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PERCEPTION OF UNDERGRADUATE STUDENTS TOWARDS ONLINE PROJECT BASED LEARNING DURING COVID-19 PANDEMIC

Master Thesis

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Abstract

This master thesis explores perception of students towards online project based learning with relation to Fontys School of ICT choice of online tools, assessment and organization of projects in online mode of study during COVID-19 pandemic. My research findings indicate that students have positive perception of online project based learning and that successful implementation of main components of project based learning can be beneficial to students' educational success. Successful online project learning should pay additional attention to facilitate communication amongst students as well as providing additional assistance to first semester students who need help in maintaining motivation and combat distractions during online learning.

Keywords: project-based learning, online project-based learning, COVID-19 education, components of project-based learning

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Introduction

PERCEPTION OF UNDERGRADUATE STUDENTS TOWARDS ONLINE PROJECT BASED LEARNING DURING COVID-19 PANDEMIC

COVID-19 pandemic has affected many societies and caused significant economical, societal and governmental issues, followed by health system crisis and variety of lockdowns (Liguori & Winkler, 2020; Liu et al., 2020) . Scientists raise serious alarms towards effects of COVID-19 on education and student mental health (Grubic et al., 2020). With the introduction of country-wide lockdown measures for prevention of further spread of COVID-19, the government of the Netherlands has prohibited all activities that require physical attendance at universities and institutes of higher education (Rijksoverheid, 2021). The introduction of these measures led towards rapid organization of online studies as an alternative to studies bound with physical classroom attendance at all levels of higher education (Rijksoverheid, 2021). This master thesis investigates a phenomenon of transition from traditional classroom to online learning for undergraduate level students of higher professional education in the Netherlands. The aims of this study are to explore perception of undergraduate students towards online project based learning and to investigate students' participation in online project based learning, organizational habits and usage of technology during online project based learning. The goal of this study is to produce advice for further development of online project based learning facilities at Fontys University of Applied Science. The research of this master thesis focuses on experiences and input by undergraduate students in the bachelor degree program in Information and Communication Technologies at Fontys University of Applied Sciences in the Netherlands who participate in English-taught undergraduate program. Fontys University of Applied Sciences is a member of HBO-i foundation which gathers the majority of schools that provide undergraduate programs in Information and Communication Technologies in the Netherlands in further text HBO ICT (HBO-i, 2018). With its 57 members, HBO-i foundation strives to connect the teachers of the relevant study programs, who share knowledge and collaborate on creation of "Domain description", a document which serves as a guideline in organization, content and learning outcome of HBO ICT studies (HBO-i, 2018). This master thesis aims to contribute to the development of online project based learning facilities at other HBO-i members' HBO ICT programs respectively. Taken into consideration that the primary focus group of this research attends an educational program which is developed according to universally shared standards by all members of HBO-i foundation, as well as the governmental measures affecting all participating universities in the Netherlands, it is expected that focus group of this master thesis shares similar experiences and qualities as the students of other HBO-i participating educational programs.

Project-based learning has been applied for professional training in medicine and engineering since the 20th century (Kızkapan & Bektaş, 2017; Mills & Teragust, 2004). It is also believed that project-based learning has its roots in emergence of more progressive approach to education which dates historically to beginnings of constructivism as a theory and a progressive movement, a tradition whose aim was to minimize the gap between school learning and the learning that occurs in the everyday life outside of school (Jumaat et al., 2017; Pellegrino & Hilton, 2013). Project-based learning is a method that belongs to constructivist point of view on education, pioneered by 20th century American psychologist, John Dewey (Dewey, 1916). In his works Dewey indicated that education depends on action, which in in further elaboration means that the experiences given to learners are important because these experiences produce meaning to them, learners (Dewey, 1916). Constructivism further aims to understand how learners produce their own understanding of their experiences during learning process. This means, in context of project-based learning that learners need to be submitted to different kinds of experiences during which learning emerges by means of active participation, learning by doing. The learners in this case are active constructors of the meaning which they have autonomously obtained during their performances. Another constructivist view on learning which aims to define learning and development in the broad sense, contributes to previous claims by arguing that learning involves the acquisition of general thought structures which apply to many situations (Ginsburg & Opper, 1988; Jumaat et al., 2017). It is therefore a necessity for learners to be provided with enough liberty to engage in these situations.

Problem based learning is a widely accepted form of education in the Netherlands (van den Wijngaard, 2018). The end of the 20th century in the Netherlands has brought significant changes in the way education is organized and provided to students of different educational levels. Although the universal acceptance of competence and demand based education by Dutch universities of applied sciences has been adopted in 1998, the project based learning has emerged in the Netherlands as a concept of education in 1978 with Maastricht University being at the forefront of this transition (Smit, 2006). In 2021 project based learning is still offered at Maastricht University, but also by other universities and universities of applied sciences in the Netherlands (van den Wijngaard, 2018).

One of common criticisms of project-based learning revolves around the issue of grading student's achievements when participating in project-based learning. Research focusing on grading aspect of project-based learning activities has shown that students evaluate their peers on contributions that an instructor would not easily be able to observe, and by this might prove shortcoming of grades issued by the instructor (Lee & Lim, 2012; Patchan & Schunn, 2015). The current ease of availability of technology used in educational activities might be beneficial in solving the problem of instructor's shortcoming of deep perception of individual student's participation during the assessment moments. A two independent studies performed respectively amongst Israeli and Spanish students in field of technological sciences and has recorded positive outcomes of project-based learning assessment

process in a computerized environment where assessment emerges as a task whose success may act as momentum in promoting learning/teaching processes in schools (Doppelt, 2003; Traverso-Ribón et al., 2016).

Problem-based learning has its roots in traditional classroom, however since popularization of online learning, problem-based learning has also been applied in virtual educational solutions, such as online education programs. Designing effective problem-based learning within virtual educational solutions has shown as a challenge to some providers of online education (Bloom & Kowalske, 2016; Herrington et al., 2003). The effectiveness of these solutions relays amongst other factors, on finding ways of engaging students who seldom participate in the online problem-based learning team (Larmer et al., 2015; Savin-Baden, 2007).

Many students who engage in online educational activities which are designed in accordance with project-based learning principles have an experience of traditional classroom education and more instructor centered, knowledge transmissive mode of educational activities. It is recommendable therefore to augment the probability of successful problem-based (or project-based) learning online by facilitating physical attendance in the initial stage of learning activity or a course (Savin-Baden, 2007; Singh, 2021). In project-based learning, students have to produce an artefact towards demonstration of their mastery of content. In problem-based learning, students have to come up with a solution to a clearly defined authentic problem. Problem-based learning is very similar to project-based learning and a popular opinion is that problem-based learning is a component of project-based learning (Korkmaz et al., 2019; Savery, 2006).

Literature review

Project-based learning: definition and rationale

Project-based learning is a form of situated learning rooted in constructivist thought that students gain a deeper understanding of educational material when they actively construct their understand. This construction occurs while working with each other and using ideas (Krajcik & Blumenfeld, 2005; Owens & Hite, 2020). Project-based learning is closely related to experiential education and the philosophy of John Dewey. Project-based learning method received initial purpose in design of educational activities due to various developments that took place in the advent of 20th century and in the modern times of 21st century (Jumaat et al., 2017). Learning is a social activity, and teaching methods can rely on students' prior knowledge and experiences while maintaining a focus on community and student's participation in it (Humphrey et al., 2020; Lithgow, 2011). Due to increasing technological innovations and widespread of global society, it is important to prepare students not only to think about new information, but to engage in practical tasks that will guarantee students' successful participation in later, increasingly international workspace. Rising approval of scientific community towards cognitivist and constructivist view on education has brought significant changes in way education is organized and offered to students (Bates, 2019). These improvements are nowadays perceived as modern educational environments, and they often follow the project-based learning as popular thought behind the concept of this modern education. The field has recorded evidence in which project-based learning proves to be beneficial to learners in higher educational programs. A study (Ralph, 2016) that reviewed fourteen educational programs who had adopted project-based learning in STEM education found that project-based learning increased the development of knowledge and skills of participants who in addition felt encouraged in their collaboration within the group. Additionally this study also reported that some students experienced a lack of motivation for groupwork.

There exists a continuing lack of consensus amongst the scholars on what must be present in a classroom for it to be considered a project-based learning classroom (Condliffe et al., 2017). Therefore this literature review aims to reflect on popular opinions and relevant articles that intend to familiarize the concept of project-based learning in practice. Researchers often focus on effects of project-based learning in higher education by placing focus on learners' knowledge, strategies, and skills which are usually examined through self-reported questionnaires, rubrics, tests, interviews, observation, self-reflection journals, and artifacts, however these studies also measure student's perceived benefits of project-based learning which results in difficultly interpretable findings (Guo et al., 2020).

Thomas (2000) stated that there are five criteria which can be employed in order to define what one project needs to contain in order to be placed under project-based learning concept "...five criteria are centrality, driving question, constructive investigations, autonomy, and realism.". In project-based learning projects present the teaching strategy and serve much like curriculums, this means that students encounter and learn the central concepts of the discipline via the project, and not that project serves as supportive activity to instructive teaching (Thomas, 2000). Furthermore project-based learning projects must be relevant and engaging enough for the students and must spark the drive towards exploration of central concepts of the discipline (Thomas, 2000). The main activities of the project within project-based learning must involve the transformation and construction of knowledge for the students involved (Thomas, 2000). Project-based learning projects must be student-driven and not instructed by others involved in education and they must facilitate usage and further development of existing knowledge (Thomas, 2000). Lastly, projects must be authentic and provide feeling of real-life experience for participating students (Thomas, 2000).

Krajcik & Blumenfeld (2005, p. 318) in their book on project-based learning stated that:

> Project-based learning is an overall approach to the design of learning environments. Learning environments that are project based have five key features:
>
> 1. They start with a driving question, a problem to be solved.
>
> 2. Students explore the driving question by participating in authentic, situated inquiry - processes of problem solving that are central to expert performance in the discipline. As students explore the driving question, they learn and apply important ideas in the discipline.
>
> 3. Students, teachers, and community members engage in collaborative activities to find solution to the driving question. This mirrors the complex social situation of expert problem solving.
>
> 4. While engaged in the inquiry process, students are scaffolded with learning technologies that help them participate in activities normally beyond their ability.
>
> 5. Students create a set of tangible products that address the driving question. These are shared artifacts, publicly accessible external representations of the class's learning.

More recent studies on structure of project-based learning argue that there are many substantial differences across disciplines, educational levels and contexts. Furthermore recent studies argue that there are different ways to implement project-based learning and multiple design decisions to be undertaken by the instructor in order to maintain successful implementation of project based learning. (Sindre et al., 2018)

Sindre et al (2018, p. 155) characterize project based learning as reflective of following components: teaching context; range of implementation; learning context; institutional context; personnel composition; assessment; project variety; degrees of freedom of the project; degrees of freedom in deliverables. Having established that project-based learning designs are multidimensional, Sindre et al (2018, p. 160) conclude that "choice along one dimension typically has a positive or detrimental effect on another aspect". This means that project-based learning designs should essentially be adaptable to the context of the educational setting.

Project activities within project-based learning can serve students of different academic levels by placing learning in a context that provides each student with a certain meaning of the activities. These projects are open to accept students of different intelligences and learning styles while providing variety and options to students can increase student motivation in pursue of individual talents or interests (Chen, 2019; Fleming, 2000).

Project-based learning through prism of educational frameworks

Project-based learning is performed by groups of students. In such group work, collaboration takes place and important role. PISA framework has deemed collaborative problem-solving skills as a critical skillset used both in education and in the labor market. Collaborative problem-solving provides individual students with a chance to exchange their opinions, knowledge and understandings towards final problem solving. The competencies which are assessed in the PISA 2015 collaborative problem-solving assessment are used to reflect the skills found in project-based learning. In both educational and professional settings, students are expected to be proficient in variety of skills including: communicating, managing conflict, organizing a team, building consensus and managing progress (*OECD*, 2017). In addition to PISA framework which recognizes the importance of project-based learning in development of student's skillset, another framework has emerged in 2016 at the Buck Institute for Education, The High Quality Project Based Learning Framework. This learning framework fundamentally spans over six criteria: Intellectual Challenge and Accomplishment, Authenticity, Public Product, Collaboration, Project Management, and Reflection. The HQPBL framework mandates at least minimal presence of all six fundamental criteria in a project for a project to be judged "high quality", while it is important to remember that high quality project-base learning is not easy to realize in practice (Arshavsky et al., 2017; Mergendoller et al., 2006).

Some teachers do not fully understand their role in project-based learning, as scientific field has not reached the consensus on the level in which teachers should interfere with the project-based learning activities of their students (Aksela et al., 2018; Blumenfeld et al., 1991). In further explanation of

HQPBL framework, Mergendoller er al. (2006, p. 54-56) explain the role of the teacher in context of HQPBL learning framework as following:

> HQPBL teachers know that lectures and class discussions are sometimes the best way to clarify a problematic concept or covey an important skill, and they constantly monitor student learning and the difficulties that arise during project work. This allows them to address student confusion and learning hurdles in real time. In addition, before launching a project, HQPBL teachers assess the skills and knowledge necessary for project success, and determine how to prepare students before the project begins and/or provide lessons and other scaffolds once the project starts. To use a common simile, the role of the HQPBL teacher is like that of a coach, building skills and confidence through example and instruction.

A study on the relationship between student teams composed of different personalities and academic performance according to the Five Factor Model (FFM) has shown that personal characteristics and educational effectiveness are not significantly related for an individual while the educational effectiveness in project-based learning activities is highest when a team is composed of students with management and anchor types without leadership types (Sunaga et al., 2017).

Since project-based learning has a role of preparing students for the labor market challenges it is important to consider the role that business and organizations play in the design of project-based learning (*OECD*, 2017). Organizational learning is considered to be the process of creating, retaining, and transferring knowledge within an organization by which this organization achieves further success (Argote, 2013; Saadat, 2016). It has been widely promoted that the concept of "organizational learning" presents a solution for organizational development in companies requiring high level of technological knowledge, which is one of the 21st century skills concepts. The concept of organizational learning can be seen in project teams, and types of organizations which organize work in project teams can be called "project" based organizations (Law & Chuah, 2004; Saadat, 2016). A framework for action learning reflecting on project-team action learning has been designed in order to facilitate teams with both a challenge on which team should work and the learning environment. In this PTA learning framework both project and learning goals are the considered as initial blocks of the framework. HBO-i Domain description 2018 is a framework for undergraduate of science programs in Information and Communication Technology programs at Dutch universities of applied sciences. This framework includes perspective of the work field and educational professionals and institutional representatives. This profile and framework has also been established in such a way that it allows each school to determine how a study program can best be designed to match the needs of the specific region in which school is producing the new professionals (Vonken et al., 2018).

Vonken et al (2018, p. 6) further specify importance and fundaments of HBO-i Domain description as:

> The HBO-i domain description is a national framework for the final qualifications for graduates of Dutch programmes for higher professional education (hbo) in the ICT domain at an Associate, Undergraduate and Professional Master degree level. The domain description is maintained by the HBO-i foundation. Related to and inspired by international developments, frameworks and formats, the domain description is periodically updated in collaboration with the business community and is established by The Netherlands Association of Universities of Applied Sciences.

The HBO-i domain description framework encompasses the professional skills segmented into four areas of interest: future-oriented organization, investigative problem solving, personal leadership and targeted interaction (Vonken et al., 2018). The four areas of interest of the this framework are considered the same for all assignments, and ideally should be satisfied in all student activities (Vonken et al., 2018). One of the four areas of interest is investigative problem solving which Vonken et al. (2018) explains as: (students) critically consider ICT assignments from various perspectives, identify problems, finding an effective approach and coming up with appropriate solutions; Being able to methodically and creatively solve problems, finding alternatives and critically analyzing own and others' line of reasoning. Furthermore, an area of interest targeted interaction is explained by Vonken et al. (2018) as: (students) determine which partners play a role in the ICT assignment, constructively collaborate and fitting communication aimed at achieving the desired impact.

Online project-based learning

Online learning environments require reconstruction of student and instructor relationships and roles. It has been shown that online environment has influence on student's learning experiences and outcomes. It is therefore important to prepare students for active role in collaboration they perform in traditional and online classrooms. Students who participate in online learning feel the need for the presence of instructor, a persona who matters on the other side and pays attention to learners progress and provides help when needed. It is therefore important to stress out the importance of the teacher's role in online learning (Martin & Bolliger, 2018). Active learning relays upon teacher's understanding of student emotional state as well as their persona during online learning. Such stance is beneficial to student's learning experience. Both instructor support as well as peer support have proved beneficial for learning achievements (Adedokun & Carleton Parker, 2017; Vonderwell et al., 2005). Online project-based learning aligns the goals of the 21st-century learning (Spector et al., 2016; Thomas,

2000). Tools of online education provide students with access to information, regardless of their location. This enables the students to have continuous access to the learning resources and continuously engage in their learning activities. 21st century in its beginnings is a time of rapid development of mobile technologies. Furthermore it has been found that significant percentage of the university level students use mobile phones not only for communication but also getting information by browsing the Internet and consequently sharing their knowledge anytime they are involved in project-based learning activities with others (Davison et al., 2015; Klimova et al., 2017; Utulu, 2012). Since online education and collaboration can encompass many different online tools, it is unfortunately so that researches have recognized physical limitations of mobile-phone usage in terms of usability since not all applications have same format and possibilities cross platform. However recent studies have shown that smartphones despite having more limited viewscreen have the same level of perceived usability amongst the students (Pal & Vanijja, 2020). Learner-to-learner interaction is very valuable for online learning as it could enhance student engagement and prevent students from boredom and isolation within learning environment. Activities aiming at engagements will help students to generate feeling of being connected to the community of learners (Martin & Bolliger, 2018). Usage of mobile phones is often very connected with usage of social media which plays a role in student's perception of learning outcomes when employed in educational activities. In similar setting a group-wide se proves also beneficial to student's perception of the learning outcomes. Therefore arguments that social media has positive effect on project group communication when employed in learning context are true (Joseph Agbo et al., 2020). The increasing use of digital environments for project-based learning activities contribute to erasing the boundaries between school and out-of-school activities. PISA 2021 framework has further made a difference in its assessment between students' use of ICT during school days and in the weekends, and between the location where ICT usage is performed. OECD 2021, in recent issue of PISA framework findings argues that the development of innovative pedagogical approaches, (e.g. project-based learning) facilitated by various educational technologies "might facilitate learning by doing, foster students' engagement and motivation, and help students develop problem-solving skills by putting students in various novel situations and encouraging them to adopt different perspectives".

Studies have reported that online project-based learning has popularity amongst students, with main relation being put between relevance, reflective thinking, interactivity, tutor support, peer support and interpretation, consequently it has been affirmed by the field that hard and soft skills can be well facilitated by online project-based learning (Sulisworo & Santyasa, 2018). The frequent challenge in implementation of project-based learning lays amongst the teachers and instructors who need guidance in implementation and design of project-based learning (Aksela et al., 2018).

When designing project-based learning activities, it is important to stress out importance of maintaining cultural sensitivity, as the studies have shown that project-based learning has beneficial

outcomes for students, but that students' perceived benefits vary and are related to students' cultural background (Barak & Yuan, 2021). Recent study from Poland has reported that medical students who were engaged in traditional classroom learning before Covid-19 pandemic and were subjected to online learning experienced that they are less active during online learning, compared to traditional learning. While assessing online learning as less effective in building skills, majority of students has characterized online learning as enjoyable (Bączek et al., 2021). Students who have previously engaged in collaborative learning resulting with unsatisfactory experiences are likely to be influenced by these experiences and form predisposition towards groupwork therefore by including strategies for effective group work regulation instructors may achieve increased student engagement in collaborative processes (Noguera et al., 2018). A weak division of work in project group will enable learning more efficiently than a strong division of work in project group, implying that the communal work on all tasks together, versus individual work on tasks will provide greater gain to all members of the project group. Furthermore, interaction amongst members sets good chances for combined collaboration and cooperation while enabling knowledge exchange (Rongbutsri, 2017). Online learning tools through which online project-based learning would take place should employ new and innovative technologies in order to enhance student's learning. Studies have shown that visualization (e.g. study progress) can be employed in order to motivate students and increase their level of awareness of their progress (Jin, 2017).

Rongbutsri (2017, p. 3) in his research on online collaborative tools in project-based learning classifies three main types of tools as: “tools for general POPBL requirements, tools for newly emerged requirements and professional tools”. In his further segmentation of three main types, Rongbutsri (2017, p. 4) states:

> These educational tools are classified into two kinds: professional and personal. A professional tool is multi-purpose software or groupware; it is complex, expensive and designed for an activity rather than a small task; students can employ a professional tool only if it is provided by their institution. A personal tool has limited scope and is designed for a single purpose; it is easy to use and is accessible from different platforms and devices; it is usually available on free subscription and incorporates entertainment functions; this study reveals that personal tools have displaced professional tools in the context of education.

Dynamic learning can be promoted by using various online educational tools which aim at synchronous and asynchronous educational activities (Lima et al., 2020). Consequently it is important to promote proactivity amongst students in higher education since proactivity on individual level has a relatable impact on internet self-efficacy of students followed by well online interactivity (Zheng et al., 2020).

Project-based learning at Fontys University of Applied Sciences School of ICT

Didactical model of education at Fontys University of Applied Sciences School of ICT (FHICT) is organized under influence of SOO model (Students Near Education). The SOO model is an educational design model that is carefully designed to complement the vision of FHICT, the so called "Student Near Education". The SOO model aids designers of learning at FHICT towards development of education that is familiar and “close” to students. The SOO model is based on the ADDIE model. The ADDIE model represents a generic process employed by instructional designers. This model contains five phases—Analysis, Design, Development, Implementation, and Evaluation—which aim at dynamic, flexible guideline for designing effective teaching and performance support educational tools.

In its policy catalogue FHICT (2021, p. 1) states that it organizes a undergraduate program in Information and Communication Technology that aims at offering broad and innovative educational program to all students on their way to becoming professionals:

> FHICT trains ICT professionals at higher vocational education level, who are able to function effectively and efficiently both professionally and independently and in a team context. FHICT offers its students the opportunity to develop optimally into professionals who are able to direct their own development. FHICT thus meets the requirements of the professional field and society. FHICT offers talent-oriented education; the individual student is our target group! We offer every student a tailor-made study, where we focus on what the student wants to become good at or even better. Education stimulates qualities, talents and ambitions. In education, students are motivated and coached to be entrepreneurial and investigative.

FHICT holds a social constructivist view of learning focusing on the dialogue between students, teachers and towards creation and learning. FHICT furthermore maintains to the international context in its education (FHICT, 2021). FHICT furthermore stimulates students to think about a problem individually or in groups, and to discover and learn through experimenting and investigating. FHICT designs programs in which students acquire knowledge by linking it to existing prior knowledge, which is considered as active knowledge creation that leads to increased motivation and learning (FHICT, 2021).

FHICT undergraduate program is based on professional practice through projects (called "proftak") which offer the simulated professional practice to students as central part of each semester and they connect teachers, students and external parties (companies) (FHICT, 2021). In its policy catalogue, FHICT (2021, p. 1) narrowly defines importance of projects within its educational program:

> At FHICT, the professional task occupies a prominent place in the educational environment. An authentic assignment, which preferably comes straight from professional practice - but can also be simulated at the start of the training - challenges the student to learn. Students work together in teams to acquire the knowledge and skills that are central to that semester in an integrated manner. In addition, the professional task is pre-eminently the environment in which the student develops into an ICT professional.

FHICT undergraduate program is segmented in such a way that it has four major modes of studying and teaching: course based learning, demand based learning, research based learning and open learning. Differences between these four major modes of study span across different points of view on teaching and learning. Differences can be based on learning form, there may be differences in test forms, the role of feedback and studies can vary in level of student dependence with independent vs. learning path-dependent assessment. Furthermore the type of supervision may differ between four major modes as well as the degree of self-direction on side of students (FHICT, 2021).

COVID-19 pandemic has global dimensions and has influenced educators to pay attention to usability of tools used by their students for purpose of online learning, this usability is therefore an important factor in providing effective and useful online learning activities (Pal & Vanijja, 2020). In the academic year 2020/2021 due to COVID-19 pandemic, Dutch government has prohibited traditional mode of education, by which Fontys students and staff needed to engage in fully online mode of education. At the moment of writing this thesis, it is still not certain when government installed measures for higher-education institutions will cease to exist. Besides students in the Netherlands, students from across the world have faced transition from traditional classroom teaching to online teaching as a consequence of global spread of COVID-19 pandemic. The researchers have set forces to explore and document this transition from perspective of students, but also parents and educational institutions (Bataineh et al., 2021; Bokayev et al., 2021; Teixeira & Zapata-Ros, 2021).

However, future prospects of online education might be experiencing the very own revolution that might result with increased awareness of online possibilities for education of the future generations, as StAmant (2021, p. 359) in its article on remapping the global context for online education states:

> Every challenge presents an opportunity to reflect, explore, and create. As more individuals around the world gain online access, the challenges for educators teaching in online contexts will only grow. It is an environment of continual opportunity for educators across all disciplines and institutions.

Research question

The focus of the study is perception of undergraduate level students at Fontys University of Applied Sciences School of ICT towards online project-based learning, by examining their satisfaction with the online mode of study and exploring their perspectives and experiences with online tools employed in online project-based learning as well as their perceived successful learning in online project-based learning mode. Furthermore, focus will be paid to main components of project-based learning as defined by Sindre et al. (2018) with relation to online setting of the education and possible COVID-19 interference with students performance: teaching context; range of implementation; learning context; institutional context; personnel composition; assessment; project variety; degrees of freedom of the project; degrees of freedom in deliverables.

Methodology

Methodology chapter explains the research component of this master thesis. This chapter contains writings on participants in the study and the types of materials and tools employed during the research. Furthermore this chapter explains which data were collected, manner in which this data was collected as well as the methods of data analysis.

The research performed during this master thesis is defined as mixed methods research which stands for conducting research involving collection and analysis as well as integration of quantitative and qualitative research (Creswell, 2018). Mixed method research was employed in this master thesis due to three main reasons. First reason was ensuring that this thesis will understand contradictions and imparities between quantitative results and qualitative findings (Creswell, 2018). These imparities were expected due to time constraints and the fact that researcher has been employed as a teacher for many of study's participants which potentially could lead to student's not expressing their complete opinion. Another reason and justification of this method choice is it's potential to reflect participants' point of view. Third reason is that mixed methods give a voice to students who participate in this study while ensuring that study findings are grounded in students' experiences. The instrument used for the quantitative part of this research is online survey. The instrument used for the qualitative part of this research is online interview with students.

The choice for online survey as research instrument was made due to good accessibility of online surveys for the students and because results of survey allow comparison between subgroups such as students of different semesters (Ravitch & Carl, 2015). Online surveys required no physical contact between researcher and students. This was important due to COVID-19 restrictions. In addition to online questionnaire survey another instrument was used as well, interviews with students. The mode of attendance in this interview is also online, with no physical contact due to same reasons previously mentioned.

Research design

Research design of this master thesis complies with triangulation research design. Specifically a subtype of triangulation, data triangulation will be employed. Data triangulation stands for the use of a variety of data sources in a study (Ravitch & Carl, 2015). Results of such research can be corroborated and potential weaknesses in the data can be compensated by the strengths of other obtained data, resulting with increasing the validity and reliability of the results (Creswell, 2018). The justification of this choice lies in the fact that this research has been conducted in relatively short

period of time with students who have little to no experience with participation in such studies. In order to eliminate potential limitations of data obtained through only one method, this master thesis seeks to rely on results from three basic resources: literature research, online survey and online interviews.

While triangulation research design in this master thesis has been employed for the elimination of potential flaws in results from one method, the main purpose of triangulation in this research is not necessarily to cross-validate data obtained from either literature research, online survey or online interview but rather to capture different dimensions of the same phenomenon, which is the perception of undergraduate level students towards online project based learning during COVID-19 pandemic.

Online survey consists of two sections. First section is collecting basic information about student respondent and is measuring satisfaction, gathering information about use of MS teams, Canvas LMS and social media as mandatory tools used at FHICT. Second section measures students satisfaction with teaching context ; range of implementation; learning context; institutional context; personnel composition; assessment; project variety; degrees of freedom of the project; degrees of freedom in deliverables. These questions are represented as Likert scale items. When responding to such questions students will be able to specify their level of agreement or disagreement on a symmetric agree-disagree scale by which this research is able to capture the intensity of their feelings for each question (Burns & Burns, 2008).

Qualitative interview is employed to gather answers to open questions focusing on four main components: students perception of online-project based learning, students perceived learning success in online-project based learning, students usage of mandatory online tools, students usage of self-selected online tools. These questions will be administered through MS Forms software in written form.

Population and sampling

The subject of this study are undergraduate students of Fontys University of Applied Sciences School of ICT, enrolled in bachelor level program in Information and Communication Technology. These students are enrolled as full-time students in academic year 2020/2021, actively participating in educational activities organized in spring semester 2020/2021 academic year. Students under study are aged 17 years old and above, with most of population being between 17 and 23 years of age. Students involved in this research follow different major programs at FHICT, and participate in either course based, open learning or demand based mode of study, organized in English language. All participants in this study speak at least one foreign language in addition to English language. Both

survey and interviews are to be conducted in English language. Participants are of various educational, ethnical, cultural and religious background. All participants of this study are to obtain undergraduate diploma upon completion of their study. All participants of this study are engaged, or were engaged in online learning as alternative to traditional learning, imposed by Dutch government in 2020 and 2021.

The population size is the total number of students at FHICT enrolled in English-taught undergraduate program, is approximately 1000 students in total with 811 students being enrolled in course-based mode of study, the major mode of study in spring semester of 2021. The sample of this population size was set to be maximally 150 students, with minimum of 100 students participating in this research being acceptable for the goal of meaningful result for this study. For the qualitative part of the research a sample size of 10 participants was set. Sampling technique used is non-probability sampling for both qualitative and quantitative part of the research. Voluntary response method was used for sampling student respondents in quantitative part of the study, the online survey. Quota sampling method was used for sampling student respondents in qualitative part of the study, the interviews.

Data gathering and analysis

Online survey was designed with MS Forms online tool, which provided possibility for creation of self-administered online questionnaire survey. The survey has been sent to undergraduate students of Fontys School of ICT enrolled in 2020/21 academic year in English-taught program either by e-mail to their official student mailbox, or through announcements portals and newsletters of official student organizations. Additionally, a notification through Canvas learning management software was sent to all students enrolled in first semester of undergraduate studies, as well as students enrolled in second, third and fourth semester of undergraduate study with major in media design.

Online interviews were performed through MS Forms in form of online self-administered interview. Upon selection of student participants, and invitation was sent to students by e-mail with hyperlink to MS Form in question. Once completed, interviews were saved on MS Forms platform/ Upon completion of data gathering a qualitative inspection of gathered material was performed to assure high quality data.

For the statistical analysis of survey, MS Forms online survey tool provides designers of online tools with built-in automated analysis of obtained data. These analyses are represented in formats such as graphs, pie charts and calculations of median, mean and average for designated questions. Additionally MS Excel analysis tools were used to expand the range of analysis when specific

relations were needed to be drafted. The quantitative analysis was descriptive, with measurements of frequency, central tendency, dispersion, variation and position (Creswell, 2018).

Qualitative analysis of online interview materials was performed according to inductive method. A type of inductive qualitative analysis performed was narrative analysis, used to point out important aspects of respondents' stories and highlighting of critical points obtained from literature and quantitative research (Ravitch & Carl, 2015).

Results

Results of quantitative research

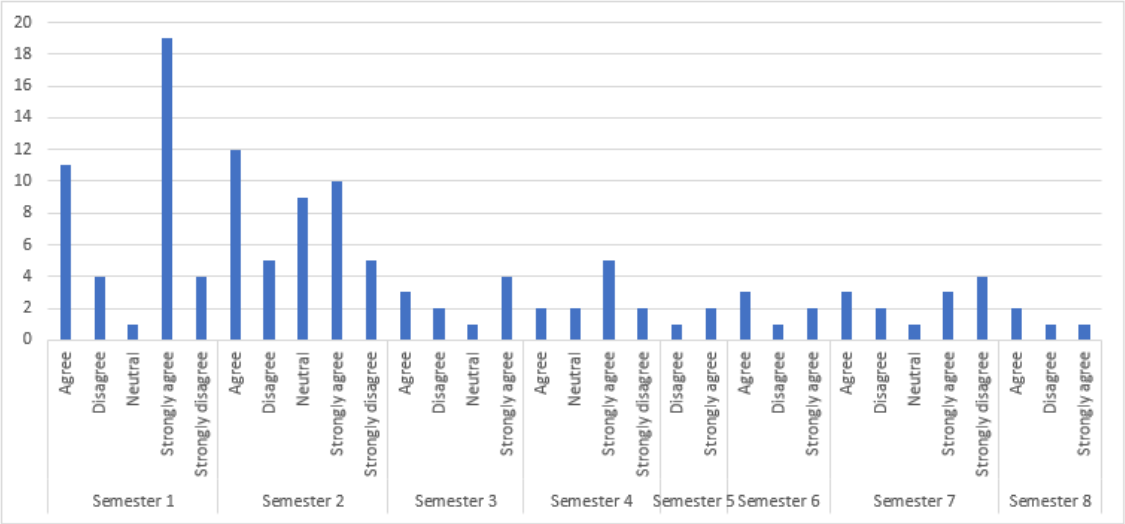
Quantitative research has been conducted by means of an online survey created on MS Forms platform and distributed amongst students of Fontys School of ICT by several online channels. Survey received 129 responses. Although the survey has been distributed amongst all students who attended English taught undergraduate programs, significant turnout was seen amongst students of first (39 responses) and second (41 responses) semester, while students of higher semesters submitted smaller numbers of responses. Respondents have mainly completed their previous studies at some of EU based schools (88 responses) followed by previous studies completed at non-EU European countries based schools (23 responses), while a small number of students completed their previous studies in countries of other continents. Majority of respondents were students between the ages of 18-24 (107 responses) followed by ages of 24-30 (13 responses) and a total of nine students with age under 18 or 30 and above. Majority of respondents identified as males (83 responses) followed by female (43 responses) and three students who identified as either nonbinary or 'prefer not to say'. 98.45 percent of students who responded have participated in project-work during 2020/2021 academic year and 92.26% of respondents performed their projects online instead of traditionally at school building.

Questions 8 and 9 of the survey were designed as Likert scale questions with possibilities to share perception on given statements as: strongly disagree, disagree, neutral, agree and strongly agree. For analysis statements strongly disagree and disagree were joined as disagreement and statements agree and strongly agree were joined as agreement while statement neutral remained singular.

When asked if they have experienced difficulties in transition from working on group-work/project-work at school to working online, 36,4% of respondents expressed disagreement, 42,7% of respondents expressed agreement with the remaining 20,9% of respondents being neutral. Tendency to 'strongly' agree with this statement is present amongst semester one students as well amongst semester 2 and higher semester students respectively.

Figure 1

Students from semester one have experienced more distraction in online learning

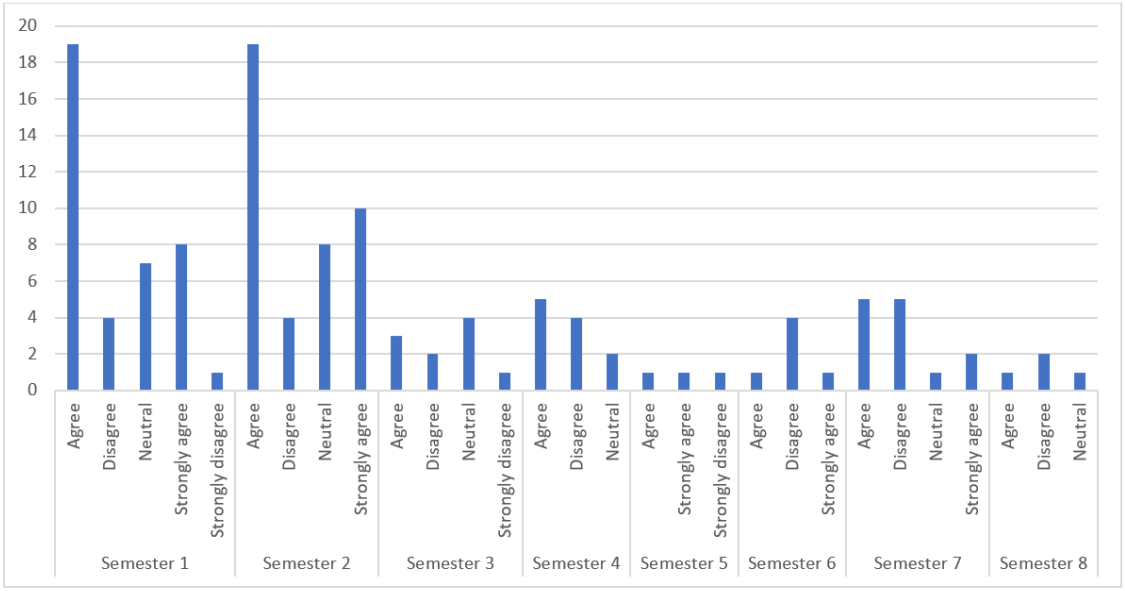


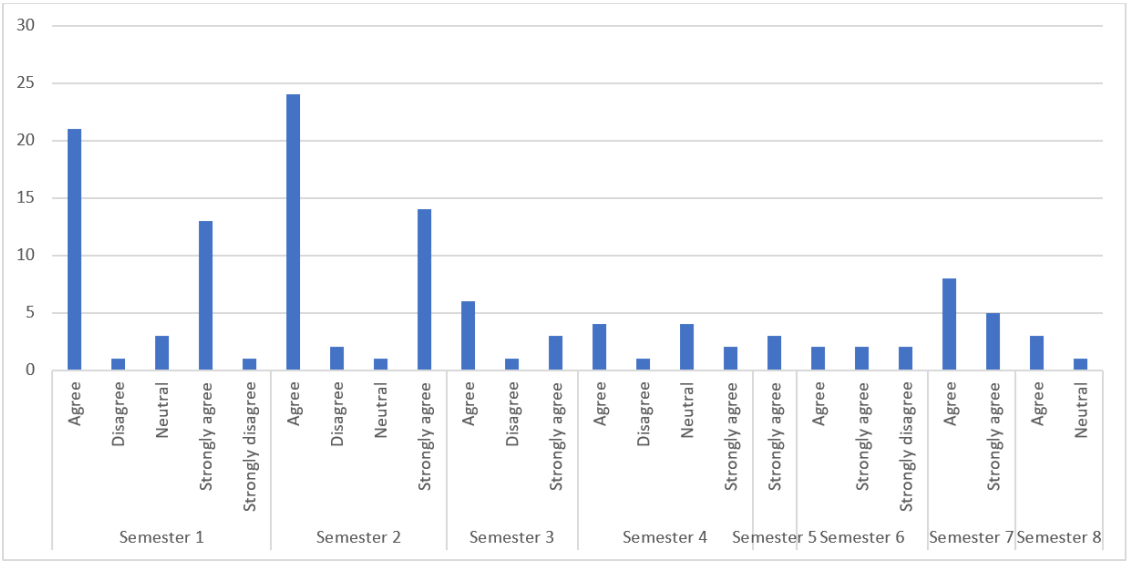
Responses on inquiry if they were sufficiently informed about the situation and transition to online learning by my teachers and the school, 17,8% of respondents expressed disagreement, 66,6% of respondents expressed agreement with the remaining 25,6% of respondents being neutral. On a similar note when asked if their teachers and Fontys provided them with sufficient amounts of online tools and environments in which they were able to follow their online education, 15,5% of respondents expressed disagreement, 61,2% of respondents expressed agreement with the remaining 23,3% of respondents being neutral.

In the statement that the Canvas learning environment was suitable for online learning, 23,2% of respondents expressed disagreement, 59% of respondents expressed agreement with the remaining 17,8% of respondents being neutral. Continuing exploration of tools, on the question if MS Teams was a suitable tool for online meetings and classes, 7% of respondents expressed disagreement, 86,1% of respondents expressed agreement with the remaining 7% of respondents being neutral. Tendency for agreement is dominantly expressed by first semester students but also by second and higher semester students as shown in Figure 2. In order to contextualize this finding, it is worth noting that these students have already collected experiences with this learning management system during their previous semester.

Figure 2

Students agree on suitability of Canvas LMS (first) and MS Teams (second)

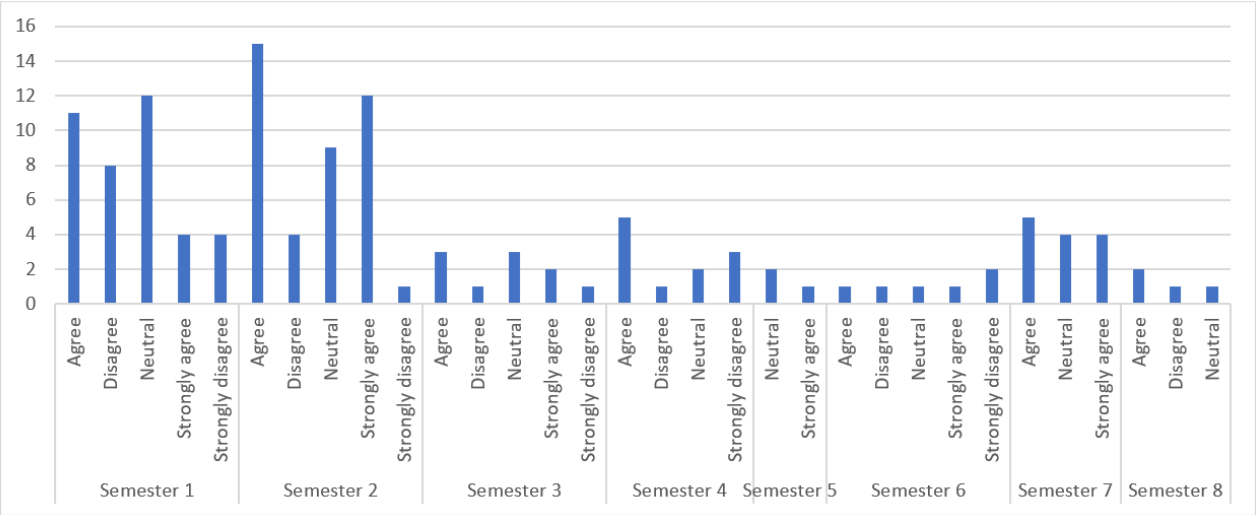




When asked if they were satisfied with the online collaboration of their project group (or assignment group), 21,7% of respondents expressed disagreement, 51,2% of respondents expressed agreement with the remaining 27,1% of respondents being neutral. Agreement has been strongly confirmed by semester two students as shown in Figure 3, while semester one students have experienced less satisfaction with online collaboration of their project group.

Figure 3

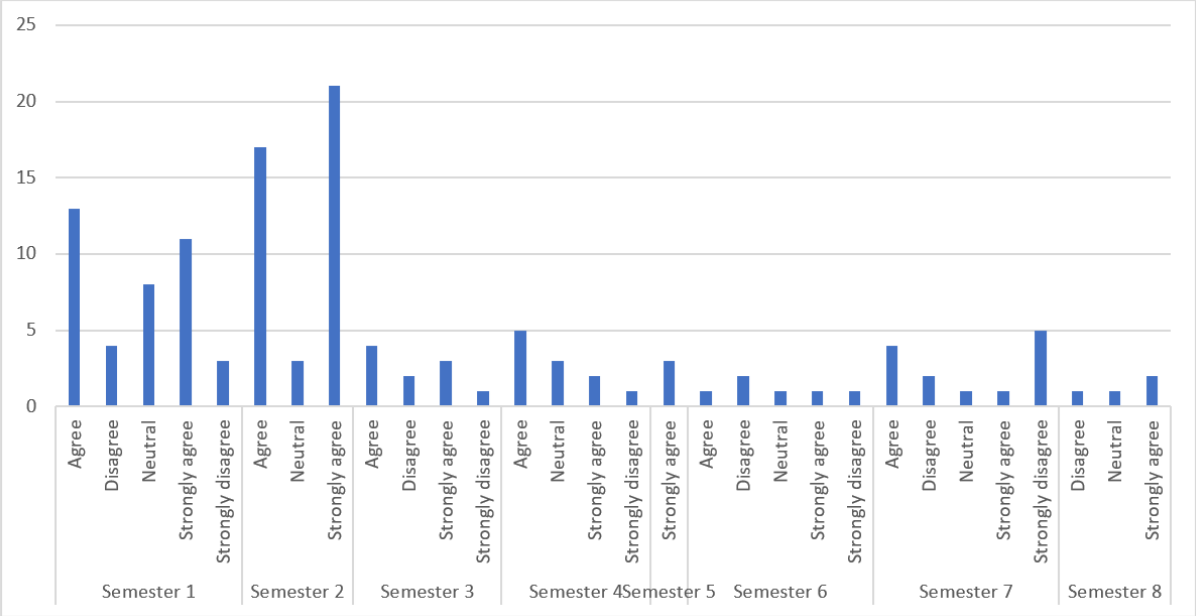
Semester two students are dominantly satisfied with online collaboration of their project group



Inspection of usage of social media in project work through question if they have used social media such as WhatsApp to communicate about project work and deliverables with their group members, 36,4% of respondents expressed disagreement, 42,7% of respondents expressed agreement with the remaining 20,9% of respondents being neutral. Unexpected results were following when asked if Social media was important for their group communication, 10,8% of respondents expressed disagreement, 82,2% of respondents expressed agreement with the remaining 20,9% of respondents being neutral. In order to contextualize this finding, it is worth noting that some students have employed different social media than WhatsApp and Facebook for their internal communication. Amongst students from semester one dominant majority who agreed on suitability of MS Teams has affirmed the role of social media importance for group communication, see Figure 4.

Figure 4

Importance of social media for communication amongst semester one students



When asked if their group sufficiently used online tools to stay organized, 12,5% of respondents expressed disagreement, 62% of respondents expressed agreement with the remaining 25,6% of respondents being neutral. Similarly, when asked if online tools helped their group in communication and staying organized during online education, 10,9% of respondents expressed disagreement, 65,9% of respondents expressed agreement with the remaining 23,3% of respondents being neutral.

Importance of online tools was affirmed through the question if online tools played a significant role in overall success of their group during online education, 13,2% of respondents expressed disagreement, 71,4% of respondents expressed agreement with the remaining 15,5% of respondents being neutral.

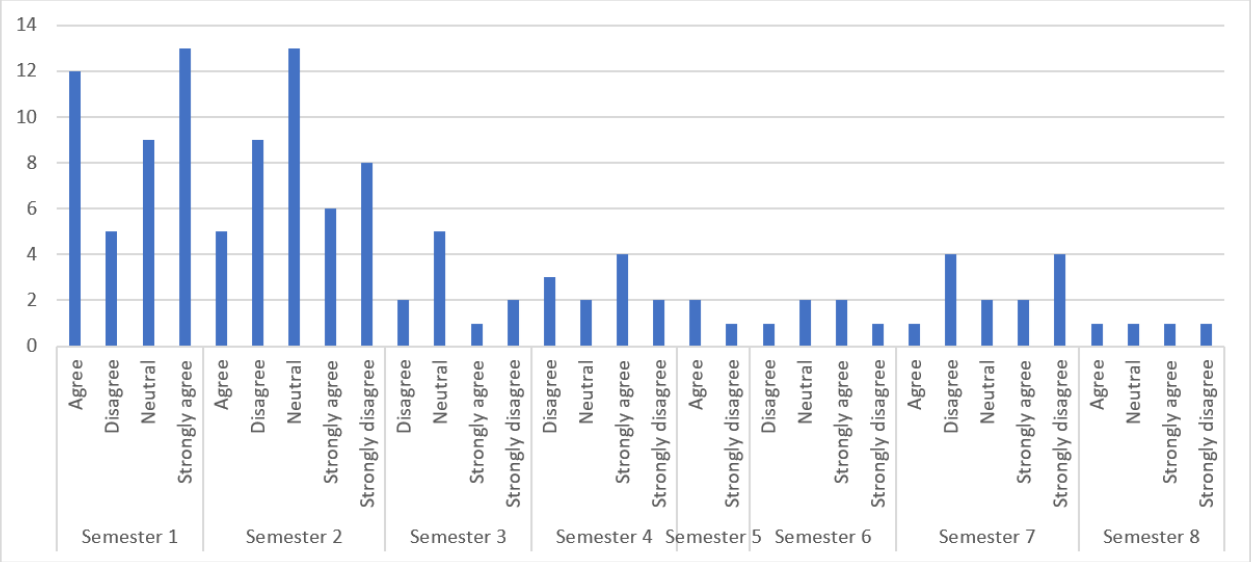
When asked if they were satisfied with communication within their group in online work, 24,9% of respondents expressed disagreement, 55,8% of respondents expressed agreement with the remaining 19,4% of respondents being neutral.

As further research has shown communication played a key role in group success, which was on similar note connected also through results of question if they have felt during online group work at least once like they needed to do more work compared to group work in a traditional setting, 25,6% of respondents expressed disagreement, 40,4% of respondents expressed agreement with the remaining 34,1% of respondents being neutral. A slight shift towards even distribution of perceptions occurred when asked if they often feel like they need to do more work in online group work compared to group work in a traditional setting, 33,4% of respondents expressed disagreement, 34,9% of respondents expressed agreement with the remaining 31,8% of respondents being neutral.

Asked if they felt more difficulties in maintaining contact with their group members during online group work compared to that in a traditional setting, 33,3% of respondents expressed disagreement, 40,3% of respondents expressed agreement with the remaining 26,4% of respondents being neutral. As shown in Figure 5, students of first semester had more difficulties in maintaining contact with their group members compared to students of other semester. In order to contextualize this finding, it is worth noting that higher semester students might be more acquainted with their group members based on experiences from previous semesters, which is not the case for Semester 1 students.

Figure 5

Difficulties in maintaining contact with group members



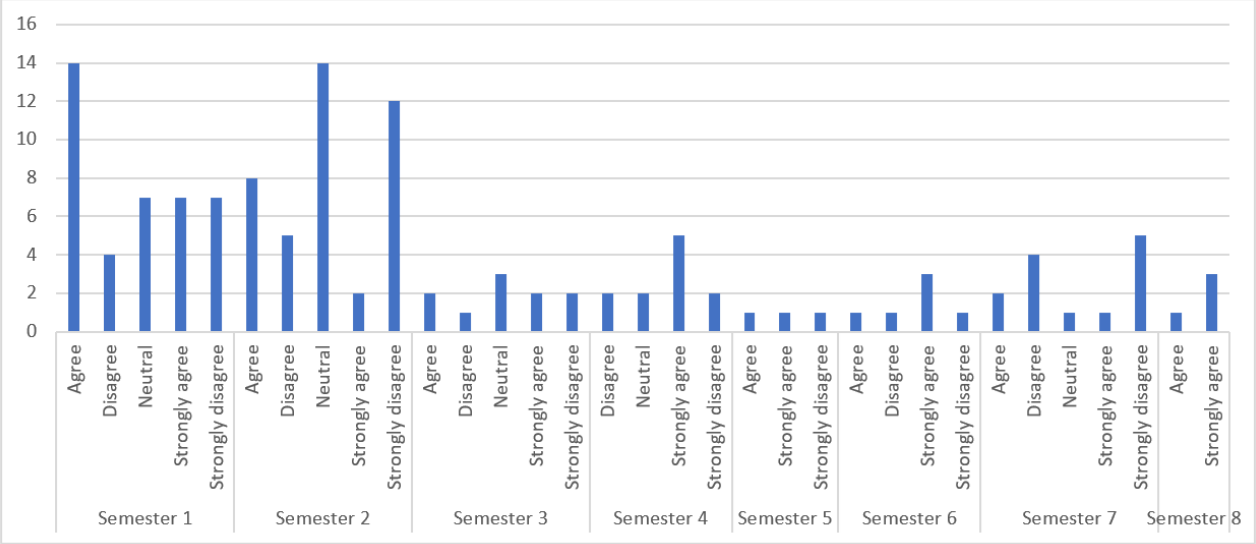
When asked if they felt less motivated to do their work during online group work compared to group work in a traditional setting, 33,3% of respondents expressed disagreement, 52,7% of respondents expressed agreement with the remaining 14% of respondents being neutral. In order to contextualize this finding, it is worth noting that results indicate the variety of experiences amongst students from all semesters with an important finding that majority of students felt less motivated during online group work.

Measuring students' independence by asking if they felt more dependent on teachers' help during online group work compared to group work in a traditional setting, 48,1% of respondents expressed disagreement, 24,8% of respondents expressed agreement with the remaining 27,1% of respondents being neutral. This finding shows that majority of students did not feel increased dependency. On a similar note when asked if they have done all they could do to maintain good performance and obtain good grades during online project work, 7% of respondents expressed disagreement, 76,7% of respondents expressed agreement with the remaining 16,3% of respondents being neutral.

Asked if they were good in organizing their own duties and tasks during entire online project work and remained on track, 19,4% of respondents expressed disagreement, 60,4% of respondents expressed agreement with the remaining 20,2% of respondents being neutral. When asked if online mode of study badly influenced their motivation to give their best during online project work, 36,5% of respondents expressed disagreement, 42,7% of respondents expressed agreement with the remaining 20,9% of respondents being neutral. In order to contextualize this finding, it is worth noting that especially amongst semester one students who have no previous experience with Fontys style of teaching, online mode of study seemed to badly influence motivation for excellence in school work as shown in Figure 6.

Figure 6

Online mode of study badly influenced students' motivation to give their best during online project work



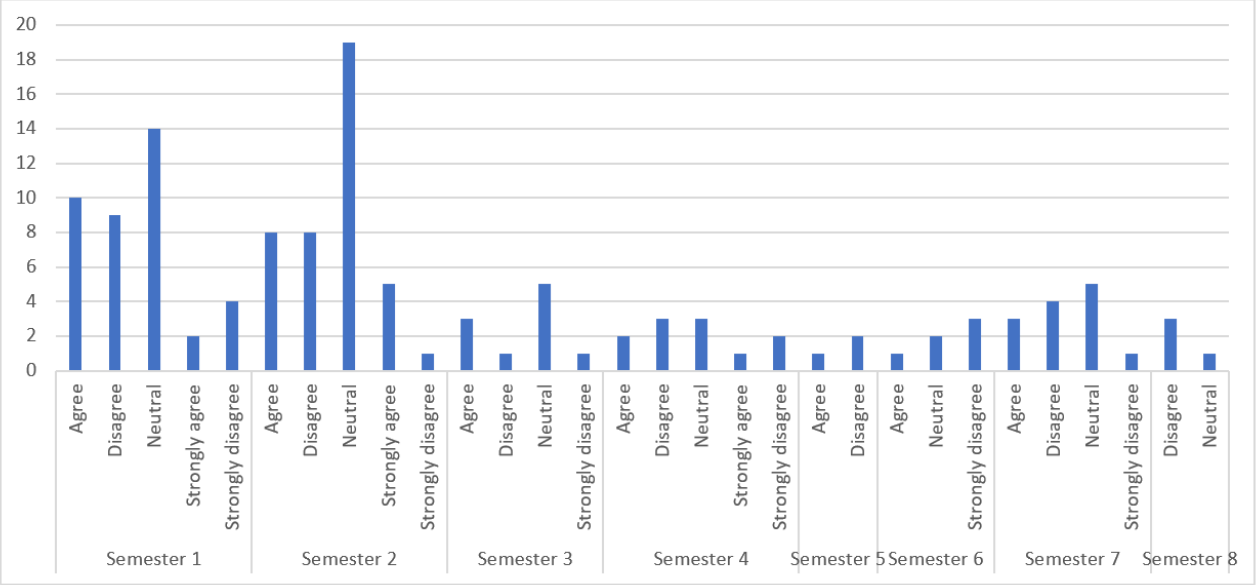
When asked if by having to work from home they experienced more distraction than they would have experienced at school, 24% of respondents expressed disagreement, 65,1% of respondents expressed agreement with the remaining 10,9% of respondents being neutral. Examining students' motivation towards study excellence, asked if Covid-19 pandemic made obtaining good grades less important to them than it was before, 45,8% of respondents expressed disagreement, 35,7% of respondents expressed agreement with the remaining 18,6% of respondents being neutral.

When asked if during online education they felt more need for guidance, help and compassion from their group, 36,4% of respondents expressed disagreement, 42,7% of respondents expressed agreement with the remaining 20,9% of respondents being neutral.

On a similar note of the teacher's role, asked if teachers helped them well during online group work compared to group work at Fontys building, 22,5% of respondents expressed disagreement, 38% of respondents expressed agreement with the remaining 39,5% of respondents being neutral. When asked if during online education they felt more need for guidance, help and compassion from teachers, 24,1% of respondents expressed disagreement, 41,9% of respondents expressed agreement with the remaining 34,1% of respondents being neutral. These expectations have been met when asked if during online education they received more guidance, help and compassion from their teachers than before, 31% of respondents expressed disagreement, 40,3% of respondents expressed agreement with the remaining 28,7% of respondents being neutral. However a tendency for neutral opinion on this question has been prominently represented in answers from semester two students as shown in Figure 7.

Figure 7

Second semester students lean towards neutral opinion on teacher's input



When asked if they were satisfied with the results of online group work compared to group work at Fontys building, 27,9% of respondents expressed disagreement, 38,8% of respondents expressed agreement with the remaining 33,3% of respondents being neutral.

In order to contextualize this finding, it is worth noting that possibility for such evenly spread of results can be traced when asked if they felt that group performance was sometimes negatively influenced by lack of communication in their group, 31,8% of respondents expressed disagreement, 53,5% of respondents expressed agreement with the remaining 14,7% of respondents being neutral.

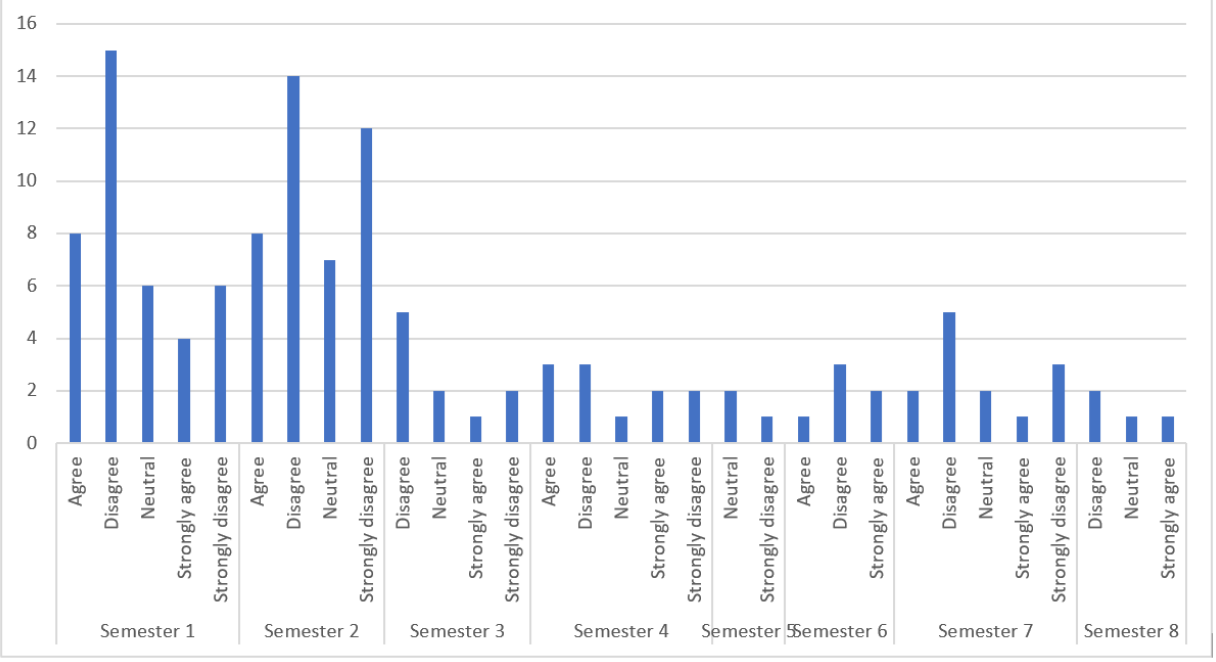
Students' previous knowledge was examined with a question if they felt that group performance was sometimes negatively influenced by lack of their knowledge of online tools and technology, 55,8% of

respondents expressed disagreement, 25,6% of respondents expressed agreement with the remaining 18,6% of respondents being neutral. When asked if they felt that group performance was sometimes negatively influenced by lack of other students' knowledge of online tools and technology, 47,3% of respondents expressed disagreement, 34,1% of respondents expressed agreement with the remaining 18,6% of respondents being neutral.

When asked if they sometimes felt invisible during online project work, 57,4% of respondents expressed disagreement, 26,3% of respondents expressed agreement with the remaining 16,3% of respondents being neutral. As shown in Figure 8, first semester students significantly disagree with feeling invisible during online project work. In order to contextualize this finding, it is worth noting that these results can be considered positive because these students are the only ones who engaged in online project work with people whom they have possibly never met before.

Figure 8

First semester students felt visible enough during online project work



When asked if they could not voice out ideas, questions, opinions, concerns during online project work, 62,8% of respondents expressed disagreement, 27,2% of respondents expressed agreement which has remained constant with the previous question. In order to contextualize this finding, it is worth noting that some students have participated in meetings and lessons without turning on the camera, microphone or actively showing their own active approach towards learning activities, which could result in them being less likely called out etc. The remaining 10,1% of respondents were neutral. Asked if they felt enough freedom to define their own path and scope of work in online

project/group work, 14% of respondents expressed disagreement, 61,3% of respondents expressed agreement with the remaining 24,8% of respondents being neutral.

When asked if they felt enough freedom to define their own deliverables in online project/group work, 13,9% of respondents expressed disagreement, 57,4% of respondents expressed agreement with the remaining 28,7% of respondents being neutral. Asked if they feel that they have learned enough from online project/group work, 24,8% of respondents expressed disagreement, 48,8% of respondents expressed agreement with the remaining 26,4% of respondents being neutral.

Once asked if they feel that they have been assessed and graded fairly for the work performed during online education, 14% of respondents expressed disagreement, 60,5% of respondents expressed agreement with the remaining 25,6% of respondents being neutral.

Asked if their teacher had enough technological skills and knowledge to provide them with good quality online education, 13,2% of respondents expressed disagreement, 70,6% of respondents expressed agreement with the remaining 16,3% of respondents being neutral.

Relating to teachers' input, asked if their teacher had enough technological skills and knowledge to provide them with advice on online tools which can be used, when needed, 10,9% of respondents expressed disagreement, 68,3% of respondents expressed agreement with the remaining 20,9% of respondents being neutral. Asked if they, after Covid-19 pandemic passes, would like to have a combination of online and traditional learning for the rest of their education, 32,6% of respondents expressed disagreement, 51,2% of respondents expressed agreement with the remaining 16,3% of respondents being neutral.

When asked if after Covid-19 pandemic they would like to have a short break from studying, 36,9% of respondents expressed disagreement, 46,6% of respondents expressed agreement with the remaining 18,6% of respondents being neutral.

Results of qualitative research

Qualitative research component of this master thesis has been separated in two separate data collection rounds. First data collection round occurred during collection of qualitative data, where respondents had a chance to express their views and experiences in the form of one open-ended answer with free form. 49,61% of respondents, or 64 of them have opted for submitting answers to this open-ended question, which resulted with seven A4 pages populated with text from their replies. Second data collection round occurred after the closure of qualitative research, where ten students

were selected to participate in online interview, through which they needed to provide their answer, in free form to four open-ended questions. Eight of ten invited students responded to invitation.

Qualitative analysis of online interview materials was performed according to an inductive method by using Taguette online software for both qualitative datasets. A type of inductive qualitative analysis performed was narrative analysis, used to point out important aspects of respondents' stories and highlighting critical points obtained from literature and quantitative research. Narrative analysis was performed on topical stories and obtained data was coded according to values coding method.

Qualitative analysis of first data collection resulted with 16 codes which were applied to 64 open ended responses for a total of 161 times. Codes were split into primary and secondary order, where primary order codes were 'positive', 'positive attitude towards online learning', 'negative' and 'negative attitude towards online learning'. Secondary codes were employed in order to provide more in depth contextual classification of each data entry and can be seen in Table 1.

Qualitative analysis of second data collection resulted with 18 codes which were applied to 4 open ended responses for a total of 36 times. Codes were split into primary and secondary order, where primary order codes were 'positive', 'positive attitude towards online learning', 'negative' and 'negative attitude towards online learning'. Secondary codes were employed in order to provide more in depth contextual classification of each data entry and can be seen in Table 2.

Table 1

First data collection codes and spread

Code number	Code	Total amount of entries	% of 64 entries
1	Good teacher experience	4	2,56%
2	Highlights importance of communication	2	1,28%
3	Indicates improvement needed (e.g. to be performed by school)	15	9,6%

4	Motivation issues (experienced by student)	4	2,56%
5	Negative context	17	10,88%
6	Negative perception towards online learning	22	14,08%
7	Negative perception of Fontys organization	3	1,92%
8	Negative perception of online group work	12	7,68%
9	Negative perception of social media in online education	2	1,28%
10	Negative experiences with teachers in online education	6	3,84%
11	Neutral or undefined opinion	2	1,28%
12	Overload of work	6	3,84%
13	Positive context	22	14,08%
14	Positive perception towards online learning	25	16%
15	Positive group experience	12	7,68%
16	Positive role of online tools	7	4,48%

Analyzed data from first qualitative data collection round has shown that a significant amount of students who participated in open-ended questions have either positive or negative experience of online project-based education, with slightly more students who have positive experience. Out of 22 students who had negative perception of online project-based learning, 17 students have experienced a completely negative context of education while 5 students have seen this form of education having minor positive sides as well. Most beneficial factor to negative experience of online education are group-work related issues, where communication and dealing with other students was not pleasant or successful. Overload of work and negative experiences with teaching staff accounted for 6 cases each. Positive experiences and perception towards online project-based learning have been prevalent and

rooted in good group experiences, positive employment of online tools for organization and communication of the group. Participants have a good interpretation of what is happening and they spoke directly about the issues as well about the positive effects. Participants follow several assumptions where interpersonal skills come upfront as one of the most important components for successful online project-based learning.

Table 2

Second data collection codes and spread

Code number	Code	Total amount of entries	% of 9 entries
1	Good teacher experience	1	11,11%
2	Highlights importance of communication	7	77,77%
3	Indicates improvement needed (e.g. to be performed by school)	3	33,33%
4	Motivation issues (experienced by student)	4	44,44%
5	Negative context	0	0%
6	Negative perception towards online learning	2	22,22%
7	Negative perception of Fontys organization	0	0%
8	Negative perception of online group work	4	44,44%
9	Negative perception of social media in online education	0	0%
10	Negative experiences with teachers in online education	0	0%

11	Neutral or undefined opinion	0	0%
12	Overload of work	1	1,11%
13	Positive context	2	22,22%
14	Positive perception towards online learning	6	66,66%
15	Positive group experience	5	55,55%
16	Positive role of online tools	14	155,55%
17	Usage of alternative tools positive	11	122,22%
18	Usage of alternative tools negative	0	0%

Analyzed data from second qualitative data collection round has shown that a significant amount of students who participated in open-ended questions have positive experience of tools employed online project-based education, with majority of students who in addition to mandatory tools have used alternative online tools. Nine student responses have directly and contextually highlighted importance of communication within project group as contributor towards successful project. Most beneficial factor to negative experience of online education was lack of communication amongst students who participated in online project based work, where in some cases (4 students) this led partially or completely towards overall negative perception of online project passed learning. Participants have a good interpretation of what is happening and they spoke directly about the issues as well about the positive effects, where constant tendency towards accounting both good and bad experiences was present. From inspection it is possible to conclude that participants follow several assumptions where interpersonal skills come upfront as one of the most important components for successful online project-based learning. Additionally, results have shown that required online tools have met the standards for online project-based learning.

Discussion

This master thesis focused on the collection and analysis of perception of undergraduate level students at Fontys University of Applied Sciences School of ICT towards online project-based learning, by examining their satisfaction with the online mode of study and exploring their perspectives and experiences with online tools employed in online project-based learning as well as their perceived successful learning in online project-based learning mode. Furthermore, focus was paid to main components of project-based learning as defined by Sindre et al. (2018) with relation to online setting of the education and possible COVID-19 interference with students performance, seeking for affirmation of such approach towards concept of project-based learning in online setting.

Table 3
Summary of findings

Key findings:
1. Majority of students were sufficiently informed by school and staff about the situation, changes and new learning environments; 2. Usage of Canvas learning management system was experienced as positive by students; 3. Usage of MS Teams for online classroom meetings was experienced as positive by students; 4. Majority of students employed various online tools and social media messengers to improve their project process; 5. Majority of students perceive social media as beneficial for project work; 6. Majority of students do not experience increased level of efforts with respect to online project-based learning vs. traditional learning; 7. Majority of students experienced distractions while studying from home; 8. Majority of students perceive their level of motivation unchanged with regards to mode of study; 9. Majority of students do not expect more help from teachers during online education; 10. Majority of students attaches importance to good communication and believes that lack of it can have consequences for online project work; 11. Majority of students were capable of voicing their thoughts and questions and did not feel less visible in online project based learning.
Participants: 138 students of Fontys School ICT in Eindhoven
Academic year: 2020/21

In line of the hypothesis that students perception of online project based learning was positive, this research has affirmed this hypothesis and had also shown that COVID-19 pandemic has not influenced majority of students in terms of their motivation, and overall study performance.

However, this research has discovered that data obtained from semester one students varies to certain extent from the general data from entire student body. This research has discovered that majority of semester one students' motivation was negatively influenced by online study as well as experienced more distraction in online learning. However, this discovery is partially uncertain due to context in which this online study has happened, which is COVID-19 pandemic. Furthermore this indicates that school and teachers should pay more attention to these aspects of students' life and employ new methods and additional effort in providing students with enough help to remain motivated and learn how to cope with distraction.

The results of this research agree with previous research which produced arguments that social media has positive effect on project group communication when employed in learning context (Joseph Agbo et al., 2020). Additionally the results of this research also agree with several previous research on significant percentage of the university level students using mobile phones not only for communication but also getting information by browsing the Internet and consequently sharing their knowledge anytime they are involved in project-based learning activities with others (Davison et al., 2015; Klimova et al., 2017; Utulu, 2012).

The results of this research have affirmed recent study that argue that there are different ways to implement project-based learning and multiple design decisions in order to maintain successful implementation of project based learning. (Sindre et al., 2018) By introducing several online tools and adjusting teaching activities as well assessments during COVID-19 pandemic, Fontys School of ICT has implemented a new and different way of project-based learning for it's students, which resulted in positive perception of students towards online project based learning.

Furthermore the results of this research agree with previous research with respect to several main components of project-based learning as defined by Sindre et al. (2018) with relation to online setting of the education and possible COVID-19 interference with students performance: learning context; institutional context; personnel composition; assessment; degrees of freedom of the project; degrees of freedom in deliverables. The results of this research are in line with these main components of project-based learning, because the results have shown that students had positive experiences during online education which provided them sufficient degree of freedom in project and deliverables, in addition to their satisfaction with assessment, organization and information provided by the school and role of the teaching staff in their processes.

Conclusion

This master thesis focused on the investigation of perception of undergraduate level students at Fontys University of Applied Sciences School of ICT towards online project-based learning. Additionally focus was paid to main components of project-based learning as defined by Sindre et al. (2018) with relation to online setting of the education. Research of this master thesis complied with triangulation research design. Population who participated in this research were 138 students from different semester of undergraduate program in ICT from Fontys School of ICT. During transition to online learning majority of students experienced positive effects of online project based learning and were able to successfully participate in group work. Students were satisfied with MS Teams and Canvas LMS as online tools employed for online education, but have additionally relied on self-selected online tools for organization of their group work and deliverables, as well internal group communication which was supported by various social media. First semester students who were new to higher education experienced more negative influence towards their motivation and combatting distractions, which should be attention point for further organization of online studies. Majority of students highlighted importance of communication within group, and designated that lack thereof can have bad consequences for their online project based learning. This implied that future design of online studies should take into consideration better facilitation of communication within student groups. Majority of students have as well expressed their envisioning of future education as blended learning.

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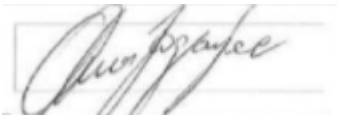
Author’s declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation thesis of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Signature: Date: Saturday, 5 June 2021



References

Adedokun, O. A., & Carleton Parker, L. (2017). Student Perceptions of a 21 st Century Learning Space. In *Journal of Learning Spaces* (Vol. 6). http://libjournal.uncg.edu/jls/article/view/1339

Aksela, M., Haatainen, &, Aksela, M., & Haatainen, O. (2018). Full Papers PROJECT-BASED LEARNING (PBL) IN PRACTISE: ACTIVE TEACHERS' VIEWS OF ITS' ADVANTAGES AND CHALLENGES. *5th International STEM in Education Conference Proceedings: Integrated Education for the Real World*. https://start.luma.fi/en/

Argote, L. (2013). Organizational learning: Creating, retaining and transferring knowledge. In *Organizational Learning: Creating, Retaining and Transferring Knowledge*. Springer US. https://doi.org/10.1007/978-1-4614-5251-5

Arshavsky, J., Glennie, N., Charles, E., & Rice, K. (2017). The relationship between project-based learning and rigor in STEM-focused high schools. *Interdisciplinary Journal of Problem-Based Learning*, *11*(1), 11. https://doi.org/10.7771/1541-5015.1618

Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., & Wożakowska-Kapłon, B. (2021). Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. *Medicine*, *100*(7), e24821. https://doi.org/10.1097/MD.0000000000024821

Barak, M., & Yuan, S. (2021). A cultural perspective to project-based learning and the cultivation of innovative thinking. *Thinking Skills and Creativity*, *39*, 100766. https://doi.org/10.1016/j.tsc.2020.100766

Bataineh, K., Atoum, M., … L. A.-… T. E., & 2021, U. (2021). A silver lining of coronavirus: Jordanian Universities turn to distance education. *Igi-Global.Com*. https://www.igi-global.com/article/a-silver-lining-of-coronavirus/260754

Bates, A. W. (2019). *Teaching in a Digital Age* (2nd ed.). The Open Textbook Project. https://opentextbc.ca/teachinginadigitalage/

Bloom, S., & Kowalske, L. (2016). Transforming Pedagogy: Changing Perspectives from Teacher-Centered to Learner-Centered. *Interdisciplinary Journal of Problem-Based Learning*, *10*(1), 10. https://doi.org/10.7771/1541-5015.1538

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning. *Educational Psychologist*, *26*(3–4), 369–398. https://doi.org/10.1080/00461520.1991.9653139

Bokayev, B., Torebekova, Z., Davletbayeva, Z., & Zhakypova, F. (2021). Distance learning in Kazakhstan: estimating parents' satisfaction of educational quality during the coronavirus. *Technology, Pedagogy and Education*. https://doi.org/10.1080/1475939X.2020.1865192

Burns, A., & Burns, R. (2008). *Basic Marketing Research* (Second). Upper Saddle River, N.J. : Pearson Prentice Hall. https://archive.org/details/basicmarketingre0000burn/page/245

Chen, C. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Elsevier*. https://www.sciencedirect.com/science/article/pii/S1747938X19300211

Condliffe, B., Quint, J., Visher, M. G., Bangser, M. R., Drohojowska, S., Saco, L., & Nelson, E. (2017). *Project-Based Learning A Literature Review Working Paper*. www.mdrc.org.

Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications, Inc.

Davison, C., Studies, E. L.-J. of T., & 2015, undefined. (2015). Adopting mobile technology in the higher education classroom. In *JSTOR*. http://www.ncver.edu.au

Dewey, J. (1916). *Democracy and Education: An Introduction to the Philosophy of Education*. Macmillan. https://archive.org/stream/democracyandedu00dewegoog#page/n6/mode/2up

Doppelt, Y. (2003). Implementation and Assessment of Project-Based Learning in a Flexible Environment. *International Journal of Technology and Design Education*, *13*(2003), 255–272.

FHICT. (2021). *FHICT Beleidswiki - https://beleidswiki.fhict.nl/*. https:/beleidswiki.fhict.nl/

Fleming, D. (2000, January). *A Teacher's Guide to Project-Based Learning*. https://www.researchgate.net/publication/234773596_A_Teacher's_Guide_to_Project-Based_Learning

Ginsburg, H. P., & Opper, S. (1988). *Piaget's Theory of Intellectual Development Third Edition* (3rd ed.). Pearson. www.freepsychotherapybooks.org

Grubic, N., Badovinac, S., & Johri, A. M. (2020). Student mental health in the midst of the COVID-19 pandemic: A call for further research and immediate solutions. In *International Journal of Social Psychiatry* (Vol. 66, Issue 5, pp. 517–518). SAGE Publications Ltd. https://doi.org/10.1177/0020764020925108

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586

HBO-i. (2018). *HBO-i organisatie - HBO-i stichting*. https://www.hbo-i.nl/hbo-i-organisatie/

Herrington, J., Oliver, R., & Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments. *Australasian Journal of Educational Technology*, *19*(1). https://doi.org/10.14742/ajet.1701

Humphrey, N., Lendrum, A., & Wigelsworth, M. (2020). *Social and emotional learning*. https://books.google.com/books?hl=nl&lr=&id=39DgDwAAQBAJ&oi=fnd&pg=PT5&dq=learning+is+social+and+emotional&ots=Oc_3VZdvt5&sig=KSC5-3KolTb347taJtJXp5e3MoU

Jin, S. (2017). Using Visualization to Motivate Student Participation in Collaborative Online Learning Environments. *Undefined*.

Joseph Agbo, F., Olawumi, O., Sunday Oyelere, S., Awuni Kolog, E., Adewale Olaleye, S., Agjei, R. O., Ukpabi, D. C., Abubakar Yunusa, A., Gbadegeshin, S. A., Awoniyi, L., Mogaji, E., Duabari Silas, A., Nwachukwu, C. E., & Olawuni, A. (2020). Social Media Usage for Computing Education: The Effect of Tie Strength and Group Communication on Perceived Learning Outcome. In *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* (Vol. 16).

Jumaat, N., Tasir, Z., … N. H.-A. S., & 2017, U. (2017). Project-based learning from constructivism point of view. *Ingentaconnect.Com*. https://www.ingentaconnect.com/contentone/asp/asl/2017/00000023/00000008/art00222

Kızkapan, O., & Bektaş, O. (2017). The Effect of Project Based Learning on Seventh Grade Students' Academic Achievement 1. In *ERIC* (Vol. 10, Issue 1). https://eric.ed.gov/?id=EJ1125144

Klimova, B., Poulová, P., & Poulova, P. (2017). Mobile Learning in Higher Education. *Ingentaconnect.Com*. https://doi.org/10.1166/asl.2016.6673

Korkmaz, G., KALAYCI Gazi Üniversitesi Eğitim Fakültesi, N., Gazi Üniversitesi Eğitim Fakültesi, T., Bilgisi Öz, M., & Üniversitesi Eğitim Fakültesi Dergisi, Ç. (2019). Theoretical Foundations of Project Based Curricula in Higher Education * Yükseköğretimde Proje Tabanlı Eğitim Programlarının Kuramsal Temelleri. *Dergipark.Org.Tr*, *48*(1), 236–274. https://doi.org/10.14812/cufej.479322

Krajcik, J. S., & Blumenfeld, P. C. (2005). Project-Based Learning. In *The Cambridge Handbook of the Learning Sciences* (pp. 317–334). Cambridge University Press. https://doi.org/10.1017/CBO9780511816833.020

Larmer, J., Mergendoller, J., & Boss, S. (2015). *Setting the standard for project based learning*. https://books.google.com/books?hl=nl&lr=&id=10XwCQAAQBAJ&oi=fnd&pg=PP1&dq=onli

ne+project+based+learning+difficult&ots=ME3ae-p5CG&sig=oCiO8H5uxpHkP9eknPjMvosWsuY

Law, K., & Chuah, K. B. (2004). *Article in Team Performance Management ·*. https://doi.org/10.1108/13527590410569904

Lee, H.-J., & Lim, C. (2012). Peer Evaluation in Blended Team Project-Based Learning: What Do Students Find Important? *Educational Technology & Society*, *15(4)*, 214–224.

Liguori, E., & Winkler, C. (2020). Editorial From Offline to Online: Challenges and Opportunities for Entrepreneurship Education Following the COVID-19 Pandemic. *Entrepreneurship Education and Pedagogy*, *3*(4), 346–351. https://doi.org/10.1177/2515127420916738

Lima, K. R., das Neves, B.-H. S., Ramires, C. C., dos Santos Soares, M., Martini, V. Á., Lopes, L. F., & Mello-Carpes, P. B. (2020). Student assessment of online tools to foster engagement during the COVID-19 quarantine. *Advances in Physiology Education*, *44*(4), 679–683. https://doi.org/10.1152/advan.00131.2020

Lithgow, K. (2011, November 18). *Learning is a Social Activity – Katherine Lithgow – Centre for Teaching Excellence Blog*. https://cte-blog.uwaterloo.ca/?p=2539

Liu, D., Sun, W., & Zhang, X. (2020). Is the Chinese Economy Well Positioned to Fight the COVID-19 Pandemic? the Financial Cycle Perspective. *Emerging Markets Finance and Trade*, *56*(10), 2259–2276. https://doi.org/10.1080/1540496X.2020.1787152

Martin, F., & Bolliger, D. U. (2018). Engagement Matters: Student Perceptions on the Importance of Engagement Strategies in the Online Learning Environment Engagement Matters: Student Perceptions on the Importance of Engagement Strategies in the Online Learning Environment Engagement Matters: Student Perceptions on the Importance of Engagement Strategies in the Online Learning Environment. *Learning Journal*, *22*. https://doi.org/10.24059/olj.v22i1.1092

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2006). The Effectiveness of Problem-Based Instruction: A Comparative Study of Instructional Methods and Student Characteristics. *Interdisciplinary Journal of Problem-Based Learning*, *1*(2). https://doi.org/10.7771/1541-5015.1026

Mills, J., & Teragust, D. (2004). ENGINEERING EDUCATION – IS PROBLEM- BASED OR PROJECT-BASED LEARNING THE ANSWER? Julie. *AUSTRALASIAN JOURNAL OF ENGINEERING EDUCATION Co-Editors*. http://www.aaee.com.au/journal/2003/mills_treagust03.pdf

Noguera, I., Guerrero-Rold, A.-E., & Mas, R. (2018). Collaborative agile learning in online

environments: Strategies for improving team regulation and project management. *Elsevier*. https://doi.org/10.1016/j.compedu.2017.09.008

Omniascience, E., & Ralph, R. A. (2016). POST SECONDARY PROJECT-BASED LEARNING IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS. *TECHNOLOGY, ENGINEERING AND MATHEMATICS Journal of Technology and Science Education*, *6*(1), 26–35. https://doi.org/10.3926/jotse.155

Owens, A. D., & Hite, R. L. (2020). Enhancing student communication competencies in STEM using virtual global collaboration project based learning. *Research in Science & Technological Education*, 1–27. https://doi.org/10.1080/02635143.2020.1778663

Pal, D., & Vanijja, V. (2020). Perceived usability evaluation of Microsoft Teams as an online learning platform during COVID-19 using system usability scale and technology acceptance model in India. *Children and Youth Services Review*, *119*. https://doi.org/10.1016/j.childyouth.2020.105535

Patchan, M. M., & Schunn, C. D. (2015). Understanding the benefits of providing peer feedback: how students respond to peers' texts of varying quality. *Springer*, *43*(5), 591–614. https://doi.org/10.1007/s11251-015-9353-x

Pellegrino, J. W., & Hilton, M. L. (2013). Education for life and work: Developing transferable knowledge and skills in the 21st century. In *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. National Academies Press. https://doi.org/10.17226/13398

PISA 2015 COLLABORATIVE PROBLEM-SOLVING FRAMEWORK. (2017).

Ravitch, S. M., & Carl, N. M. (2015). *Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological* (1st ed.). SAGE Publications, Inc.

Rijksoverheid. (2021). *Coronavirus en het hoger onderwijs | Coronavirus COVID-19 | Rijksoverheid.nl*. https://www.rijksoverheid.nl/onderwerpen/coronavirus-covid-19/onderwijs-en-kinderopvang/hogescholen-en-universiteiten-hoger-onderwijs

Rongbutsri, N. (2017). *Aalborg Universitet Students Using Online Collaborative Tools in Problem-Oriented Project-Based Learning Rongbutsri, Nikorn*. https://doi.org/10.5278/vbn.phd.hum.00072

Saadat, V. (2016). Organizational learning as a key role of organizational success. *Elsevier*. https://www.sciencedirect.com/science/article/pii/S1877042816311296

Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *The*

Interdisciplinary Journal of Problem-Based Learning •, *1*(1), 9–20. https://doi.org/10.7771/1541-5015.1002

Savin-Baden, M. (2007). *A Practical Guide to Problem-based Learning Online* (1ST ed.). Routledge. https://books.google.nl/books?hl=nl&lr=&id=O8mX6ZGSTU4C&oi=fnd&pg=PP1&dq=project+based+learning+online&ots=_Mrs6AAHze&sig=JdHkE971Ct3WXex-MhZZW5y0VaQ

Sindre, G., Giannakos, M., Krogstie, B. R., Munkvold, R., & Aalberg, T. (2018). *Project-Based Learning in IT Education: Definitions and Qualities*. 147–163. https://doi.org/10.18261/ISSN.1893-8981-2018-02-06

Singh, H. (2021). Building Effective Blended Learning Programs. In *Issue of Educational Technology* (Vol. 43, Issue 6). http://bookstoread.com/framework

Smit, W. (2006). Traditioneel versus probleemgestuurd onderwijs. *Nederlands Tijdschrift Voor de Psychologie En Haar Grensgebieden*, *61*(1), 23–29. https://doi.org/10.1007/bf03062357

Spector, J. M., Ifenthaler, D., Sampson, D., Yang, J. L., Mukama, E., Warusavitarana, A., & …gibson, D. C. (2016). Technology enhanced formative assessment for 21st century learning. In *Journal of Educational Technology and Society* (Vol. 19, Issue 3). http://www.ifets.info/journals/19_3/7.pdf

StAmant, K. (2020). Afterword: Re-Mapping the Global Context for Online Education. *PARS in Practice: More Resources and Strategies for Online Writing Instructors*, 355–360. https://doi.org/10.37514/PRA-B.2021.1145.3.2

Sulisworo, D., & Santyasa, W. (2018). Educational Research and Reviews Maximize the mobile learning interaction through project-based learning activities. *Educational Research and Reviews*, *13*(5), 144–149. https://doi.org/10.5897/ERR2018.3463

Sunaga, Y., Washizaki, H., Kakehi, K., Fukazawa, Y., Yamato, S., & Okubo, M. (2017). Relation between Combinations of Personal Characteristic Types and Educational Effectiveness for a Controlled Project-Based Learning Course. *IEEE Transactions on Emerging Topics in Computing*, *5*(1), 69–76. https://doi.org/10.1109/TETC.2016.2526664

Teixeira, A., & Zapata-Ros, M. (2021). Presentation of the special issue" Transition from conventional education to online education and learning, as a consequence of COVID19. *Revistas.Um.Es*. https://revistas.um.es/red/article/download/462271/299031

Thomas, J. W. (2000). *A REVIEW OF RESEARCH ON PROJECT-BASED LEARNING The Autodesk Foundation 111 McInnis Parkway San Rafael, California 94903 (415) 507-6336 Fax (415) 507-6339 http://www.autodesk.com/foundation*. http://www.autodesk.com/foundation

Traverso-Ribón, I., Balderas-Alberico, A., Dodero, J. M., Ruiz-Rube, I., & Palomo-Duarte, M. (2016). Open data framework for sustainable assessment of project-based learning experiences. *Program*, *50*(4), 380–398. https://doi.org/10.1108/PROG-12-2015-0078

Utulu, S. C. (2012). Use of mobile phones for project based learning by undergraduate students of Nigerian private universities. In *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* (Vol. 8). http://www.internetworldstats.com

van den Wijngaard, L. (2018). *Probleemgestuurd onderwijs: wat is het en hoe werkt het? - Het Rechtenstudentje*. https://www.hetrechtenstudentje.nl/studentenleven/probleemgestuurd-onderwijs-wat-is-het-en-hoe-werkt-het/

Vonderwell, S., Vonderwell, S., & Turner, S. (2005). Active Learning and Preservice Teachers' Experiences in an Online Course: A... *Journal of Technology and Teacher Education*, *13*(1), 65–84.

Vonken, F., Bredek, J., Michael Franssen, H., Argante, E., Hacquebard Rienk van der Ploeg, A., Mensink, T., & John Gorter, H. (2018). *HBO-i domain description 2018 Work group With thanks to*. www.HBO-i.nl

Zheng, F., Khan, N. A., & Hussain, S. (2020). The COVID 19 pandemic and digital higher education: Exploring the impact of proactive personality on social capital through internet self-efficacy and online interaction quality. *Children and Youth Services Review*, *119*. https://doi.org/10.1016/j.childyouth.2020.105694

Appendix A

Design of quantitative research online form

PERCEPTION OF UNDERGRADUATE STUDENTS TOWARDS ONLINE PROJECT BASED LEARNING DURING COVID-19

Dear student,

You are participating in academic research on perception of undergraduate students towards online project based learning during Covid-19 pandemic. This survey aims to collect data on perception and experiences of bachelor of ICT students at Fontys School of ICT who have participated in online learning as result of nation-wide COVID-19 restrictions.

This survey is a part of master thesis research conducted by Amer Jaganjac at Tartu University, who teaches at Fontys School of ICT. The results of this research will hep us understand your experiences and provide sufficient information and inspiration towards improvement of future online-learning at FHICT.

Important disclosure: Your private information will not be accessed, which means that your input is anonymus. The results of this survey will not be analysed on individual level, but as collective datasets.

If you have any questions or unclarities you are welcome to get in contact with Amer Jaganjac by e-mail at a.jaganjac[at]fontys.nl (http://fontys.nl)

Thank you!

A. Jaganjac

* Required

5/18/2021

1

Which semester are you currently enrolled in? *

- ◯ Semester 1
- ◯ Semester 2
- ◯ Semester 3
- ◯ Semester 4
- ◯ Semester 5
- ◯ Semester 6
- ◯ Semester 7
- ◯ Semester 8
- ◯ Other (e.g. in between semesters or custom made semester)

2

What is the language of instruction in your education? *

- ◯ English
- ◯ Dutch
- ◯ Combination English/Dutch
- ◯ Other

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3

Where did you complete your previous studies? *

- ◯ Africa
- ◯ Asia
- ◯ Australia
- ◯ EU
- ◯ NON-EU European countries
- ◯ North America
- ◯ South America (including what is considered 'Middle' America)

4

What is your age? * *

- ◯ Under 18
- ◯ 18-24
- ◯ 24-30
- ◯ 30 and above

5

What is your gender? *

- ◯ Woman
- ◯ Man
- ◯ Non-binary
- ◯ Prefer not to say

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6

As part of your education, have you participated in a group-work/project-work at any moment in 2020 and/or 2021? *

- ◯ Yes
- ◯ No

7

Was group-work/project-work which you have participated in 2020 and/or 2021 performed online instead of physical location (at Fontys)? *

- ◯ Yes
- ◯ No

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8

Please rate following statements based on your private experiences. *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I experienced difficulties in transition from working on group-work/project-work at school to working online	○	○	○	○	○
I was sufficiently informed about the situation and transition to online learning by my teachers and Fontys	○	○	○	○	○
My teachers and Fontys provided me with sufficient amount of online tools and environments in which I was able to follow my online education	○	○	○	○	○
Canvas learning environment is suitable for online learning	○	○	○	○	○
MS Teams is suitable tool for online meetings and classes	○	○	○	○	○
I am satisfied with the online collaboration of my project group (or assignment group)	○	○	○	○	○
I used social media such as Whatsapp or Facebook to communicate about project work and deliverables with others in my project or assignment group	○	○	○	○	○

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	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Social media was important for our group communication	○	○	○	○	○
My group sufficiently used online tools to stay organised	○	○	○	○	○
Online tools helped my group in communication and staying organised during online education	○	○	○	○	○
Online tools played significant role in overal success of my group during online education	○	○	○	○	○
I am satisfied with communication within my group in online work	○	○	○	○	○
I felt during my online group work at least once like I needed to do more work compared to group work at Fontys building	○	○	○	○	○
I often feel like I need to do more work in online group work compared to group work at Fontys building	○	○	○	○	○
I felt more difficulties in maintaining contact with my group members during online group work compared to group work at Fontys building	○	○	○	○	○
I felt less motivated to do my work during online group work compared to group work at Fontys building	○	○	○	○	○

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	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I felt more depending on teachers help during online group work compared to group work at Fontys building	○	○	○	○	○
I have done all I could do to maintain good performance and obtain good grades during online project work	○	○	○	○	○
I was good in organising my own duties and tasks during entire online project work and I remained on track	○	○	○	○	○
Online mode of study badly influenced my motivation to give my best during online project work	○	○	○	○	○

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9

Please rate following statements based on your private experiences. *

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
By having to work from home I experienced more distraction than I would have experienced at school	○	○	○	○	○
Covid-19 pandemic made obtaining good grades less important to me than it was before	○	○	○	○	○
My teachers helped me well during online group work compared to group work at Fontys building	○	○	○	○	○
During online education I felt more need for guidance, help and compassion from my teachers	○	○	○	○	○
During online education I felt more need for guidance, help and compassion from my group members than before	○	○	○	○	○
During online education I received more guidance, help and compassion from my teachers than before	○	○	○	○	○
I am satisfied with the results of online group work compared to group work at Fontys building	○	○	○	○	○

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	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I feel that group performance was sometimes negatively influenced by lack of communication in my group	○	○	○	○	○
I feel that group performance was sometimes negatively influenced by lack of my knowledge of online tools and technology	○	○	○	○	○
I feel that group performance was sometimes negatively influenced by lack of students' knowledge of online tools and technology	○	○	○	○	○
I (sometimes) felt invisible during online project work	○	○	○	○	○
I (sometimes) could not voice out my ideas, questions, opinions, concerns during online project work	○	○	○	○	○
I felt enough freedom to define my own path and scope of work in online project/group work	○	○	○	○	○
I felt enough freedom to define my own deliverables in online project/group work	○	○	○	○	○
I feel that I have learned enough from online project/group work	○	○	○	○	○

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	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I feel that I have been assessed and graded fairly for the work I performed during online education	○	○	○	○	○
My teacher had enough technological skills and knowledge to provide me with good quality online education	○	○	○	○	○
My teacher had enough technological skills and knowledge to provide me with advice on online tools which can be used, when needed	○	○	○	○	○
After Covid-19 pandemic passes I would like to have combination of online and traditional learning for the rest of my education	○	○	○	○	○
After Covid-19 pandemic I would like to have a short break from studying	○	○	○	○	○

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10

OPTIONAL: What are your thoughts on online project/group work? Did it go well, or did it go bad? What could be improved? Which new things did you learn? What helped you and your group to improve your work?

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Thank you for your answers!

Thank you very much for your participation! Your answers will be saved and analysed and hopefully, the results of this research will give us new insights and help scientific field to learn something new and improve online education for our joint future!

5/18/2021

Appendix B

Design of qualitative research online form

Final phase - Online project based learning research

Dear student,

You are participating in final phase of academic research on perception of undergraduate students towards online project based learning during Covid-19 pandemic. You have previously had a chance to fill in a survey form on similar topic.

This survey is a part of master thesis research conducted by Amer Jaganjac at Tartu University, who teaches at Fontys School of ICT. The results of this research will hep us understand your experiences and provide sufficient information and inspiration towards improvement of future online-learning at FHICT.

Important disclosure: Your private information will not be accessed, which means that your input is anonymus. The results of this survey will not be analysed on individual level, but as collective datasets.

If you have any questions or unclarities you are welcome to get in contact with Amer Jaganjac by e-mail at a.jaganjac[at]fontys.nl (http://fontys.nl)

Thank you!

A. Jaganjac

Instructions

This form is a substitution for traditional interview. You are invited to give your open answers on proposed topic. Length, extent and form of your answers are completely up to you. Feel free to say anything you wish to say, and bear in mind that your responses will be treated with uttermost privacy. Your name will only be available to Amer Jaganjac, and only if you decide to submit your name which is optional choice.

1. Your name (if you wish to remain anonymous please skip this field)

5/18/2021

2. What is your perception of learning through online projects? How were your experiences, what did you like the most? Can you think of challenges and problems that you or your colleagues faced during online project engagements?

3. Please reflect on your success during online projects. Are you satisfied with amount of things you have learned and what feeling do you have about your professional self after online project work?

5/18/2021

4. What do you think of tools such as MS Teams and Canvas (with attention to having to use them during online projects and online learning)? Did you (and your group) use some other online tools as alternative and/or addition? If yes, what has motivated you to do so?

5/18/2021

Thank you!

Your answers will be processed towards better education of tomorrow!

5/18/2021

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