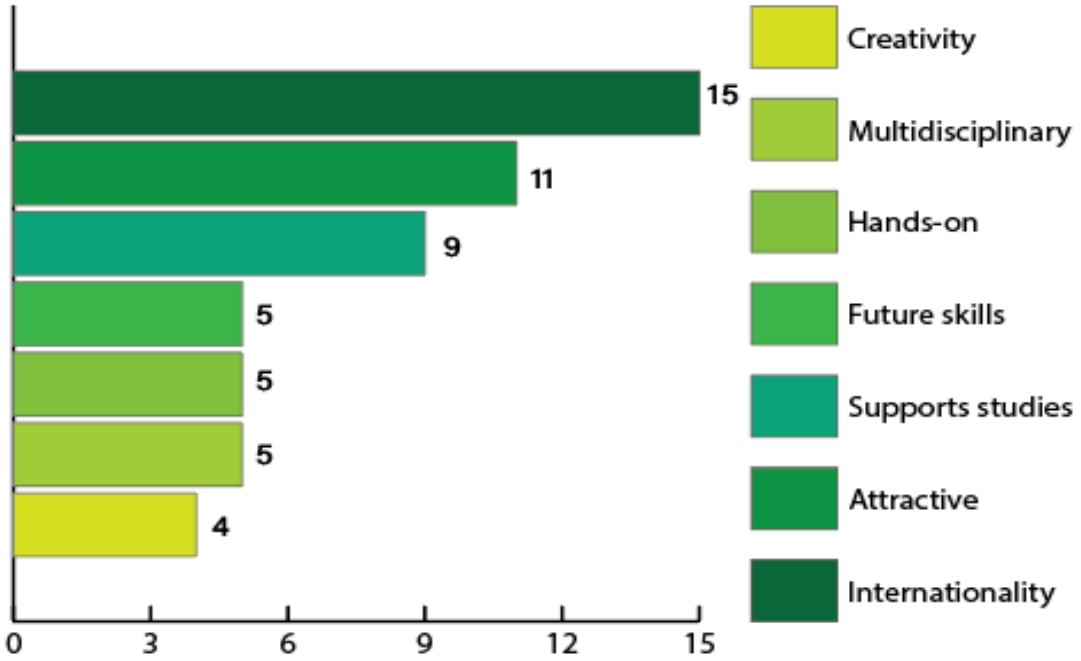
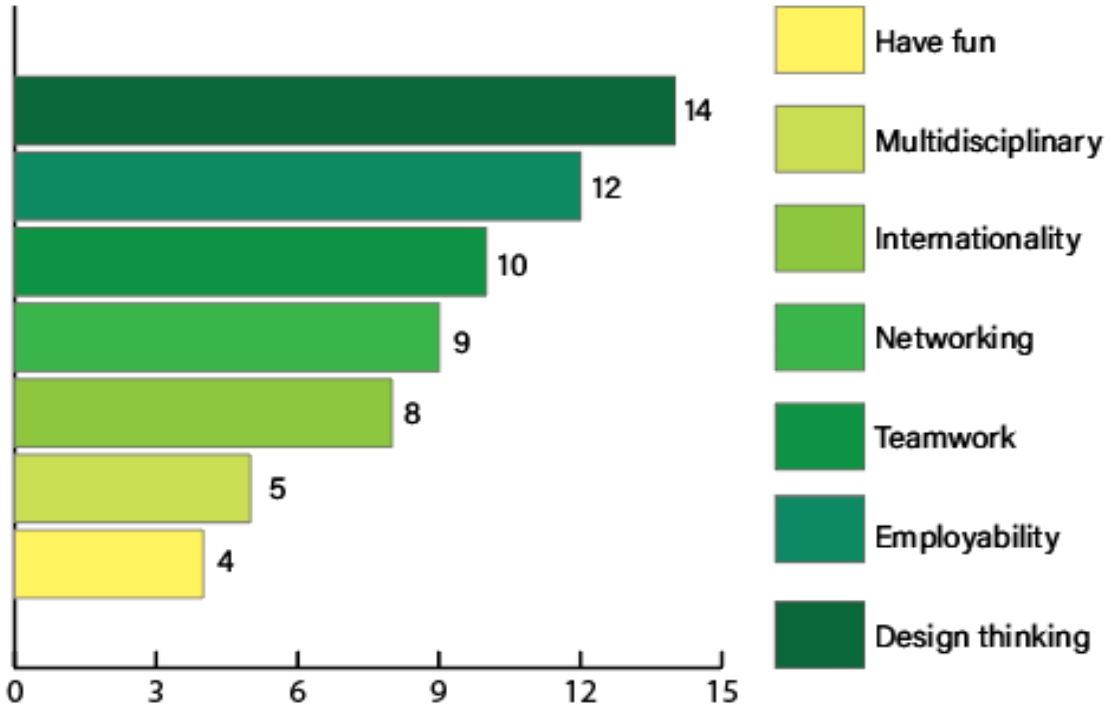


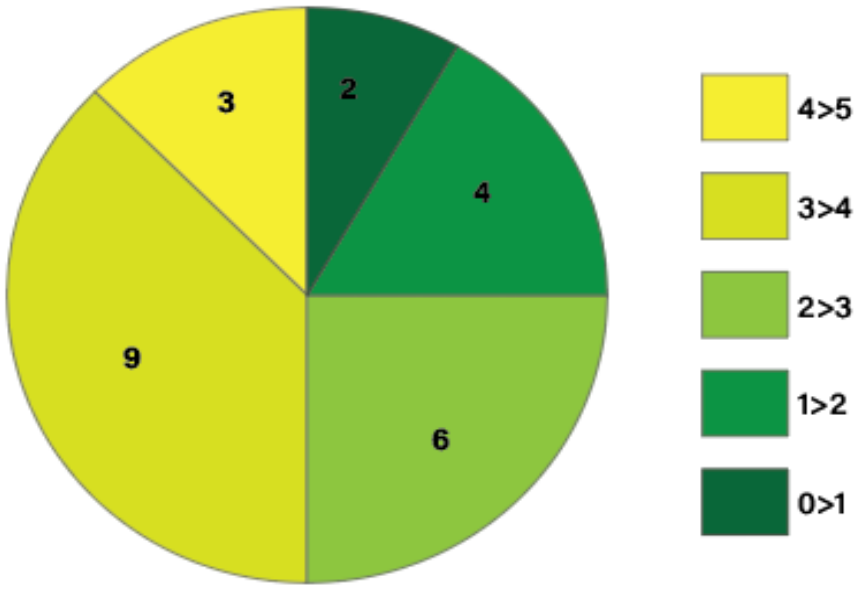
Table 4 shows the expectations of the students towards the course. Some of the categories were mentioned directly by the students but some were inferred from the data. For instance, the responses like, “work with a real company”, “to get the best solution as we can for the sponsor”, and “collaborate with companies” where categorized as employability. The most frequent answer was about the fact that the students wanted to learn more about design thinking as a process. They were also thinking ahead about the leverage in the future job markets this kind of course could give them. And of course, in third place was teamwork. It was great to notice that some were looking forward of having fun with the course as well, since innovative ideas and multicultural aspect can also give students that.

Table 4: What are your expectations towards the course?



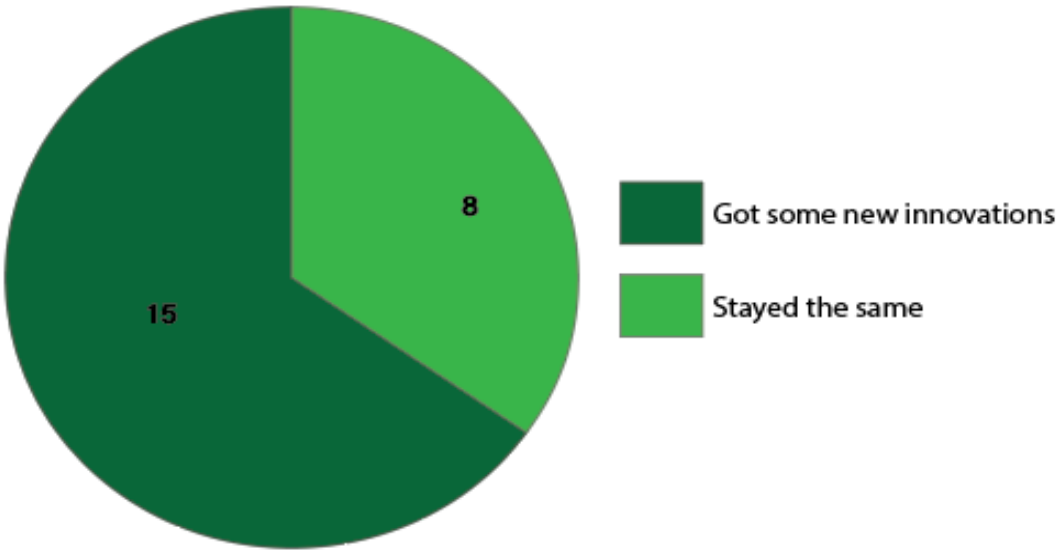
As it is seen in Table 5 almost all students had a clue what design thinking is before starting the iPdP. When asked to explain the term to someone who knows nothing about the term, all the answers were totally different. This proves that even though the term might be known, the understanding of it is completely different. And this is one big reason why the students gain so much by attending these courses.

Table 5: How familiar you are with the term design thinking?



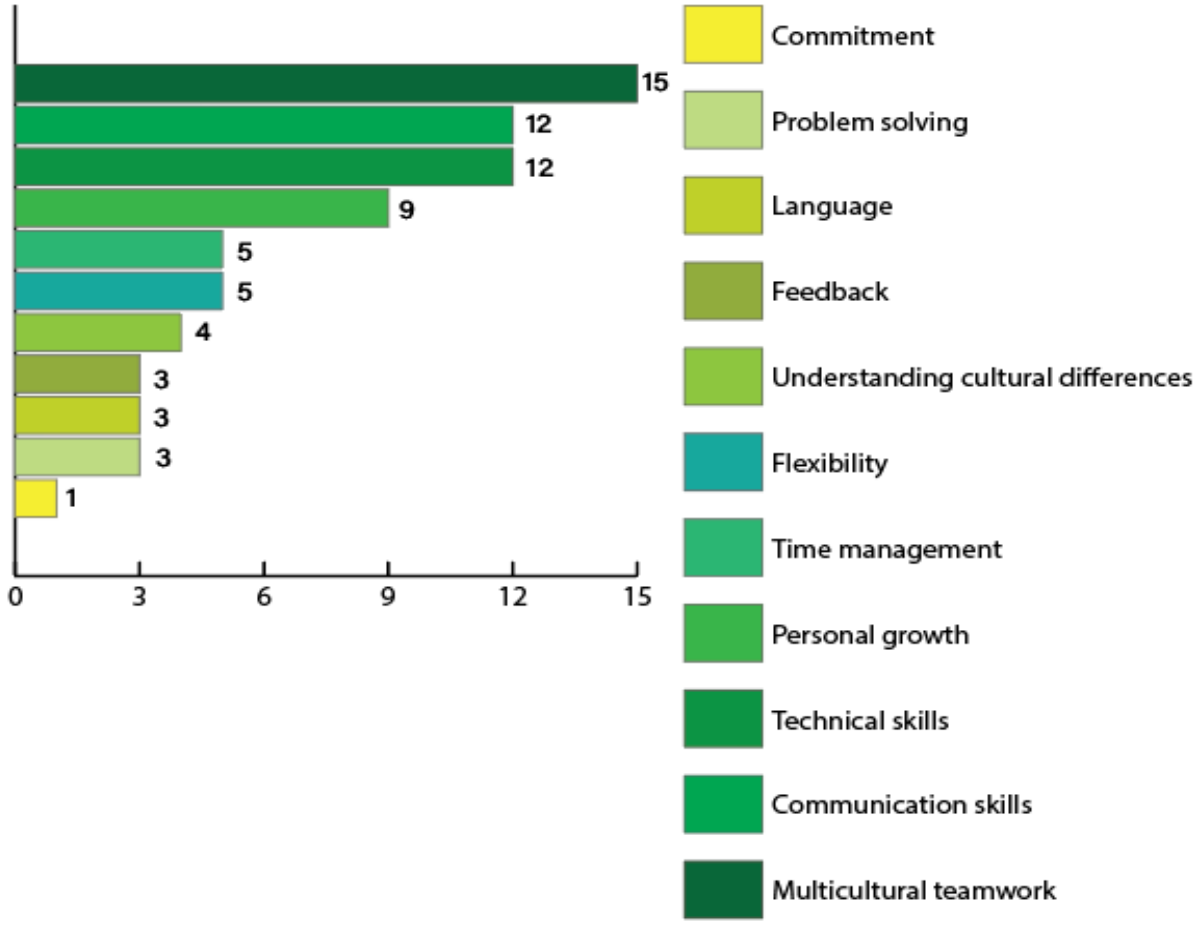
As almost every student claimed to have at least some knowledge about design thinking before the course started was one of the questions about evolution the take on design thinking as is seen on Table 6.

Table 6: After the course is over, has your take on design thinking evolved?



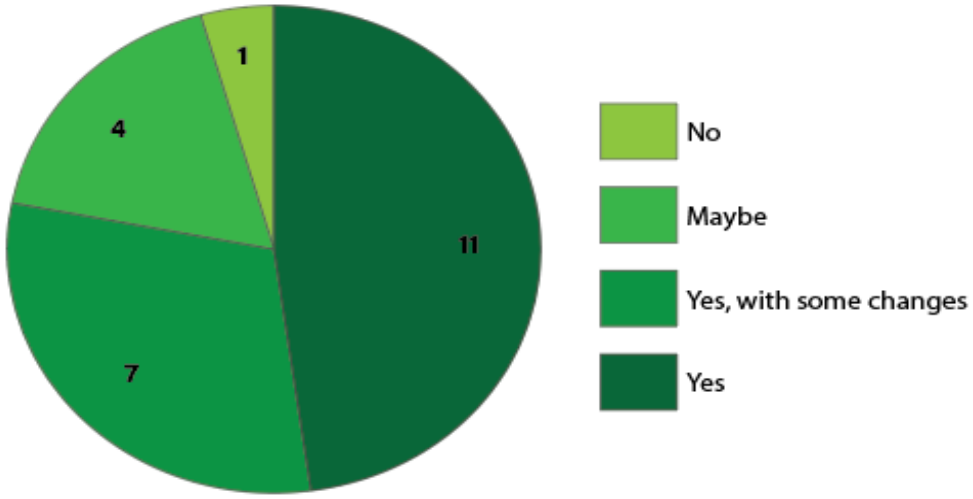
In Table 7 is reported what kind of skills the participants had learned during the iPdP. As in the previous listing in this one, too, some were mentioned directly but some were inferred from the data. For example, under Personal growth went answers like “the way of understanding things”, “commitment”, “consistency, as in before I didn’t go back to my decisions”. The most common answer was multicultural teamwork, which was an expected answer, followed by communication and technical skills.

Table 7: Name three (3) things you feel that have improved by attending iPdP?



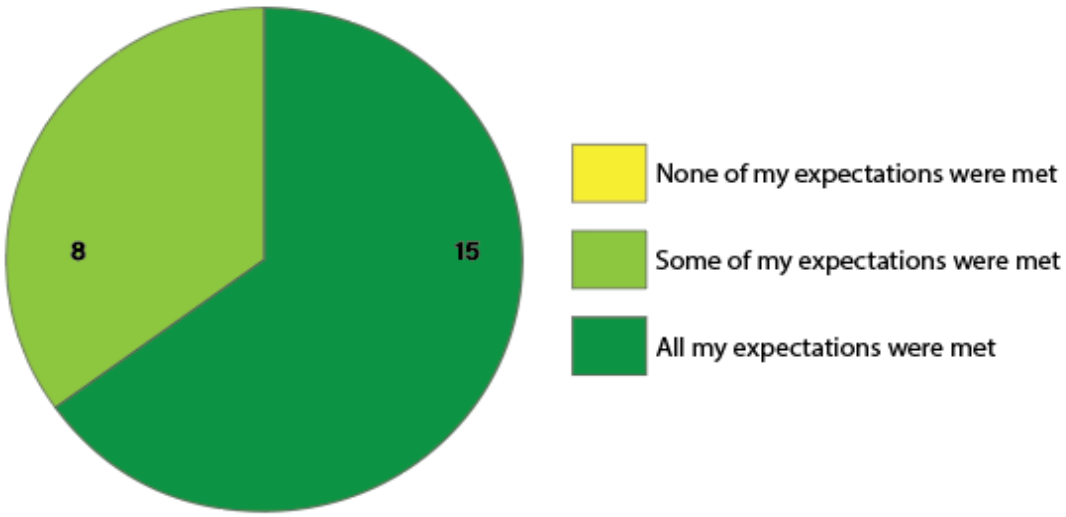
Since the course is designed to have different sponsors and challenges every year, it is possible for some students to participate more than once. Table 8 shows how eager most of the students are to take part in this course again.

Table 8: Would you participate again if given a chance?



In the first part of the interviews there was a question about the students' expectations towards the course. In the second interview the expectations were repeated to the students, and they were asked and in the if they thought their expectations were met or not. The responses for this are shown in Table 9. Nobody thought that their expectations were not met which is a positive sign that the course keeps what is promised.

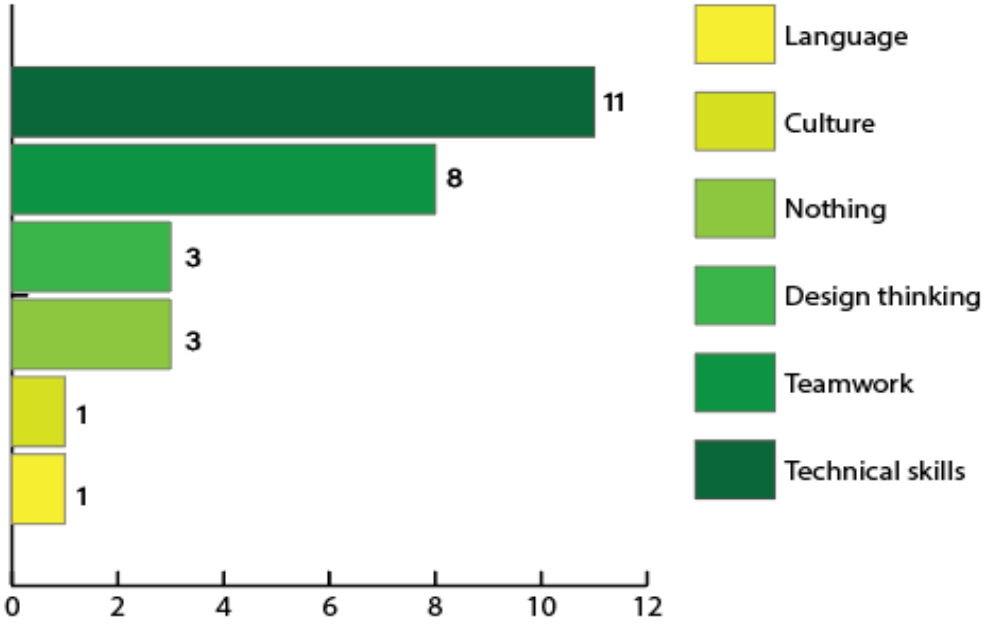
Table 9: How were your expectations towards the course met?



To be able to know if the students were surprised by the effect of participating iPdP and to report what kind of things the students learned even without expecting are categorised in

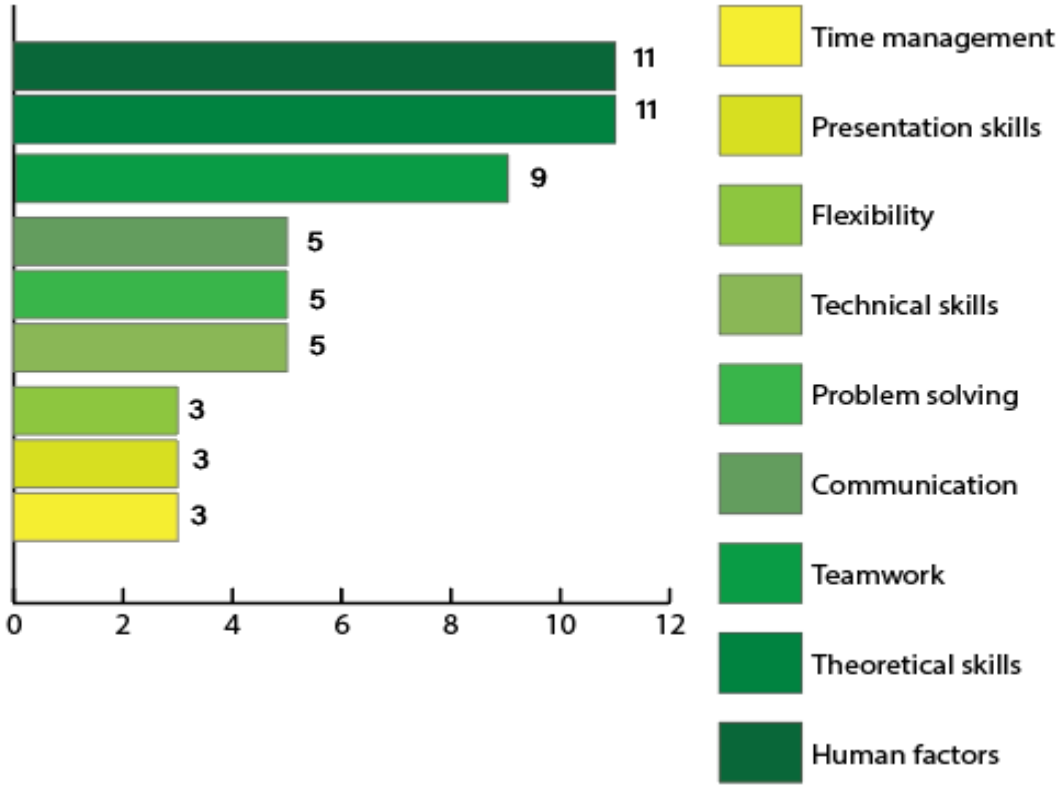
Table 10. As in the earlier listings, for example, under teamwork there are answers like “I didn’t expect teamwork to be so great”, “teamwork in a multicultural team was harder than expected” and “Working with people from different degree fields, backgrounds and age groups was eye opening”. And under technical skills there are answers like “Figma skills have improved”, “Well, I had to learn 3D printing”, “Not so many big things, small things – technical skills”, “I didn’t expect to learn about laser cutting”.

Table 10: Did you learn something that you did not expect from the course?



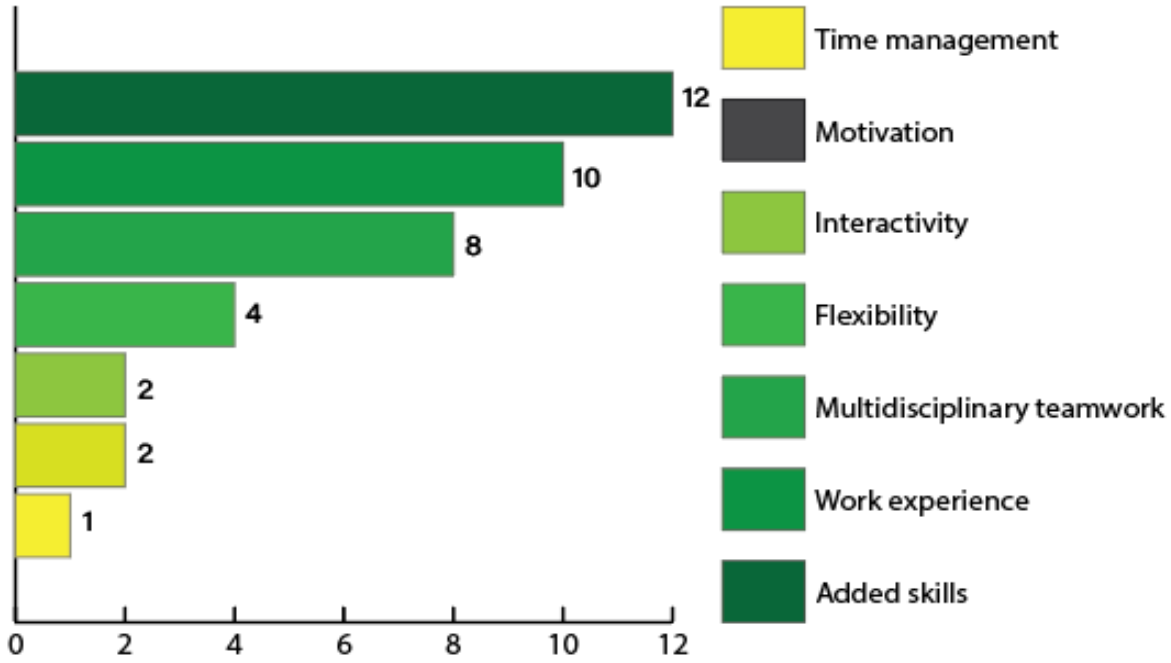
The last part of the interviews was about the future skills and the students were asked what they thought about those. Most answers in Table 11 were self-evident like problem solving, teamwork and presentation skills. Then there were answers that were categorized under human factors like “…trustworthiness, kindness”, “understanding and respecting others”, “Based on the course topic, I feel mastering emotional intelligence and digital literacy are skills that will help me to stay relevant and thrive in the future.”, “Depends on the people, because some people don't have any soft skills and would benefit from those, some are lacking the fundamental skills.”. And under theoretical skills went answers like “Know where and how to get information and how to spread information”, “technical skills, everything is moving quickly forward”, “Fundamental skills based on your occupation”, “Broader take on things”, “global aspect”.

Table 11: What kind of skills need to be taught in the future?



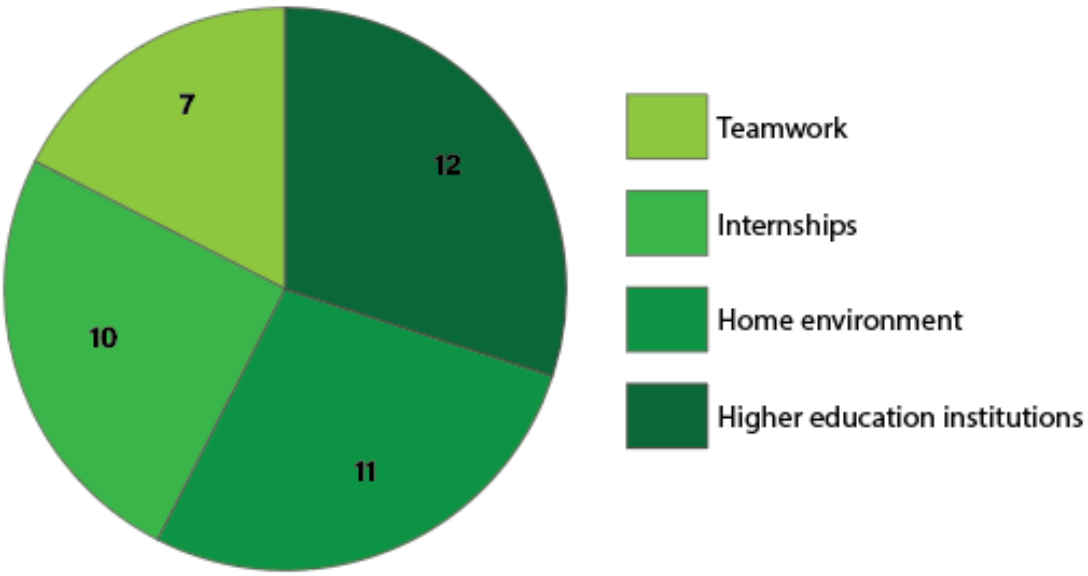
As one part of this thesis and the research behind it, there is a need to know if the students thought that courses like iPdP could help to teach the needed skills. The results gave hope that these types of courses are needed now and in the future. As in the earlier answers, some answers to this question were easy to understand like Time management and Flexibility. In Table 12 under Added skills are listed answers like “It develops some skills, not so much digital skills, communication skills are developed through hybrid model, how to exchange your ideas with others on a hybrid model via mural etc.”, “It is a really good crash course to develop these skills, because all of it is preparing you to the work experience, different cultures, different people, deadlines, kinda learning something new, having new things thrown at you every week, new tasks”, “This course allows you to be curious about the problem and it gives you the possibility to have your knowledge shared and presented”, “E-commerce Marketing, Digital Marketing, Video Editing, and creating sales funnels on e-commerce platforms.”, “Yes it can, because you can take all skills in use”.

Table 12: How could this course develop the needed skills?



The students were also asked about the responsibility of teaching these future skills that they listed. The idea behind this question was simple; Is it only the higher education institutions that are responsible of making sure that the future's employees have the necessary skills to answer the need of the labour market. As can be seen from the students' responses in Table 13, they think that it's most likely a combination between person's upbringing, HEIs and internships, all led by ones strong will for development.

Table 13: What else could support the development of the needed skills?



5 Analysis

When the idea behind this thesis was starting to come to life, it was simple, to do a case study surrounding the iPdP. Thinking more about the topic it evolved to cover the also the future skills.

The analysis chapter delves into key inquiries shaping the trajectory of the international product development project. Firstly, students' anticipations are explored, probing into the depth of their expectations. Subsequently, the intricate tapestry of how students perceive the evolution of their skills throughout the project is unravelled. Lastly, the landscape of future skills is scrutinized, contemplating the integral role the international product development project might play in cultivating these essential competencies. This chapter navigates the intersection of expectations, skill perception, and the project's potential contribution to future skill development. The research questions in the beginning were the following:

1. What are students' expectations for the international product development project?
2. How do the students perceive skills development during the international product development project?
3. What are the future skills, and could international product development project be a part of developing the needed skills?

The iPdP program provides students with a global and cross-disciplinary educational setting, fostering collaboration in diverse teams to address real-world product development issues presented by industry partners. A significant proportion of students, approximately 60 %, cited the course's international character as their primary motivation for enrolment, while nearly 50% found the course highly appealing. Around 20% of students identified the course's multidisciplinary nature, emphasis on future-oriented skills, and practical, hands-on approach as key factors influencing their decision to join.

The findings underscore that although students did not primarily select the iPdP course based on their expectations for future skills development, their perceptions indicate that such development did indeed occur throughout the course. In accordance with the expert knowledge theory (Tynjälä, 1999), students perceived growth in various dimensions, including factual knowledge, conceptual knowledge, procedural knowledge, tacit knowledge, and self-regulative knowledge during their participation in iPdP. This suggests that the process of addressing genuine challenges in international and interdisciplinary teams effectively facilitated the acquisition of valuable future skills and 21st Century Skills.

It's worth noting that this research was confined to a single international product development project course, and further investigations into other course implementations are warranted. Moreover, establishing connections between 21st Century skills and European skills could yield a deeper comprehension of the subject.

Future skills refer to the abilities, knowledge, and attributes that are anticipated to be crucial for success in the evolving job market and society. Several future skills have been identified as important due to advancements in technology, changes in the global economy and shifting societal needs. These skills are expected to become increasingly valuable in various industries and professions. International product development projects can indeed be a valuable avenue for developing many of these future skills. Such projects often involve working with diverse teams from different countries, which enhances cultural awareness, communication skills, and global mindset (Trilling & Fadel, 2009).

It is important to note that the definition of future skills may vary slightly depending on the source, and the landscape is dynamic, continually influenced by technological advancements and societal changes. Modified from a variety of sources including The Organisation for Economic Co-operation and Development (OECD, n.d.) and all the previous sources read for the thesis, here are some of the future skills listed:

1. **Digital Literacy and Technology Proficiency:** With the continued integration of technology into various aspects of life and work, being comfortable with digital tools, understanding data analysis, and having the ability to adapt to new technologies is essential. And as it is shown by the interview results these are important for students as well.
2. **Critical Thinking and Problem-Solving:** As automation will take over routine tasks, the ability to analyse complex situations, think critically, and come up with innovative solutions becomes more valuable. This is also shown already in the case study.
3. **Creativity and Innovation:** The human ability to generate novel ideas, think outside the box, and innovate is something that machines have not been able to replicate effectively. As design-based education and Design Factories around the World encourage students to this, I cannot highlight how important this is.
4. **Adaptability and Flexibility:** The pace of change in the modern world requires individuals to be adaptable and open to learning new skills and taking on new roles. Courses like iPdP allow students to feel the pressure of a real-life project in a safe environment, this is how people get valuable experience.
5. **Emotional Intelligence:** The capacity to understand and manage emotions in oneself and others is crucial for effective collaboration, communication, and leadership. This is something that Artificial Intelligence (AI) can't replace, and I personally was happy to notice that the interviewed students' felt like it too.
6. **Interpersonal Communication:** As workplaces become more global and interconnected, strong communication skills, especially in diverse cultural contexts, are vital. Courses that allow multicultural and international aspects are their worth in gold.
7. **Collaboration and Teamwork:** Many tasks and projects require collaboration among individuals with diverse backgrounds and expertise. Even though the importance of teamwork is always talk about, this is something that can be learned only by experiencing it first-hand.
8. **Cultural Awareness and Global Mindset:** With increased globalization, an understanding of different cultures and the ability to work across borders are becoming more important. International product development project alongside with similar courses allow students to interact over borders and culture.
9. **Lifelong Learning:** The concept of continuous learning is gaining significance as new technologies and practices emerge rapidly. One can only learn by studying and studying is up to the one willing to do so, meaning lifelong learning and continuing to develop oneself is all depending on the person being in charge - you.

However, it's important to note that the effectiveness of skill development through international projects can vary based on the individual's engagement, the nature of the project, and the level of support and guidance provided by the organization (Trilling & Fadel, 2009).

6 Conclusion

If I look at the iPdP from my own perspective – first as a participant and then as an observer- I must say that on both times I learned a lot. I learned skills that might not be listed on the curricula of my degree but are vital for the future. It is no secret that the world around us is evolving and everything keeps on developing more rapidly. To be able to compete against time and gain valuable insights on how to work in multidisciplinary surroundings and respect different cultures, is a huge asset. In my opinion, strongly backed-up with the research I made for HAMK DF about iPdP, design-based education and courses like this play a decisive role in the future.

My first idea for the topic of this thesis was just to concentrate on iPdP. After participating into first and second edition of European Student Assembly (ESA), I soon realised that I could broaden my topic a little bit. That is how the future skills theme came to be a part of this. Self-development and the development of the HEIs are close to my heart and this year being the Year of Skills all these themes that are discussed within my thesis intertwine nicely.

As a continuation for the research, I thought about conducting a larger survey but unfortunately, I just didn’t have enough time to concentrate correctly on that. I am pleased that I managed to interview 11 out of 12 students twice and only one student didn’t have time to participate into the second round of the interviews.

In conclusion, the findings of this thesis strongly support the success of courses like the international product development project (iPdP) in enhancing students' skills for both the job market and life beyond academia. The integration of design-based education, exemplified by institutions like HAMK, proves to be an effective educational method, providing students with a valuable foundation for their future careers. The positive outcomes underscore the significance of incorporating design thinking as both a topic and learning tool within the curriculum. This thesis establishes a compelling case for the instrumental role of iPdP and design-based education in empowering students for the challenges and opportunities they will encounter in their professional and personal lives.

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Appendix 1. The questions for the interviews

Questions – conducted in March 2023

1. How do you choose extra courses?
2. How did you find out about iPdP?
3. Why did you choose iPdP?
4. What are your expectations towards the course?
5. Familiarity with design thinking 0-5, when 0 is nothing and 5 is “I am an expert”.
6. How would you describe design thinking to someone who knows nothing about it?

Questions – conducted in June 2023

1. Now after the course has your take on design thinking evolved.
2. Name 3 things/skills you feel like have improved by attending iPdP?
3. Would you participate again if given a chance?
4. How were your expectations for the course met?
5. Did you learn something that you did not expect from the course?
6. What kind of skills need to be taught in the future?
7. How could this course develop the needed skills?
8. What else could support the development?