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PERSPECTIVES OF THE ONLINE EXAMINATIONS AND E-PROCTORING – CASE STUDY OF ESTONIA

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VEEBIPÕHISTE EKSAMITE PERSPEKTIIVID – JUHTUMIUURING EESTI NÄITEL

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Online examination has begun to gain popularity as an evaluation tool in both online and conventional learning settings. When incorporated properly in online learning programs, they offer many advantages to the learning process and learners. Furthermore, During the COVID-19 outbreak, researchers concentrated on analyzing and exploring the online examination experience. However, comprehension of how individuals perceive e-proctoring tools during the online examination experience remains limited in Estonia. This thesis examines students' and lecturers' views and questions regarding the online exam and usage experience of e-proctoring tools in exams and the advantages and drawbacks of e-exams in general. Additionally, it emphasizes the effect of e-proctoring tools on student performance and preferences in order to direct educational institutions toward more appropriate practices in the future, especially given the pandemic's possible far-reaching implications.

This research's results shed light on students' views on the online exam and their e-proctoring experience, notably their primary concerns about privacy and various psychosocial and technical aspects. This study not only examined from students' perspective, but it also examined lecturers' perception and experience towards the utilization of e-proctoring applications in online examinations. Additionally, the study identifies problems associated with applying the e-proctoring tool and its impact on student success, performance, and grades. Moreover, the study recommends Project-based Learning (PBL) as an assessment method to ease the challenges of examinations.

Key words: e-examination, online examination, e-assessment, e-proctoring, online proctoring.

This thesis is written in English language and is sixty-four 64 pages long, including six (6) chapters, six (6) figures, and six (6) tables.

Annotatsioon

Veebilahenduste kasutamine hindamisel on hakanud populaarsust koguma nii veebi- kui ka tavapärases õppes. Kui elektrooniline hindamine on õigesti integreeritud veebipõhistesse õppeprogrammidesse, pakuvad need õppeprotsesside kui kaõppijate jaoks palju eeliseid.

COVID-19 puhangu ajal on analüüsitud ja uuritud veebi vahendusel toimuvate eksamite kogemust. Arusaam sellest, kuidas inimesed tajuvad prokotooritud süsteemide kasutamist veebi vahendusel toimuval hindamisel, on siiski piiratud. Selles lõputöös uuritakse üliõpilaste ja õppejõudude seisukohti ja küsimusi seoses veebieksamite ja proktooritud lahenduste kasutuskogemusega COVID-19 pandeemia ajal eksamitel, s.he-eksamite eeliseid ja puudusi üldiselt. Lisaks rõhutatakse uuringus proktooritud vahendite mõju õpilaste tulemustele ja eelistustele, et suunata haridusasutusi tulevikus sobivamate tavade poole, eriti arvestades pandeemia võimalikke kaugeleulatuvaid tagajärgi.

Selle uuringu tulemused heidavad valgust üliõpilaste vaadetele ja kogemustele seoses veebi vahendusel toimuvate eksamitega, sealhulgas nende peamistele muredele seoses privaatsuse ning mitmesuguste psühhosotsiaalsete ja keskkonnateguritega. Lisaks üliõpilaste vaatenurgale uuriti ka õppejõudude kogemusi proktooritud vahendite kasutamise osas veebieksamitel. Lisaks selgitatakse uuringus välja proktooritud tööriistade rakendamisega seotud probleemid ja selle mõju õpilaste edukusele, tulemuslikkusele ja hinnetele.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 64 leheküljel, kuut peatükki, kuut joonist, kuut tabelit.

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List of abbreviations and terms

ICT	Information and Communication Technology
PBL	Project-based Learning.
MCQ	Multiple Choice Questions
Moodle	– free, open-source web-based learning environment (http://www.moodle.org).
Proctorio	It is a remote proctoring service that is used with online classes when you take quizzes and exams in Moodle.
TTU	Tallinn University of Technology
UT	University of Tartu
TLU	Tallinn University
HITSA	Information Technology Foundation for Education
LMS	Learning management systems
EU	European Union
R&D&I	RESEARCH, DEVELOPMENT, and INNOVATION
EC	European Commission
e-proctoring tools	It is a new generation service that offers a secure environment for proctoring online exams.

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1 Introduction

Information and communication technologies (ICT) have an enormous promise in higher education for improving learning and teaching (Gillard et al., 2008). Furthermore, it promotes higher-order thought, especially when used for learning and training (Bhattacharya & Sharma, 2007). ICT innovation has also increased cross-disciplinary research collaboration and academic community participation (Aliyu & Adebayo, 2014).

Additionally, the advancement of ICT has resulted in new e-exams (Abubakar & Adebayo, 2014). With the increased use of online learning, new evaluation methods have arisen and gained popularity. This increase raises concerns about assessment methods: "Is it the same? Is it different? What's the best way to do it?" (Conrad & Openo, 2018). E-exams are machine-based programs that can administer tests and evaluate students' results using ICT. The benefits of electronic examination systems entail ease of use, low maintenance costs, and the ability to improve evaluation accuracy (Snodgrass et al., 2014). Since they allow for the use of text, images, audio, video, and immersive virtual environments, e-exams frequently have many advantages over paper-based exams (Llamas-Nistal et al., 2013).

The usage of ICT in the examination has had a huge impact on educational culture and is increasingly gaining traction in the world's higher education sector (Walker & Voce, 2012). As a result, E-exams effectively reduce a significant portion of the burdens associated with assessment procedures, thus alleviating the burden on students (Jamil et al., 2012). E-exams accelerate the overall assessment process of distance education, from passing student feedback to indicators to determining final grades (Thomas et al., 2002).

Numerous studies have been conducted to ascertain students' and teachers' prospects in on e-examinations in higher education. Several studies raised a host of concerns about the e-exam implementation. The results indicated a difference in viewpoint. Whereas most lecturers preferred electronic examinations over traditional examinations (Adebayo & Abdulhamid, 2010; Betlej, 2013), others were opposed (Dwivedi et al., 2012; Kuikka et al., 2014).

Certain instructors were reluctant to use e-exams since they did not want to adjust their current testing procedures (Betlej, 2013). It means that institutions need to devise novel strategies for motivating teachers and students to seek technical and pedagogical assistance (Kuikka et al., 2014). Any new technologies should be adopted and prepared early in the process for key stakeholders (Dwivedi et al., 2012).

Furthermore, the key concern confronting the academic system is the fairness and validity of online examinations (Milone et al., 2017). Therefore, as a result, online exams must be administered with the help of proper tools (Burgess & Sievertsen 2020). Universities have introduced various e-proctoring tools to ensure the integrity of online tests in response to the exponential rise of online learning and examinations. To deter cheating, this tool verifies students' identities and alerts Inappropriate behavior during the exam. The fast digital revolution that happened, especially during the Covid-19 pandemic, has been impressive. The companies that provide online proctoring have increased their user base from 100 per year to 120 per day (Drew, 2020).

In this research, students' and lecturers' experience and interactions with online exam and e-proctoring tools during the COVID-19 are analyzed. The research will look into students' concerns about the online exam and e-proctoring method, their views toward educational integrity in the context of e-proctoring, the effect of e-proctoring tools on students' success and grades, and students' experience using the e-proctoring systems. Moreover, this research relates from the lecturers' perspective in order to examine teachers' perceptions towards the online exam and e-proctoring tools.

1.1 Importance of research

An examination is vital to the learning process, but there are many discussions on its uses to assess best student progress and achievements (Conrad & Openo, 2018). Today, which we call the information age, is developing rapidly with the help of technology. This rapid development of technology can meet alternative needs in the field of examination with ICT. Information and communication technology use has dramatically increased for learning and examination (Stephens & Mascia, 1997). With current technological opportunities, both the quality and efficiency of distance education have increased, but fewer studies conducted research related to e-examination. As Palloff & Pratt (2007)

mentioned, one of the most crucial deficiencies encountered in online distance education is the inefficient use of measurement and evaluation methods (Palloff & Pratt, 2007). The students' views and experiences about the online exam experience are an essential variable effecting the online learning and teaching environment and student performance. Therefore, the relation between online exams and student performance/perception/thought is crucial and valuable. This study will gather valuable information from the perspective of the students as well as their experiences. In addition to students' attitudes, the study will collect data from teachers to examine teachers' experience and perception towards online exams and e-proctoring tools. The author believes that the students' opinions and experiences will also contribute to the future development of the appropriateness of the techniques for evaluation used in distance learning.

1.2 Purpose

Education is fundamental to development and growth. Students play the most vital role in the sustainability of the education institution and the system. The result of this research and investigation will help the institutions and the instructors, and the students. Since collecting the data from students and lecturers can be worthwhile for the future reforms of the online exam techniques. As mentioned above, the use of e-learning is increasing. If e-learning has considerable demand, e-examination is inevitable. Thus, the relationship between student success and e-examination and the students' perception of e-examination is critical for improving the educational environment. For students, e-examination standards must be transparent and objective. As a result, each students' background, living environment, and personality must be considered (Palloff & Pratt, 2007).

Moreover, the examination has great significance and impact on the students' performance. It can serve as a bonus to motivate us to work and to expand knowledge and skills. However, wrong or unfair evaluation can ruin the effects of education and demoralize further action (Palloff & Pratt, 2007). Therefore, this topic is crucial to investigate the further development and improvement of the distance exam systems' techniques.

In this research, students' behaviors and interactions with e-proctoring tools during the COVID-19 pandemic are investigated. The research will look into students' and lecturers'

main concerns about the online exam and e-proctoring method, students' and lecturers' attitudes toward online exams and e-proctoring tools, the effect of e-proctoring tools on students' success and performance, and students and lecturers experience with utilization of the e-proctoring tools in online examinations.

These are the main questions this research investigates.

RQ1: How is the online examination used in the distance learning environment?

SQ1: What are the main advantages and disadvantages of online exams?

SQ2: What are the main challenges of the online exams?

SQ3: What are the teachers' and students' perceptions about the online exams?

RQ2: How are e-proctoring tools used in online examinations?

SQ1: What are the students' perceptions about the usage of proctored tools in online exams?

SQ2: What are the teachers' perceptions/experience about using the proctored tools in the online exams?

SQ3: What are the main challenges of using proctored tools in online exams?

SQ4: What are the students' opinions about their performance after using e-proctoring tools?

1.3 Emergence of e-examination

The emergence of information technology in education began in the 1970s. Prior to that days, just one computer could take up an entire room, making it challenging to integrate them into the academic environment. At the University of Illinois, the PLATO, the idea of using computers for both teachings and study first emerged in the 1960s. However, advances in downsized computer components were made in the 1970s, enabling education to be mixed with technology (Celce-Murcia, 2001). In the 1980s, educators and academics continued to adopt computers as possible examination methods. In other words, computer-assisted experiments were used in areas such as chemistry, arithmetic, physics, architecture, etc., though they were often conducted by the research objectives (Carton et al., 1991).

Fortunately, with the increasing popularity of the World Wide Web in the 1990s, technological advances started to prosper in education. Educational WebCT, desire2learn, Claroline, and many other education-oriented programs like Moodle began to be adopted to use the Internet (Maravi & Pinter, 2010). Specifically, the expanded use of computers in the teaching process and advancements in mental assessment principles enabled technology to create increasingly effective, reliable, and individualized assessment models (Tung, 1986). In this regard, national educational systems, notably in the United States, started to consider the effectiveness of computer-assisted exams for children, teachers, and schools and to integrate computers as evaluation instruments into their curricula. Similarly, Norway and Singapore launched studies to determine the benefits and drawbacks of computer-assisted evaluation and propose potential uses for computers in exams (Russell et al., 2003).

2 Literature review

This chapter covers the literature and context about the online exam, assessment methods, and usage of proctored tools in online examinations.

2.1 Assessment Methods in Education

Several assessment methods are used in the education institution to evaluate students' performance, results, or achievement. In this chapter, the assessment methods and types are introduced. All usage of assessment methods is elaborated, such as usage domain and aim of the assessments. And a description of each assessment has been mentioned.

- **Formative & Summative assessment**

Assessment is a continual process that emphasizes the connection between curriculum and the outcomes of the education process (Kress, 2009). As a result, it provides guidance not just on learner success but also on teachers' contributions to the learning process (Madsen, 1983). The assessment generally consists of various categories such as summative assessment, formative assessment.

Wiggins (1998) asserts that formative assessment's primary goal is to inform and enhance student results, not to evaluate them (Wiggins,1998) simply. Additionally, formative assessment is activities undertaken by teachers and their students in self-assessment—that generate data that can be used to change the teaching and learning process (Dixson, D & Worrell, 2016). This assessment is completed after each unit to determine students' academic deficiencies and difficulties. This type of assessment provides feedback to students and teachers, allows students to detect misunderstandings, increases motivation, and shows students essential concepts. Furthermore, this assessment is process-oriented and may include an approach focused on developing skills such as collaboration, critical reasoning, reporting, or problem-solving in areas unrelated to the content field (Simonson et al., 2012).

Summative assessment, on the contrary, is another type of assessment used to provide a final result or outcome. Summative assessment entails deciding a students' success or

accomplishment after a semester, term, or curriculum. It is usually carried out using achievement tests consisting of questions covering more than one unit (Gelbal, 2013). Moreover, summative assessment, which is more associated with the final exams, students' exam results can also be considered during the project and the semester (Gunawardena & La Pointe, 2003). Thus, summative assessment has more relation to this research than formative assessment, since the e-assessment methods which author examined final primarily results or outcome of the course.

- **Authentic Assessment**

Authentic assessment is a form of assessment in which students are required to show the challenges they are likely to encounter daily and their ability and competence to solve these problems. Students are asked to generate ideas, fuse information, and complete the necessary tasks for their use in the real world (Ball, 2009). Multiple evaluation methods and techniques are used in the authentic evaluation approach. In this assessment approach, it is crucial to consider the contextual improvements in the students' prior experience and strengthen the learning process rather than how much the student may remember what he or she learned (Crisp, 2010).

- **Portfolio**

A portfolio assessment is a collection of studies that reflect a complete picture of the students' development. It can be expressed as a form of performance evaluation that requires production rather than selecting or marking a reaction predicted by traditional understanding. Barbera (2009) defines a portfolio as the purposeful sum of student work reflecting the learner's efforts, development, and achievements. Generally, in the portfolio, the learner actively participates in selecting the content and determining the selection criteria (Barbera (2009). Besides, the portfolio method allows students to improve by considering electronically stored documents, projects, assignments, journals, or blog entries. Presentations can also be included in the e-portfolio evaluation (Crisp, 2010).

- **Open book**

According to Rakes (2008), exams that allow viewing books to assess student achievement in distance education are also usable—the exams using the open book

method test students in higher-order thinking skills (Rakes, 2008). Furthermore, the student tries to solve the questions by using and organizing the information that can easily be accessed from the sources (Rakes, 2008). Thus, this method of examination has not required any blocking of the browser. Therefore, the author believes that it is usable and convenient in terms of students' perspectives. In addition, open books eliminate using the additional tool, which causes extra costs for universities.

- **Project-based learning**

Project-based Learning is indeed a great learning approach in which students gain new abilities and expertise while working on a project to solve real-world challenges (Peterson, 2012; Pellegrino & Hilton, 2012). PBL is a student-centered teaching method accompanied by students' autonomy, proactive inquiry, goal-finding, teamwork, connectivity, and contemplation within real-world activities (Kokotsaki et al., 2016).

Furthermore, Project-based Learning (PBL) not only for specific areas such as technology or engineering; it can be done through the courses such as language courses, arts, social sciences (Chu et al., 2017). Moreover, PBL not only imparts knowledge to the students, but it also helps students develop problem-solving abilities, logical and innovative thinking, teamwork, and lifetime learning (Khoiri et al., 2013). Hartini (2014) stated that when PBL is implemented, the substantial impact was significant on students' academic achievement (Hartini, 2014).

Furthermore, according to numerous studies, PBL fosters deeper learning via authentic engagement of real-life projects, making PBL more learner-centric and critical for training graduates for future job success (Huberman et al., 2014; Condliffe et al., 2017). Additionally, as Lo (2018) said, PBL is achievable in social studies, resulting in deep learning. Therefore, lecturers need to design learning environments which create opportunity for students to acquire the professional skills and qualifications needed by employers and businesses.

2.2 Previous studies on online exam

A computer-assisted examination is a method of examination that makes use of information technology. Additionally, it is referred to as e-examination. Since the 1980s, a computer-assisted examination has arisen as a realistic alternative to paper-based

examinations, advancing tests due to the assumption that digitalization results in an expansion in the variety of possibilities for planning, conducting, and grading an exam (Oz & Ozturan, 2018).

Universities are constantly using online examinations as a means of measurement and appraisal to maintain the benefits of online learning. For instance, in 2012 at Australian University, 12 percent of examinations were completed online, namely courses from the science, arts, engineering, and humanities departments (Hillier, 2014). Moreover, in Finland at Tampere University, the long-term practice of using online exams for competence began in 2014 when they set up the BEXAM initiative (Laine et al., 2016). Additionally, in 2014 Saudi Electronic University's online exam implementation was launched as part of their learning management scheme (Alsadoon 2017).

A substantial number of studies reflect on university staff and student views of the benefits and difficulties of online examinations and the need to successfully incorporate them (Hodgson & Pang, 2012; James, 2016; Farzin, 2016).

The below table consists of theories in the literature about the online exam.

Table 1: Primary aspects related to Online examination. Source: Author

Advantages	**Source**
Immediate feedback, results	Heinrich et al., 2009, Kuikka et al., 2014, Dermo, 2009, Ozden et al. 2004, Gilbert et al., 2011
It saves time and effort	Dreher et al., 2011; Baleni, 2015
Adds value for gaining knowledge	Sorensen, 2013

Disadvantages	**Source**
Barriers for some courses	Hodgson & Pang, 2012

Challenges	**Source**
Cheating	Hard et al., 2006; Harmon et al., 2010; Allen & Seaman, 2010; Rogers, 2006

	Watson & Sottile, 2010
Difficulties in objective evaluation tools	Jamil et al., 2012, Kuikka et al., 2014
Opposition to reform	Kuikka et al. 2014

2.2.1 Advantages of online exam

In the literature, the most often quoted educational advantage of online examination is instant results and feedback (Heinrich et al., 2009; Kuikka et al., 2014; Dermo, 2009). Dermo (2009) discovered, for example, that feedback allows new avenues for students to learn in a study of student attitudes conducted at the University of Bradford. Dreher et al. (2011) discovered that providing learners with positive input on their success, strengths, and areas for improvement allowed them to take the required steps to enhance their academic performances.

Hodgson and Pang (2012) conducted a survey of students at Hong Kong University and found out that prompt feedback was one of the key elements that respondents were satisfied with. As a result, such fast feedback will encourage students to think and motivate them to take more charge over their learning and engage in a change of learning strategy (Hodgson & Pang, 2012). Furthermore, according to studies (Dreher et al., 2011; Baleni, 2015), those online examinations are convenient due to the saving effort and time, expenses from university, and resources.

Additionally, Online evaluations often have the benefits of dependability, validity, and accessibility. Instructors must be precise, particularly in bigger curriculums. Therefore, the online examination is convenient (Heinrich et al., 2009). Baleni (2015) also stated that students at Eastern Cape University are pleased with the correctness of exam results on the Blackboard, owing to the fact that digital exams eliminate human error. Nevertheless, it is worth noting that such systems are only possible for multiple-choice questions (MCQs) (Farzin, 2016).

Farzin (2016) stated another advantage of online tests is that they reduce the risk of cheating since lecturers can put the questions in a different sequence for each student. On the other hand, students are uncertain about the justice of this procedure since some will be required to address challenging or difficult questions than some other students (Dermo, 2009).

2.2.2 Advantages for Students

The experiences of students are critical in the decision-making procedure before launching online exams. A variety of reports in the latest literature have looked at students' impressions of digital exams. Students are mostly pleased with the introduction of electronic examination, though some have expressed concerns. Ozden et al. (2004) conducted a survey and administered interviews to ascertain students' perceptions of online evaluations, focusing on user engagement, device utilization, and impact on the learning process. Students preferred online examination due to functionality such as quick feedback, question collection, and the declaration of the grade immediately (Ozden et al., 2004).

Sorensen (2013) conducted an investigation into students' perceptions of e-examination and discovered that students' perception was positive towards the online exam. Students believed that the online exam added importance to their learning and provided immediate feedback (Sorenson, 2013).

Students preferred e-examination since e- examination gives more control over the exam and more user-friendly interfaces, which results in an educational environment more appealing (Ridgway & McCusker, 2004). Additionally, e-examination is easy to use and fast compared to traditional examination (Alruwais, 2018). Also, e-examination ensures instant feedback in contrast to the conventional paper-based exam, which improves the approach to learning (Gilbert et al., 2011).

Leeds University and Glamorgan University stated that e-examination could positively impact student performance (Gilbert et al., 2011). Because it encourages and motivates students to improve their performance (Marriott, 2009), e-examination can also be conducted anywhere. It ensures flexibility for the students who live in rural areas (Way. A, 2012).

2.2.3 Advantages for Teachers

The paper-based traditional exams take more time for the instructors to control and feedback for each paper. However, e-examination eliminates that issue and saves the time of teachers (Gilbert et al., 2011; Donovan et al., 2007; Sorensen, 2013). For instance, a

study conducted at Leeds Metropolitan University discovered that e-examination saved the instructor's time. Additionally, an electronic examination allows teachers to improve the quality of the examination (Ridgway et al.., 2004; Way,2012). E-examination helps instructors monitor the students' educational achievements and scores and act and analyze according to many examinations (Ellaway et al..,2008). Immediate feedback from e-assessment helps teachers find misconceptions that are not understandable and solve those negative perceptions before the next or final exam (Ellaway et al.,2008). Moreover, another benefit of using e-exams for the teachers is to decrease the load to evaluate a large number of students (Nicol, 2007).

2.2.4 Advantages for Institution

There is a demand for a fast and precise examination method since the number of students is growing day by day (Ridgway et al., 2004; Way, 2012). Besides, e-examination reduces the students' expenses since the consumed time for assessing decreases (Donovan et al., 2007; Sorensen, 2013). Moreover, e-examination ensures and does not allow the student to copy the questions since it includes verification of identity in the exam. Exam questions are in a different order for each student.

2.2.5 Students' performance in online exam

The studies investigate the effect of online examination on students' exam success. They discovered a significant correlation between learners' engagement in examinations and education and academic achievement. Werhner (2010) published an analysis to assess online and face-to-face students’ achievement using the same online test in science classes. The findings revealed that both classes of students performed substantially similarly in their exams (Werhner, 2010). Karay et al. (2015) conducted another analysis in which they grouped medical students into two categories based on previous examination outcomes and offered similar space and seating arrangements. According to the study, there were no statistically significant differences in findings between traditional and e-examination variants (Karay et al., 2015).

2.3 Challenges when conducting examinations online.

Even though online examination has enormous advantages for the students, teachers, and institutions, it also has some challenges. This section covers the challenges of the online examination, such as academic dishonesty, integrity, and other difficulties for the students and Lecturers.

2.3.1 Difficulties

According to certain reports, the fundamental constraints that electronic examinations face are due to the time and experience need to establish analytical examinations (Kuikka et al., 2014).

Jamil et al. (2012) interviewed teachers at different universities in Pakistan to ascertain their views on electronic vs. paper-based tests. The study discovered that most lecturers were extremely worried regarding the challenges associated with developing multiple forms of objective questions for online exams (Jamil et al., 2012). Correspondingly, Kuikka et al. (2014) examined a comparative analysis of teachers at Finland's Turku University of Applied Sciences to identify possible barriers to introducing e-exams. They discovered opposition to reform, in which lecturers were reluctant to alter their examination methods. The study concluded that adequate support and dedication to encouragement would be useful in addressing this barrier (Kuikka et al., 2014).

James (2016) showed that students had a decent understanding of how technology works in the online world, especially for first-year university students but was worried about poor internet access and technological issues (James, 2016).

2.3.2 Academic Integrity

Postsecondary education has been called equitable and efficient approaches for upholding academic honesty. Though the likelihood of students engaging in academic cheating has always appeared, there is a common perception that academic integrity violations are growing (Hard et al., 2006). Integration of technology into the classroom and the growing prevalence of online education, new opportunities for "e-cheating" have emerged (Harmon et al., 2010). Distance learning courses have expanded exponentially in the twenty-first century, with attendance increasing from a reported 9.6 percent in 2002 to 63.11 percent in 2010 (Allen & Seaman, 2010). Online distance education is expected to

grow in the coming years. As universities shift to online delivery, faculty and administrators will face designing ways to effectively measure student learning in an online setting while ensuring academic integrity (Allen & Seaman, 2010).

Academic integrity is a severe issue in online education, owing to the absence of face-to-face interaction between students and lecturers (Moten et al., 2013). There are several new ways to cheat in an online environment, including but not limited to: downloading papers from the Internet and claiming them as one's work, using materials without permission during an online exam, communicating with other students through the Internet to obtain answers, or having another person complete an online exam or assignment instead of the student who is submitting it (Jung & Yeom, 2009; Rogers, 2006).

While literature is divided on whether or not more cheating happens in online tests than in-person exams, there is consensus that cheating has often existed regardless of the delivery process (Barnes & Paris, 2013). Multiple ideas have been addressed in the online teaching sense to tackle academic dishonesty in the online test world. Another point of view is that online tests will provide a realistic alternative for students who live far away from campus or other testing facilities while also upholding academic integrity with the proper changes and protection procedures. However, each of the suggested alternatives has its own set of drawbacks (Barnes & Paris, 2013).

2.3.3 Incidence of cheating

Cheating is widely assumed to arise more often in online classes than in in-person courses. Most students think that it is easier the copy from other resources in an online environment (Watson & Sottile, 2010). While several studies have been conducted on academic dishonesty in in-person courses, few studies have compared cheating rates in in-person and online classes. The findings from different studies seem contradictory, with some demonstrating that cheating occurs more frequently in online courses than in face-to-face (Khan & Balasubramanian, 2012; Watson & Sottile, 2010). Some researchers indicated that similar cheating levels (Grijalva et al., 2006; Ladyshewsky, 2015). However, some studies indicated that cheating occurs lesser in an online environment than in a traditional (Stuber-McEwen et al., 2009).

For example, Watson and Sottile (2010) used the Academic Dishonesty assessment for 635 students from various faculties. According to the report, 32.7 percent of respondents confessed to cheating in an online course more frequently, while 32.1 percent stated cheating in an in-person class. Furthermore, students agreed that cheating is four times more likely to cheat in an online environment than face-to-face (Watson & Sottile, 2010).

Ladyschewsky (2015), on the other hand, discovered that multiple-choice test scores in an unproctored online environment were no different from scores in a proctored, in-person exam in a study of postgraduate students.

2.4 Utilization of e-proctoring tools in Online exams

Usually, proctored tools are working with artificial intelligence to examine movement during the exam to detect any cheating activity. Online proctoring services have flexibility since they can be used from any place via the Internet (Hylton et al., 2016). The online proctoring tools require access to webcams, microphones of the student. Throughout the exam duration, students are expected to keep webcams and microphones on for the proctor tools. The students also must prove their identity by displaying ID towards the camera (González-González et al. 2020).

Online proctoring is classified into three broad categories: video summarization, web video capture, and live online proctoring (Holden et al., 2020).

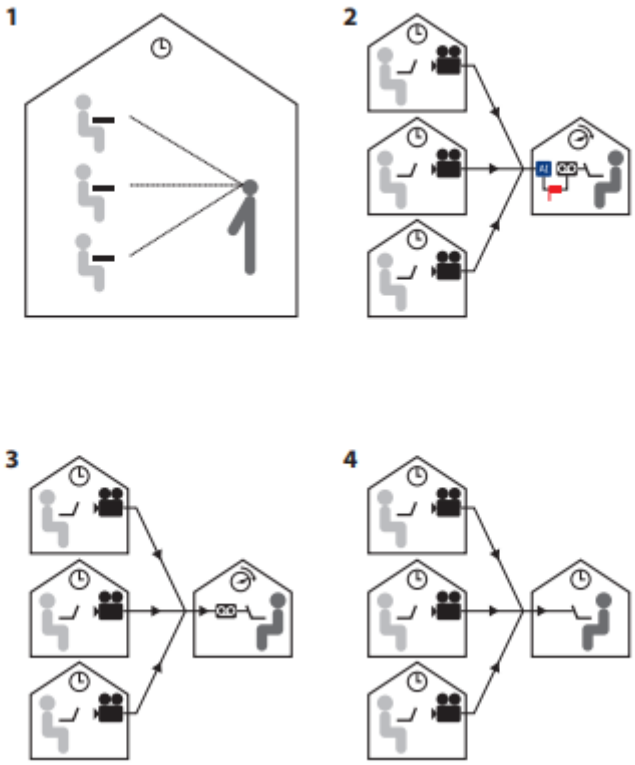

Figure 1: Figure 1: Types of Proctoring 1) In-person, 2) Video summary, 3) Web video capturing, 4) Online live Proctoring. (Holden et al., 2020).

2.4.1 Previous studies about proctored online examinations.

Many researchers have examined e-proctoring technologies from various aspects. Milone et al. (2017) investigated in their research the impact of using online proctoring tools. They examined pharmacy students' experiences in a typical environment (without pandemic). According to the study, the educational institution decided not to continue online proctoring despite the advantages of managing a massive, huge group of students. Additionally, the study stated that the primary factors outweighing the benefits of e-proctoring techniques are the increased expense associated with each exam and technical difficulties (Milone et al., 2017).

Privacy is the primary concern in e-learning settings, and it is also the most crucial component addressed in the studies (Majeed et al., 2016). Consequently, privacy is a primary consideration when incorporating e-proctoring systems in an e-learning environment (González-González et al., 2020).

2.4.2 Challenges of Using Proctoring tools

Many worries have been raised regarding the use of e-proctoring software. First, there is the capacity and willingness of universities and faculties to conduct the secure examination. Most universities accept a considerable number of students whose assignments are concurrently proctored and whose examinations are simultaneously reported (Khaled, 2020). Additionally, students must be instructed on how to use the e-proctoring tools available and can be integrated with the LMS, including Moodle and Blackboard. However, it is simple to handle the technological preparation problem with server extension and online training of students who show how to use the system and log in for training by step-by-by-step tutorials. Consequently, even in countries like India, not all research facilities can conduct online tests using these e-proctoring software applications (Khaled, 2020).

Cheating

More notably, e-proctoring systems are not able to deter cheating, where questionable cases demonstrate that cheating can still be challenging. Mitra & Gofman (2016) stated that online exams face an enhancement when conducted in the presence of a live supervisor because it is more difficult to detect cheating in this sort of situation. Students can access sources such as the internet or have help from others. These researchers attempted to determine the prevalence of cheaters among the group of students in a research study of online exams (Mitra & Gofman (2016).

Furthermore, another challenge of using an e-proctoring tool is that it might detect cheating when exam takers move their bodies, face away from the screen. As a result, the e-proctoring tool is considered suspicious activity (Mitra & Gofman, 2016). Numerous inquiries have been made due to the reason that students can move their bodies or make movements for a variety of acceptable purposes that cannot be shown to be a desire to cheat. Additionally, if the exam taker takes the exam at home, their acts would be more natural and relaxed. Several illustrations illustrate how difficult it is to establish intent to cheat, like a female student wearing a hijab or if students want to go to the restroom (Jalali & Noorbehbahani, 2017). Other issues such as internet connection problems during online exams might be enough excuses for exam takers to retake. It would, however, be

difficult to confirm whether or not such an event occurred (internet crash). Proctoring automated approaches are ineffective in these situations (Jalali & Noorbehbahani, 2017).

Furthermore, Woldeab et al. (2017) conducted a preliminary online test study of students' attitudes towards proctored exams before the exam. The findings revealed that 38% of participants (864 students) indicated that they had little confidence in their technology to be suitable for exams, and 52% reported that they were very or not sure in their ability to use technology for exams. Students who feel insecure when asked to respond in front of the mirror do frighten by online tests in general (Woldeab et al., 2017; Woldeab & Brothen, 2019).

Privacy

Privacy is one of the key concerns when using such tools since the university, and the software provider have the right to view personal spaces and biometric and test data. The main concern is if the video files will be used after the test and whether and who will connect to them. Although biometrics could cause over 43% of the students to feel anxious, 73% regarded this as an infringement of privacy (Mitra & Gofman, 2016). Moreover, Mitra & Gofman (2016) discovered that most students felt uneasy taking an online test while being observed (Mitra & Gofman, 2016). Opposition arose due to questions about personal data protection in Australia's universities, and the Netherlands both issued an online petition to combat e-proctoring apps (Doffman, 2020; Zhou, 2020). Universities are allowed to retain the right to screen their students in tests, enabling them to complete oversight over the institution. However, these are only the two ways they have of keeping a check on their students' independence on campus. (Doffman, 2020; Zhou, 2020).

Moreover, a previous study showed that students' test scores went down after the usage of e-proctoring tools in online exams (Alessio et al., 2017; Alessio & Maurer, 2018). This will lower the prestige level of the university if the students cannot adequately represent their ability (Delbert et al., 2020).

The below table includes the theories from literature about the usage of e-proctoring tools in the online examination.

Table 2: Challenges of Using Proctorio in online exams. Source: Author

Challenges	Source
Cheating	Mitra & Gofman, 2016
Lack of confidence	Wolde et al., 2017
Students feel insecure	Woldeab et al., 2017, Woldeab & Brothen, 2019
Privacy	Doffman, 2020; Zhou, 2020
Affects test performance	Alessio & Maurer, 2018, Alessio et al., 2017

Summary

In this section of the study, previous studies from literature covered the advantages/disadvantages and the challenges of online examinations—the elaborated advantages for the students, teachers, and institutions. Then later experience and the performance of the students in the online examinations. Further, the use of Proctored tools in the online examination is covered. Then challenges of using the Proctorio tool in the online examination are analyzed.

3 Methodology

This chapter explains and justifies the study methods used to achieve the aforementioned aim. The research structure is explored, including the research approach and case study method. Besides, the research questions are then presented. The environment and participants are identified in detail. The instruments and procedures for data collection are identified, including interviews, surveys, documentations.

3.1 Main Research questions

The purpose of the main research questions is to investigate the perspective of online examinations in higher institutions and the utilization of e-proctoring tools. Furthermore, both lecturers' and students' perspectives were analyzed.

Main RQ: How to enhance the usage of online examinations in higher education institutions?

RQ1: How is the online examination used in the distance learning environment?

SQ1: What are the main advantages and disadvantages of online exams?

SQ2: What are the main challenges of the online exams?

SQ3: What are the perceptions of students and teachers towards the online exams?

RQ2: How are e-proctoring tools used in online examinations?

SQ1: What are the students' perceptions about the usage of proctored tools in online exams?

SQ2: What are the teachers' perceptions/experience about using the proctored tools in the online exams?

SQ3: What are the main challenges of using proctored tools in online exams?

SQ4: What are the students' opinions about their performance after using e-proctoring tools?

Research design

This research is a qualitative case study of conducting online examinations in higher education. This research aims to discover the advantages and challenges of examination in the online learning environment. This case study focuses mainly on the public universities of Estonia. Moreover, surveys from students and interviews from lecturers were used during the study period to ensure richer data from different sources.

The survey was intended to identify students' experience and perception about the online exam and e-proctoring tools in online exams. The interview was conducted with teachers who have conducted online exams and Proctorio tools in online exams.

Case study approach

This section explains the key features of case studies as a research method or strategy. The concept strategy is used deliberately since a case study is not a technique but rather a choice of topic to be studied; the selected object is the case. If the event or object has been identified and described, several methods and practices, such as assessment, interviews, and photographic analysis, can be utilized to analyze the case (Adelman et al., 1980).

A case study, according to Yin, is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident" (Yin, 1994). McDonough and McDonough (1997) consider case studies to be a standard method related to the main qualitative analysis principle through being emic. As stated by Creswell, a case study is a qualitative research where researchers examine historically restricted single or multiple situations in-depth with various sources. The themes related to cases and problems are extracted and explained (Creswell, 2007).

Case of Estonia

Estonia is one of the member states of the European Union. Estonian area is 45,226 square kilometers and with 1,31 million people. Estonia is represented by a well-organized e-University consortium in the EU. The consortium resulted in outstanding work in this regard, with the implementation of e-learning as a core component of the Estonian

R&D&I Strategy (Kalvet, 2007). In that sense, Estonia is an excellent example of using ICT in all areas of life, notably in the education sector. Therefore, Estonia is appropriate for this case study since Estonian educational institutions use ICT in education for a long time. Additionally, Estonia is the most digitized place on earth, making the author confident when choosing the case.

Estonia's leading universities are involved in promoting e-learning in higher education, organizing and conducting various e-learning classes for university lecturers. Estonia has made great strides in promoting e-learning, hybrid learning, and distance education, taking demographics and students studying in higher education. Thus, Estonia fulfilled but far exceeded the EC's goal of setting a precedent for the other European Member States. Estonian virtual learning education sphere and other digital services are highly regarded and generally known globally. The Estonian example of success in these fields is significant for global ICT growth (GULLU et al., 2014).

In the frames of this study, three top public universities of Estonia were chosen. In terms of the number of students, these three universities have the most students. TTU, TLU, and UT are the most prominent and most significant universities in Estonia (GULLU et al., 2014). Therefore, as a case, these three universities were chosen.

Tallinn University of Technology

In 1918, Tallinn University of Technology was established. According to the student population, it is Estonia's second-largest university after UT. Collaboration with other organizations plays a critical role in the advancement of e-learning at TTU. HITSA Innovation Centre plays a crucial role in this interaction by coordinating and supporting TTU's e-learning processes. Moodle is the primary learning management system used at TTU (GULLU et al., 2014).

University of Tartu

The University of Tartu, established in 1632, began practicing e-learning practices, starting in 1995 at the Faculty of Mathematics to deliver an email-based course to students. However, three years later, in 1998, the UT created and delivered the first web-based lesson in the WebCT setting. Later, in 2000, the University Council assigned e-

learning at UT the highest priority. The Distance Education Centre was formed as a strategic entity charged with improving e-learning at UT. The UT's E-University site was launched in 2002. This site offers research and professional assistance to students and academic personnel. Since 2003, the UT has been a part of the newly formed network of Estonian e-Universities. In 2009, the UT began using the web-based learning environment Moodle. Later on, in 2011, Moodle was integrated with the Study Information System (GULLU et al., 2014).

Tallinn University

The TU E-learning Centre, founded in 2005, offers a variety of technological solutions for e-learning (ICT technology, video conferencing facilities, etc.) and assistance for academic personnel engaged in e-learning activities. Although TU formerly used an in-house built learning management system (LMS) named IVA, the university has since migrated to Moodle, eDidaktikum.ee, and Open Learning Environments (blogs, wikis) for the development of e-courses and education. (GULLU et al., 2014).

Data Collection Procedures

Kabir (2016) asserts that data collection is a critical and challenging process of study. It is standard in all fields of analysis, regardless of the methodology used. Any data collection aims to acquire sufficient information, which leads to data interpretation and, ultimately, resolution of the issue under review. To that end, he added that precision should be prioritized during data collection (Kabir, 2016).

Kabir (2016) stated that data collection entails gathering and measuring data on a topic in accordance with existing guidelines that assist a researcher in answering formulated research questions, testing theories, and evaluating findings. The description stressed that the data collected should facilitate the resolution of study questions.

In order to ensure adequate coverage of sources, this study uses current existing documents about the topic. In addition to the existing documents, this study conducted expert interviews and gathered data from students through a survey.

Document Review

A document review is a comprehensive analysis of the available literature on a topic. A researcher becomes aware of the topic's awareness deficit through paper analysis, which then advises or demonstrates the need for a new investigation. A researcher requires sufficient record analysis to write a solid article since prior research would provide the foundations for such writing. Additionally, adequate paper analysis demonstrates to readers that the writer has a sufficient understanding of the topic, enhancing the writer's reputation and the credibility of the conclusions (Denney & Tewksbury, 2013).
Furthermore, according to Denney and Tewksbury (2013), the analysis starts with a broad overview of the subject. It progresses to a more detailed examination of the research questions the writer has set, particularly critical in qualitative analysis.

In this study, the documents were gathered from reports, scholarly studies, books, journals and articles. When it comes to document sources, locating relevant articles about the usage of Proctorio was especially challenging. The paper inclusion dates ranged from 2010 to 2021. The most used sources for this research are Science direct, Springer, ResearchGate, Academia, etc. Additionally, the older records were used in situations where subsequent documents were unavailable.

Survey

With the advent of communication technology, conducting online surveys to gather data for research purposes has become a reasonably widespread practice (Kumar, R. 2014). Surveys are known to be versatile tools for qualitative data collection. A survey has various advantages, including low costs, the brevity of time, reliability, direct data entry, and broad geographic scope (Sue & Ritter., 2011).
The survey's structure is deliberately considered in light of the target audience's size and diversity. Due to time constraints, this method of data collection is appropriate. Additionally, delivery of surveys online is advantageous due to geographic constraints.
Furthermore, in the survey, primarily multiple-choice responses were selected as the answer format during survey question layout design. According to Sue and Ritter (2011), asking participants to choose one response from a list is preferable to other types of question design. Hence, the survey was primarily designed employing this method.

The questionnaire was shared through the internet via social media and email. The total number of respondents who have submitted their responses is 162. The questionnaire consisted of 17 questions (Appendix 01) aiming to collect the basic information about the citizens, perceptions, experiences, concerns, and suggestions for future online examinations.

Interviews

In the frames of the study, interviews were conducted to collect information from lecturers. The interview is used to identify the perspective, solicit and obtain answers from specific participants to determine the study's research question. Interviews can be structured, unstructured, or semi-structured. The semi-structured interview involves an interview schedule that includes a list of key questions and subjects to cover during the interview. The questions often contain open-ended questions, that allow for answer variations (Kabir, 2016).

To elicit the lecturers' perspective, this study used a semi-structured interview (Appendix 02). The interview questions were primarily open-ended, which allowed for the detailed expression of responses and any additional insights. The interviews were administered online due to the pandemic. The interviews were recorded and transcribed using the ***Otter.ai*** application, which uses artificial intelligence in order to transcribe a recorded voice. The application also helps to find a keyword and themes which are used most during an interview. The duration of each interview of the lecturers was about 30 minutes.

Lecturers who have direct experiences with online exams and using Proctorio tools in exams were chosen for this study. The first segment of the interviews was intended to learn about the positions they held. Followingly, it was about their experiences with online exams and Proctorio tools (advantages and disadvantages, challenges).
Overall, four lecturers were interviewed. All of them were from Tallinn University of Technology who have experienced online exams and Proctorio tool. The discussion revealed that the lecturers had experienced an online exam using the Proctorio tool multiple times.

Analysis Procedures

According to Runeson et al. (2012), data analysis enables us to comprehend precisely what occurred in the case. The authors' comprehension of the case allows for him or her to derive themes and hypotheses from the evidence. Several crucial points made by Runeson et al. include the following: the researcher should consist of adequate detail about each stage of the study and significant decision made, and the review process should be iterative rather than sequential.

This study followed Larke and Raun's six-phase review methods, which include the following (Terry et al., 2017):

1. Acquaint with the data gathered
2. Creating codes
3. Constructing themes
4. Examining possible themes
5. Themes described and named.
6. Creating the report

The study firstly transcribed data using ***Otter.ai*** software. Then the author read the text repeatedly. After that, codes are generated with the use of Microsoft Word and Excel (Appendix, 03 (tutorial)). The author then analyzed the codes to identify relevant themes and grouped them. Next up, he compared the codes' possible themes and the data collection to ensure that the theming was accurate. Then, the study of the themes resulted in the definition and naming of the themes. Lastly, the author chose the most pertinent sections for the article writing about the study question and literature review, from which the conclusions are drawn.

4 Findings

This chapter consists of the findings of the survey and interviews.

4.1 Survey

In terms of details and results, firstly, the gender of the students has been asked. The majority were male students who participated, which is 61.7% of the total number. Then 37% of all respondents were female students. 1.2% of students preferred not to respond to the gender question. Next, the age of respondents was asked, and the result showed that the majority of students were between 18-24 years old, which is 46.9% of the total number of people that submitted their responses. After that, the following age group range was 25-34 years old, 46.3% of the total answer. Then the 35-44 years old range was one of the age range groups, which is about 5.6% of the total response. Lastly, the 45-54 years old age range was the least age range which consisted of only 1.2%. The Z generation students, who are 18-24 years old, were more active, and the younger generation was more interested in virtual learning, and doing examinations online was more exciting and appealing.

Then students were asked which university they are studying in Estonia. The majority was from the top and public universities of Estonia. Corresponding to the survey results, most students were from Tallinn University of Technology, which was 70.4% of the total respondents. After that, students from Tartu University filled the survey with 12.3% of the total number. And Tallinn University with only 6.8% respondents. The 10.5% of total responses were chosen other Option in the survey.

Furthermore, the level of education was asked. Most of the students were from master's degree which is 54%. Then 42.9% was from a bachelor's degree. Only 1.9% of students were from Ph.D. And 1.2% of total response has chosen other as an option.

The next question was about whether students ever experienced online examinations. 92% of the respondents have experienced online examinations. Following, how many times they have experienced it was asked. 37.3% of the students have experienced the online exam 0-3 times. Then 32.7% of the total number of students have used online exams 3-6 times, and 30% of total participants have experienced six and more times.

Then students were asked about the e-proctoring tools in online examination, whether they used them, and their perception about it. Among respondents, 46.2% have experienced e-proctoring tools during the examination.

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Then students were asked about the e-proctoring tool in online examination, whether they used it, and their perception about it. Among respondents, 46.2% have experienced proctored tools during the examination.

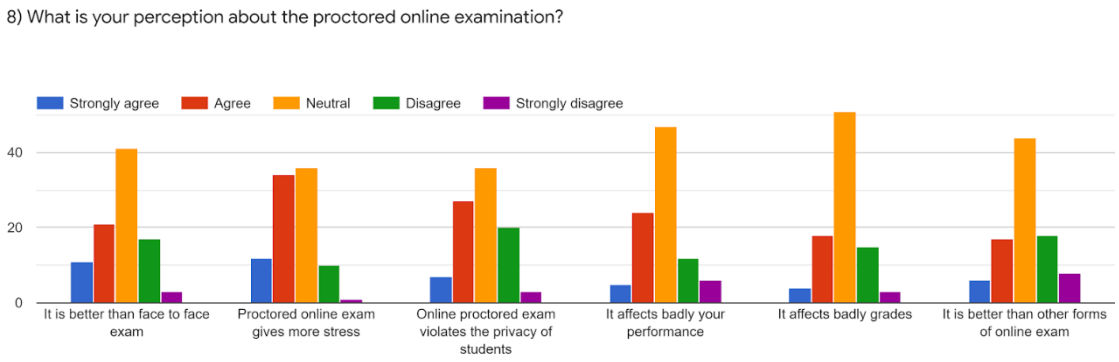

Figure 2: What is your perception about the proctored online examination? Source: Author

Then students were questioned in detail about their perception of the e-proctoring tool in the online exams. The question type was Strongly agreed, Agree, Neutral, Disagree, and Strongly disagree. The first sub-question of students' perception towards proctored tools is if it is better than the face-to-face exam. The majority (41) of the students were Neutral in this statement. Then 21% of the students have chosen Agree. It follows with a disagreement option with 17 Students, then strongly agree (11), and lastly strongly disagree (3).

The next sub-question was if the e-proctoring tool in online exams gives more stress to the students. Here 36 students selected the Neutral option. Then it follows with Agree,

which is 34 students. Later, strongly agreed (12 students), ten students were Disagree, and only one student was Strongly Disagree.

The following statement was whether an online proctored exam violates the privacy of students. The data showed that 36 students selected Neutral, and 27 students agreed with the statement. Twenty students chose the Disagree option. Followed by seven students who selected the Strongly Agree option. Lastly, only three students Strongly disagreed that the Online Proctored exam violates privacy.

The next statement was whether online proctored exams affected their performance. According to the data, 47 students were Neutral in the statements. And 24 of the respondents selected the Agree option. Then 12 students disagreed that it affects the performance. Moreover, five students selected strongly agree, and six have strongly disagreed.

After that, statements about whether e-proctoring tool in online examination affects their grades badly were asked from students. Most of the students selected the neutral option, which is 51 students. It is followed by agreeing (18 students), then disagreeing (15 students). Only four respondents selected strongly agree with the statement. Lastly, three students strongly disagreed that proctored online examination affects their grades.

The last statement of this question was asked from students, whether the online proctored examination is better than other forms of online exams. The majority of the students stayed Neutral for the statements. The 18 students disagreed, and 17 students agreed with the statement. The strongly disagree option was selected by eight students and strongly agreed by six students.

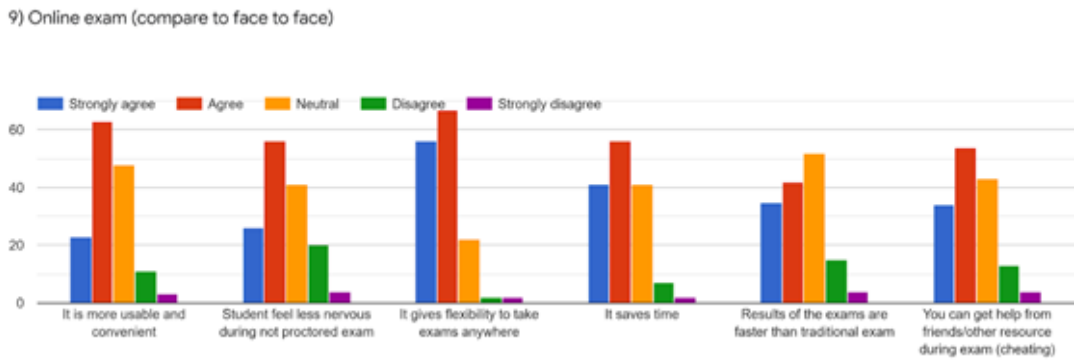

Figure 3: Online exam compared to face-to-face. Source: Author

In this question, students were questioned about six statements asking regarding their perception of the online exams compared to traditional examinations.
The first statement was whether the online exam is more usable and convenient. Most of the students agreed with the statement, which is 63 students of total respondents. The 48 students stayed Neutral for the statement, and then 23 students selected the Strongly agree option. The argument was then disagreed upon by 11 students, with three students strongly disagreeing.

The next statement was about if students feel less nervous in online exams when not proctored. Most students agreed with the statement, which is 56 students. Besides, 41 students stayed Neutral, and 26 students Strongly agreed with the statement. On the other side, 20 students disagreed with the argument, and four strongly disagreed with it.

The next statement was about the flexibility of the online exams. The students were asked whether online exams give them the flexibility to take exams anywhere. Most students agreed with the statement, which is 67 students. And 56 students selected strongly agreed to the statement. Then 22 students stayed Neutral. On the other hand, only two students disagreed, and two strongly disagreed.

Another question was whether online exams save time over conventional exams. Fifty-six students supported the argument, 41 of whom fully approved. In addition, the same number of students (41) remained neutral. The argument was then opposed by seven pupils, two of whom firmly disagreed.

The following statement was whether the results of the online exams are faster than the traditional exam. The majority of the students stayed Neutral, which is 52 students. The 42 students agreed, and 35 strongly agreed to the statement. Besides, 15 students disagreed, and only four students strongly disagreed.

Last but not least, the statement was about cheating in the exam. Students were asked whether it is easy to get help from friends or any other resources during an online exam. The majority of the respondents agreed with the statement, which is 54 students. Then 43 of the respondents stayed neutral. After that, 34 students strongly agreed with the statement about cheating in the online exam. Besides, 13 students disagreed, and four students strongly disagreed.

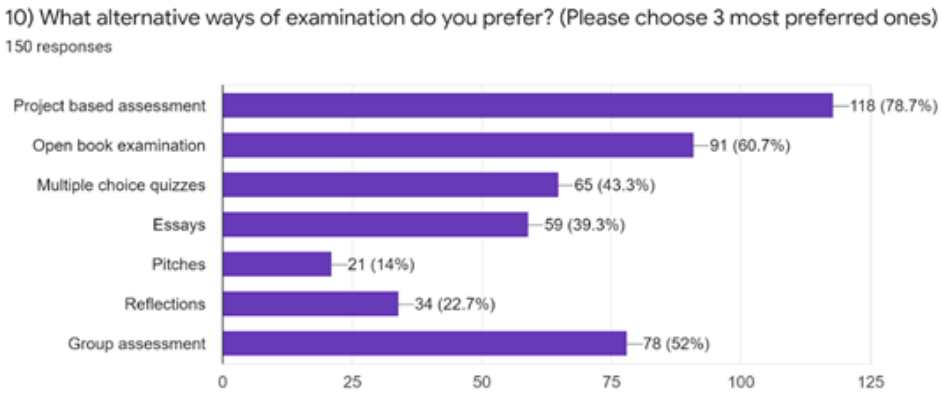

Figure 4: What alternative ways of examination do you prefer? Source: Author

Next, the students were asked about the alternative ways of examination by choosing three preferred assessment methods. Most of the students have chosen a Project-based assessment which is 118. Then Open book examination followed as the next most preferred way of examination, which 91 students chose. The Group assessment was the next favorite assessment type according to the participants (78 students). Then multiple-choice examination with 65 students, essays 59 students, reflections 34 students. The last less favorable assessment type was Pitches, according to the students.

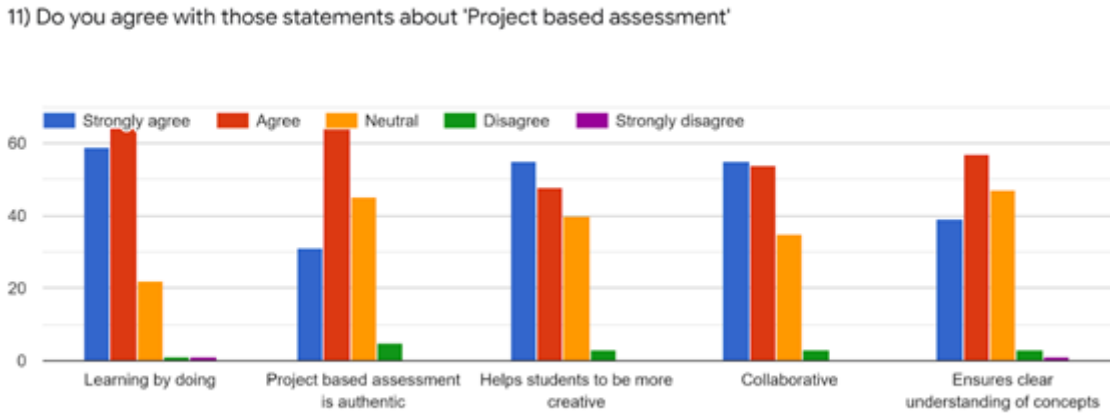

Figure 5: Do you agree with those statements about Project-based assessment?

Then students were asked their opinion about the Project-based assessment.
The first statements were 'Learning by doing. Most of the students have agreed that Project-based assessment is Learning by doing. Then 59 students strongly agreed with the statement. And 22 students stayed Neutral for the statement. Besides, only one student disagreed, and one strongly disagreed.

The next statement about the Project-based assessment was whether the Project-based assessment is authentic. The statement was agreed upon by 64 students, with 31 strongly agreeing. Besides, 45 students stayed Neutral with the statement, and five students disagreed with the statement.

Then whether a Project-based assessment helps students be more creative, most students strongly agreed, with 55 students and 48 students agreed with the statement. Besides, 40 participants stayed Neutral, and only three students disagreed with the statement.

After that next statement asked from students was whether Project-based assessment ensures a clear understanding of the concepts. The results indicated that most of the students agreed 57, and 39 of the participants strongly agreed with the statements. Then it follows 47 Neutral students. Besides, three students disagreed, and only one strongly disagreed with the statement.

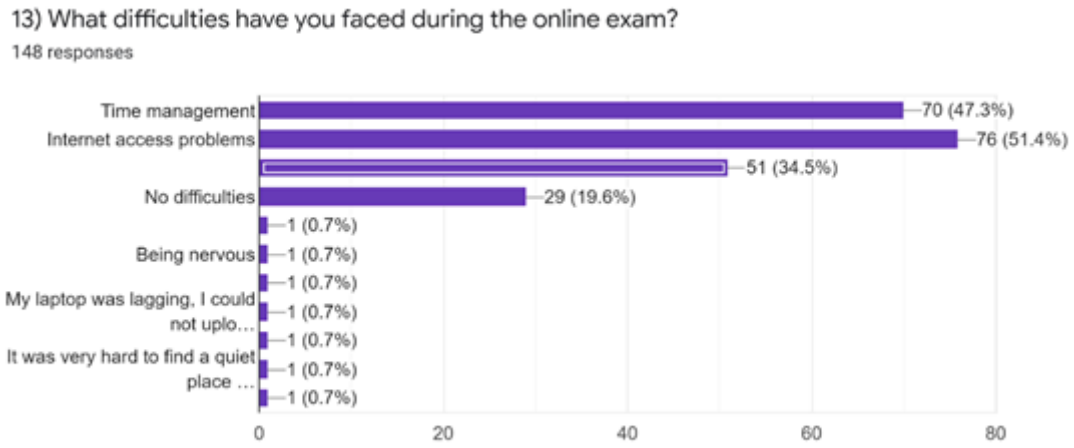

Figure 6: What difficulties have you faced during the online exams?

Then students asked what kind of difficulties they have faced during the online exam. The survey results showed that the most well-known problem for the students during online exams was the Internet access problem which 76 students chose. Then it followed with the time management, 70 students. On the other hand, 29 students claimed so that they had not faced any difficulties during an online exam. One of the students wrote that being nervous was a difficulty during an online exam. Another one has encountered a technical problem such as his/her laptop was lagging and not uploading. Moreover, one student found it difficult to find a quiet place during the online exam.

Then students were asked to write three main advantages and three main disadvantages of online examination. The below table illustrates the most well-known advantages and disadvantages of online exams according to the participants. This question was open-ended.

Table 3: Advantages and disadvantages of online exams. Source: Author

Advantages	**Disadvantages**
Faster typing	More stressful
Social distancing	Internet connection problems
The low percentage of failing the subject	You can get distracted easily
Technological sound	Time management/Pressure of time
You can use your notebook	Less interactive

It can take any place on Earth	Less competitive
No need to get dressed	Lack of conversation with the lecturer
A solution to the World pandemic crisis	Less emotion
Minimum health risk	Less excitement
Less grammatical errors	Biasedness
Timesaving	You are responsible for the internet connection
Faster results	Irregular grading
You can get help	Less attention to details
More freedom	Limited test formats
Easy grades	The chances of dishonesty

Last but not least, the question in the survey was about the suggestion from students for future online exam techniques.

The below are the more noted and well-known suggestion from the students:

Table 4: Suggestions from students for future online exams. Source Author

"Classical exams don't reflect the real abilities of a student. I prefer various small assignments during the semester."
"Prefer Project-based assessment as an evaluation method."
"There should be case studies included in the online exam to evaluate knowledge gained by the student."
"Open book examination, especially during an online exam."
"Change the typical 2-hour exams to be a home exercise/project; in that situation, you have more time to ask questions and the internet problems are not a big deal since you have enough time."
"I think it's better to go with open books or projects. I don't see a point in close book exams anyways"'
“Exams should be offline to be a fair evaluation.”
“More time offered - The teacher would be online on zoom or any other platform, so questions can be asked right away.”
“I believe practical examination is the future, meaning, having an exam where you have to do a project/build something from scratch at that moment (not like the traditional project-based examination which usually is semester-long), then the defense of the project needs to match certain criteria from the course outcome.”

“Do not ask students to turn on the cameras - many of us feel uncomfortably in front of those”

4.2 Interview findings

Description of interviewees

This part consists of an overview of the interviewees who were chosen to take part in the interviews. All the lecturers were from Tallinn University of Technology who have experienced online examination and e-proctoring tools. The discussion revealed that the lecturers had experienced an online exam using the Proctorio tool a couple of times. In addition, this section shows all the themes and codes mentioned by Interviewees.

Challenges of the online exams

Identification

As stated by Interviewees, the Identification of the exam takers was challenging for the lecturers during online exams. According to the Interviewees, Tallinn University of technology is using Moodle as a Learning management system. Moodle is poor when it comes to identifying persons and making sure that there is no academic cheating happening during the exam. The Lecturers’ main concern was that there is no way to verify the student when doing an online exam with Moodle. Authentication and authorization can be done with Moodle. But lecturers cannot do personal verification. Nowadays, identification and monitoring are a must for Universities, especially when they are new students (Interviewees 01, 02, 03, 04).

Trust

Trust is one of the main challenges when you conduct an online exam. Two of the Interviewees mentioned that if they have an opportunity to choose between face-to-face and online exams, they will go for face-to-face. They noted that trust is the main reason for this since they cannot see anything on what students have on the desk if they do an online exam (Interviewees, 01, 02).

Cheating

According to Lecturers, there are more chances of cheating during online exams, but some have already experienced face-to-face exams where some students were cheating. Despite that, all the lecturers agreed that the threat of cheating is bigger in online exams compared to face-to-face. They also mentioned that when students cheat, they do not learn, so they are bullying themselves. And students do not acquire the knowledge and the skills which are required in the labor market (Interviewees, 01,02,03).

In terms of cheating one Lecturer, mentioned that he does not think that cheating necessarily happens, but it is possible. However, one of the lecturers mentioned in the interview that he did one online exam without Proctorio for 19 students in December. Out of 19 students, seven students were caught cheating when checking the exam results (Interviewee, 02, 04).

Barriers for some Courses

The lecturer who teaches microeconomics mentioned that she faces some problems in some subjects, especially in economics, that have mathematics and graphs during the exam. If only to assess theoretical questions, then an online exam is fine in microeconomics, only to assess if the students have knowledge about the concept. In mathematics and graphs, Moodle is not so straightforward and easy for students (Interviewees, 03, 04).

Advantages of Online Exam

Faster results

According to some lecturers, when you do an online exam, especially using multiple-choice and true-false, the results are faster, and it is much more convenient for the teacher.

"Related to the theory in the Autumn safe exam browser where I set a quiz online with multiple-choice questions or true-false. And students say that it was nice because they just logged in and have done the test. In this way, the examination is faster. Because immediately, the answer is given whether it is right or wrong. And from my side, I do not have to do anything else. I mean, I will only see the performance of the students. But I do

not have to go through and check for any mathematical spec for any writing. So, in respect to a multiple-choice or true-false quiz, it is much faster to assess the students." (Interviewee, 03).

Disadvantages

Students want easy credentials.

As stated by lecturers, there are lots of different interest groups when talking about online exams. Some students, especially bachelor students, might think an online exam is an opportunity and a chance to get a good grade. One of the lecturers also mentioned that the students who are new to the university and younger (first-year students) might think it is an online exam so he/she can cheat easily and get good grades, thinking perhaps easily and nobody would find out. Therefore, it is better to use Proctorio, especially for new and young students When analyzing, not only need to analyze purely from the students' perspective, because students at least most of them want to get their credentials easily (Interviewees, 01, 02, 03).

Proctorio Tool in online exams

Setting process of Proctorio at Tallinn University of technology

According to the Interviewee, when they started researching the different proctoring tools, there were many them on the market. It was a surprisingly mature market, but it was not so common in Estonia. And then, they compared three or four e-proctoring tools, and they ended up with Proctorio quite quickly because Proctorio has excellent integration with Moodle. That was the primary requirement from a functional perspective. Proctorio had its own Moodle toolkit; also, it has a user interface for both students and teachers. As a result, the learning curve for academic staff and students is relatively short. There are extra steps to take the exam, but the exam experience is still as smooth as possible with Proctorio. Setting up a proctored exam requires minimal head or minimal preparations from the support staff, and teachers can relatively quickly self-manage the test or exam (Interviewees, 01,02).

Licensing of the Proctorio tool

According to lecturers at Tallinn University of Technology who participated in a pilot program of implementing the Proctorio tool, they mentioned that Proctorio is making no secret of their price lists. According to them, Proctorio has two licensing components. Firstly, one type of exam taker is one licensing, and the second option is per student per year. Lecturers can do the main licenses per student, and they are covered for the whole academic year for all courses in the university. The one type of licensing was five euros per student per exam. Another type which is the annual license is 15 euros per student since the licensing structure of the Proctorio tool is reasonable so that it makes sense for academic institutions (Interviewees, 01, 02).

> *"So, they had to design the service in a way that was appealing from the usability perspective, and the pricing structure was the lowest in the market. With the pandemic, they have changed how they license, what they called licenses, more or less of the price of services. Currently, they are most competitive in the market with bundling functions, also cost perspective"* (Interviewee, 01).

As stated by lecturers, currently, Taltech covers all expenses of Proctorio. For example, when it comes to the United States, when one Lecturer did his research, he encountered several frequently asked questions where it was clearly stated that the student must pay for the Proctorio license. So, for instance, in the United States, universities are pushing. In Estonia, universities are shouldering students, so there is no cost for students. The only requirement from the students' side is they must have a workable laptop with a webcam (Interviewee 01, 02).

Challenges of setting up Proctorio.

According to the two lecturers who participated in the pilot program, the analysis of Proctoring tools was the easiest part. They stated that "*When you implement such a solution, the most difficult part was the training of the academic personnel and training and presentation to the students.*" (Interviewees, 01,02). "*Onboarding of the students such as selling the solutions for them was challenging. Since they might think it is bad. So, this was a bigger undertaking. So, it is not like someone who just tells the proctoring to go do something. Step-by-step instructions that you need to do this you need to consider*

you need to provide your identification and the material design of the process. In that sense, it was more of a challenge than they initially thought" (Interviewee, 01).

Challenges of Proctorio tool

Stress

In terms of stress when using Proctorio during an online exam, teachers disagreed that it gives more stress. They did not see a significant difference. According to them, when you think of a classroom teacher looking over your shoulder, it is the same stress. Therefore, according to the interviewees, the stress level of the students was the same as in the traditional exam. They mentioned that it is overblown that the proctored test is more stressful than a one-to-one classroom exam with a teacher. Additionally, lecturers said that Proctorio is a significant undertaking and major costs from the Human Resources perspective, accommodating, or doing from the teachers' perspective teachers could not care more if students are uncomfortable because of stress. One of the lecturers said that it is a grown-up world because it is University exams.

On the other hand, one lecturer said that since the Proctorio tool gives very detailed information, it might cause some students to feel more stress.

> "*This is comprehensible. However, at the same time, the current generation is quite used to being followed all the time or living on the internet, and everything is stored there, and they walk on the streets, and there are cameras everywhere. Also, they have a conversation with their friends through communication lines that can be surveyed. Therefore, the Z generation is used to being in a condition where they can be followed. But for the older generation, it might give more stress because of the invigilation"* (Interviewee 04).

Performance of the students

According to most Interviewees, there was no significant difference in the students' performance during the online exam than face-to-face. If someone was already great, then the performance is still there. However, one lecturer said that after exams started being conducted online, everybody became just great students. She said that on the one hand, "*it might be okay if they understand the subject. If it is because of cheating or getting help from friends, it is an issue."* (Interviewee, 03).

Moreover, the lecturer experienced that students made mistakes also during the online exam. So, she mentioned that students were making almost the same mistakes during the online exam compared to face-to-face. And grades were pretty much the same. She does not think that students might make mistakes intentionally to hide cheating and get lower grades (Interviewee, 03).

Lack of technology

According to lecturers, some students race a question related to the lack of technology. Some students raced this problem because they do not have the microphone on their computer, and some of them said that they do not have a webcam on their laptop. However, lecturers disagreed with that. It was not convincing to the lecturers since nowadays all the laptops have a microphone and webcam (Interviewees, 01, 02, 03).

Privacy concern

The student organizations have blamed the Proctorio tools because of the GDPR, personally identifiable information. Moreover, students and some institutions have claimed that e-proctoring tools collect a lot of data during the exam, facial, voice, internet activity, etc. Despite all of that, the Proctorio tool has won all crucial cases because they are compliant with all the regulations. Everything is encrypted in a way that Proctorio does not have access to the data collected during the exam. So, those take points, all in all, there is no human from the Proctorio perspective involved; the only teacher can see that. Only the teacher who is in the teacher role in the Moodle course can see the proctor results. No one else can see them (Interviewee, 01, 02).

On The other hand, one of the Lecturers interviewed used Proctorio eleven times during online exams. According to him, some students mentioned the Proctorio plugin issues because of privacy. He noted that students do not have the correct information about the Proctorio plugin. Additionally, he does not think that fear from the spy computer system is very serious. "*There are many plugins everybody is using, which has the probability of being a backdoor to their computer*." (Interviewee, 02). Moreover, the lecturer mentioned that he does not think that using Proctorio will cause any kind of Spy problems.

Another lecturer has faced a pose related to the privacy issue of Proctorio. According to her, only a couple of the students raced the problem because of the video recording of the

Proctorio. The majority of the students were foreigners, and they did not pose privacy issues. Moreover, only a few students sent links to the European Union law or reports about privacy (Interviewee, 03).

"*However, at the same time, the current generation is quite used to being followed all the time or living on the internet, and everything is stored there, and they walk on the streets, and there are cameras everywhere. Therefore, younger students are less concerned with their privacy. Also, they have a conversation with their friends through communication lines that can be surveyed*". Therefore, the Z generation is used to being in a condition where they can be followed. But for the older generation might give more stress because of the invigilation (Interviewee, 04).

Advantages of Proctorio tool

Distance flexibility

According to one Lecturer who used Proctorio and participated in the implementation process of Proctorio at Tallinn University of Technology,

> "*If we are talking about certification, especially in the IT field, most certification exams are done using the Proctoring system, and these certification exam guides do not question whether you want to use the Proctored tool or not. If you do not use Proctored tools, you will not have a certification. Proctoring tools are very wise from a certification perspective since it gives the flexibility to take exams anywhere. If the certification exam is in London, a person has to travel to London, but otherwise, they can take the exam at home just using Proctoring tools"* (Interviewee, 02).

Another lecturer also mentioned that "*If you look at the map students have taken after the exam, you can see that in some places in Estonia. And if, for example, a student has to travel from Tartu to Tallinn to take the exam, the class that he/she has to use for almost two days for only one examination, versus otherwise he can sit in his home in Tartu and take the exam"* (Interviewee, 02). Due to this reason, in Autumn, 187 students chose the Proctorio tool as an option.

According to one lecturer who also participated in the pilot program of the Proctorio, his students were happy with taking Proctor exams. He said that he had students from all over Estonia, from Saaremaa, from southern Estonia. And the exam was only 30 mins.

> *"So, a person needs to take 4 hours to come to Tallinn and do an exam and go back. It takes too much time and is also uncomfortable. For this reason, taking the proctored exam was a good and convenient option" (*Interviewee, *02).*

Another Lecturer mentioned that, who has experience in the admission office. He claimed that from an admission perspective, Proctorio is super beneficial and usable. He said that universities are geared more towards foreigners. At university, for example, at Taltech, there is a cybersecurity course. In previous years like 80% were from Pakistan, India, China, Bangladesh lots of foreigners. When the lockdown came, the course crashed because foreigners were not allowed to enter Estonia. Proctoring enabled the continuation of those courses. Because Students can be truly distant learners, and they can take exams from a distance (Interviewee, 01).

Assurance and convenience

According to the three lectures, one of the main advantages is that it gives full assurance, what was happening in the space or in the room when students did the exam. Additionally, lecturers do not have to see all recorded videos in Proctorio. Teachers just need to pay attention to some particular indications that Proctorio gives, according to its analysis. The lecturer needs to check those indications that Proctorio highlights. Therefore, it is straightforward to use from a teachers' perspective.

Disadvantages of the Proctorio

Disruption

As stated by Lecturers, when you are using Proctorio during the online exam, and if you move, the system might doubt that students are cheating. And students were moving all the time because they are not robots that can stay stationary, mainly when they write. Additionally, some suddenly talked with their parents, some with brothers and sisters due to students taking exams at home.

One of the Lecturers was getting an email from students, saying, '*sorry my brother/sister came in the room while I am in the exam*,' *despite instructions that please try to be in a quiet place while taking the exam. Otherwise, the Proctorio might doubt that you are getting help and cheating.* It was challenging for the lecturers and students since not everybody has a separate room or comfortable room to do exams (Interviewees, 03, 04).

Cost

When you introduce new tools, additional costs are inevitable, which might give a burden to the University. A couple of the lecturers said that the argument against using Proctorio was the cost of the Proctorio tool. Because universities need to pay for each student per exam, which is a powerful argument to avoid Proctorio. The cost argument made them think twice before using Proctorio. They tried to avoid using Proctorio in some courses where the Proctorio tool is not very important (Interviewees, 01, 04).

5 Discussion

This chapter of the thesis analyses the data collected from surveys and interviews. Then findings of the research are discussed and compared with the literature review gathered from documents.

5.1 Advantages of online exam

The advantages of online exams are mentioned in literature and by students and lecturers. The faster results were the most mentioned advantages of the online exam in the Literature and by Interviewees.

5.1.1 Faster results

In the literature, the most often quoted educational advantage of online examination is instant results and feedback (Heinrich et al., 2009; Kuikka et al., 2014; Dermo, 2009). Moreover, Hodgson and Pang (2012) conducted a survey of students at Hong Kong University and found out that prompt feedback was one of the key elements of respondents. As a result, such fast feedback will encourage students to think and motivate them to take more charge over their learning and engage in a change of learning strategy (Hodgson & Pang, 2012).

In the survey frame, students asked whether the results of the online exams are faster than the traditional exam during this research. Most of the students stayed Neutral, which is 52 students. The 42 students agreed, and 35 strongly agreed to the statement. Besides, 15 students disagreed, and only four students strongly disagreed.

According to some lecturers, when you do an online exam, especially using multiple-choice and true-false, the results are faster, and it is much more convenient for the teacher.

"Related to the theory in the Autumn safe exam browser where I set a quiz online with multiple-choice questions or true-false. And students say that it was nice because they just logged in and have done the test. In this way, the examination is faster. Because immediately, the answer is given whether it is right or wrong. And from my side, I do not have to do anything else. I mean, I will only see the performance of the students. But I do

not have to go through and check for any mathematical spec for any writing. So, in respect to a multiple-choice or true-false quiz, it is much faster to assess the students." (Interviewee 03).

5.2 Challenges of online exams

When it comes to the challenges of the online exams, the most cited challenge is academic dishonesty. Then identification and trust and berries in some courses.

5.2.1 Cheating

According to Lecturers, there are more chances of cheating during online exams, but some have already experienced face-to-face exams where some students were cheating. Despite that, all the lecturers agreed that the threat of cheating is bigger in online exams compared to face-to-face. They also mentioned that when students cheat, they do not learn, so they are bullying themselves. And students do not acquire the knowledge and skills required in the labor market (Interviewees, 01,02,03). Additionally, in terms of cheating one Lecturer, mentioned that he does not think that cheating necessarily happens, but it is possible. However, one of the lecturers mentioned that he did one online exam without Proctorio for 19 students in December. Out of 19 students, seven students were caught cheating when checking the exam results (Interviewee, 02, 04).

The data from the literature, survey, and interview demonstrated higher chances of cheating during online exams. With the introduction of technology into the classroom and the growing prevalence of online education, new opportunities for "e-cheating" have emerged (Harmon et al., 2010). Academic integrity is a severe issue in online education, owing to the absence of face-to-face interaction between students and lecturers (Moten et al., 2013). Furthermore, Cheating is widely assumed to arise more often in online classes than in in-person courses. Most students think it is easier to copy from other resources in an online environment (King et al., 2009; Watson & Sottile, 2010).

In order to overcome academic dishonesty, the Lecturers can use PBL as an evaluation method. Additionally, the result of the survey demonstrated that students believe in the PBL student-centric assessment method. Project-based Learning is indeed a great learning approach in which students gain new abilities and expertise while working on a

project to solve real-world challenges (Peterson, 2012; Pellegrino & Hilton, 2012). PBL is a student-centered teaching method accompanied by students' autonomy, proactive inquiry, goal-finding, teamwork, connectivity, and contemplation within real-world activities (Kokotsaki et al., 2016).

Furthermore, Project-based Learning (PBL) not only for specific areas such as technology or engineering; it can be done through the courses such as language courses, arts, social sciences (Chu et al., 2017). Moreover, PBL not only imparts knowledge to the students, but it also helps students develop problem-solving abilities, logical and innovative thinking, teamwork, and lifetime learning (Khoiri et al., 2013). Hartini (2014) stated that when PBL is implemented, the substantial impact was significant on students' academic achievement (Hartini, 2014).

Furthermore, according to numerous studies, PBL fosters deeper learning via authentic engagement of real-life projects, making PBL more learner-centric and critical for training graduates for future job success (Huberman et al., 2014; Condliffe et al., 2017). Additionally, as Lo (2018) said, PBL is achievable in social studies, resulting in deep learning. Therefore, lecturers need to design learning environments which create opportunity for students to acquire the professional skills and qualifications needed by employers and businesses.

5.2.2 Identification

As stated by Interviewees, the Identification of the exam takers was challenging for the lecturers during online exams. According to the Interviewees, Tallinn University of technology is using Moodle as a Learning management system. Moodle is poor when it comes to identifying persons and making sure that there is no academic cheating happening during the exam. The Lecturers' main concern was that there is no way to verify the student when doing an online exam with Moodle. Authentication and authorization can be done with Moodle. But lecturers cannot do personal verification. Nowadays, identification and monitoring are a must for Universities, especially when they are new students (Interviewees 01, 02, 03, 04). When lecturers doubt the probability of cheating or any other educational fraud, they can utilize Proctorio. However, it should not be presented as the main approach, and it should be used selectively. Students should have an option to do an exam face-to-face or using Proctorio. Additionally, lecturers can

change the assessment methods in order to solve identification problems during online exams.

5.2.3 Trust

In addition, trust was also one of the challenges in online exams from a lecturers' perspective. The majority of the Interviewees mentioned that they would go face-to-face if they can choose between face-to-face and online exams. Lecturers said that trust is the main reason for this. Since lecturers cannot see anything on what students have on the desk if they do an online exam, teachers believe that online examination provides more opportunities for academic deception than typical, live-proctored educational environments (Rogers, 2006). Even though some lecturers prefer face-to-face examination, the online examination cannot be neglected. Since the Covid-19 pandemic showed us that, we cannot do exams in class, at least in critical times. Therefore, the author believes that lecturers can consider changing their examination methods in online exams. For instance, they can use PBL as an evaluation method.
Moreover, if lecturers believe that for specific courses, it is not appropriate to use PBL, then lecturers can offer to students to utilize the Proctorio tool during an online exam.

5.2.4 Barriers for some courses

Furthermore, the online examination has barriers for some courses, which creates a big challenge for some courses to conduct online examinations. The lecturer who teaches microeconomics mentioned that she faces problems in some subjects, especially in economics, where it has mathematics and graphs during the exam. According to the lecturer, if only to assess theoretical questions, an online exam is fine in microeconomics, but only to assess if the students know the concept. In mathematics and graphs, the online exam with Moodle is not so straightforward and easy for students. The technology used in online tests is dependable. Nevertheless, it is worth noting that such systems are only possible for multiple-choice questions (MCQs) (Farzin, 2016).

5.2.5 Students want easy credentials.

As stated by lecturers, there are lots of different interest groups when talking about online exams. Some students, especially bachelor students, might think an online exam is an

opportunity and a chance to get a good grade. One of the lecturers also mentioned that the students who are new to the university and younger (first-year students) might think it is an online exam so he/she can cheat easily and get good grades, thinking perhaps easily and nobody would find out. Therefore, it is better to use Proctorio, especially for new and young students When you are doing analysis, it is not only that you need to analyze purely from the students' perspective, because students at least most of them want to get their credentials easily (Interviewees, 01, 02, 03). Therefore, lecturers mentioned that it is better to use e-proctoring tools such as Proctorio, especially for the new and young students.

5.3 Proctorio tool in online exam

This section covers the usage of the Proctorio tool in the online examination. Additionally, this section indicated the importance of the Proctorio tool. Moreover, significance, challenges, advantages/disadvantages are mentioned. Then challenges of setting up Proctorio at the University of Taltech were mentioned, which is valuable data found during this research, since the author did not encounter an article about the setting up process and challenges during implementation of Proctorio. Finally, the setting up process of the Proctorio in Tallinn University of Technology was discussed.

5.3.1 Challenges of setting up Proctorio.

One of the key contributions of this study is that it contributed new data to the literature on using e-proctoring tools in online examinations. Since the author did not encounter how lecturers and universities use the Proctorio tool in online examinations. According to the two lecturers who participated in the pilot program, the analysis of Proctoring tools was the easiest part. They stated that "*When you implement such a solution, the most difficult part was the training of the academic personnel and training and presentation to the students.*" (Interviewees, 01,02). "*Onboarding of the students such as selling the solutions for them was challenging. Since they might think it is bad. So, this was a bigger undertaking. So, it is not like someone who just tells the proctoring to go do something. Step-by-step instructions that you need to do this you need to consider you need to provide your identification and the material design. In that sense, it was more of a challenge than they initially thought*" (Interviewee, 01).

5.4 Challenges of Proctorio

The main and most cited challenge of using the Proctorio tool in online exams was privacy issues. Moreover, other challenges are cheating, stress, students' performance, lack of technology.

5.4.1 Privacy

Privacy is the primary concern in e-learning settings, and it is also the most crucial component addressed by the online learning literature (Majeed et al. 2016). Consequently, privacy is the primary consideration when incorporating e-proctoring systems in an e-learning system (González-González et al., 2020). In this research, the students asked whether an online proctored exam violates students' privacy. The data showed that 36 students selected Neutral, and 27 students agreed with the statement. Twenty students chose the Disagree option.

Moreover, the student organizations have blamed the Proctorio tools because of the GDPR, personally identifiable information. Moreover, students and some institutions have claimed that e-proctoring tools collect many data during the exam, facial, voice, internet activity, etc. Despite all of that, the Proctorio tool has won all crucial cases because they are compliant with all the regulations. Everything is encrypted in a way that Proctorio does not have access to the data collected during the exam. So, those take points, all in all, there is no human from the Proctorio perspective involved; the only teacher can see that. Only the teacher who is in the teacher role in the Moodle course can see the proctor results. No one else can see them (Interviewee, 01, 02).

On The other hand, one of the Lecturers interviewed used Proctorio eleven times during online exams. According to him, some students mentioned the Proctorio plugin issues because of privacy. He noted that students do not have the correct information about the Proctorio plugin. Additionally, he does not think that fear from the spy computer system is very serious. "*There are many plugins everybody is using, which has the probability of being a backdoor to their computer*." (Interviewee, 02). Moreover, the lecturer mentioned that using Proctorio will not cause any kind of Spy problems.

Another lecturer has faced a pose related to the privacy issue of Proctorio. According to her, only a couple of the students raced the problem because of the video recording of the Proctorio. The majority of the students were foreigners, and they did not pose privacy issues. Moreover, only a few students sent links to the European Union law or reports about privacy (Interviewee, 03).

"*However, at the same time, the current generation is quite used to being followed all the time or living on the internet, and everything is stored there, and they walk on the streets, and there are cameras everywhere. Therefore, younger students are less concerned with their privacy. Also, they have a conversation with their friends through communication lines that can be surveyed*". Therefore, the Z generation is used to being in a condition where they can be followed. But for the older generation might give more stress because of the invigilation (Interviewee, 04).

5.4.2 Stress

Stress was another challenge when conducting the online examination. In the course of the survey, the students were asked whether proctored online exams give more stress to the students than the traditional examination. The results indicated that 36 students selected the Neutral option. Then it follows with Agree, which is 34 students. Later, strongly agreed (12 students). The survey result analysis indicates that stress is one of the challenges for the students.

On the other hand, teachers disagreed in terms of stress when using Proctorio during an online exam. They did not see a significant difference. According to them, when you think of a classroom teacher looking over your shoulder, it is the same stress. Therefore, according to the interviewees, the stress level of the students was the same as in the traditional exam. They mentioned that it is overblown that the proctored test is more stressful than a one-to-one classroom exam with a teacher. Additionally, lecturers said that Proctorio is a significant undertaking and major costs from the Human Resources perspective, accommodating, or doing from the teachers' perspective teachers could not care more if they are uncomfortable because of stress. One of the lecturers said that it is a grown-up world since it is a University exam.

On the other hand, one lecturer said that since the Proctorio tool gives very detailed information, it might cause some students to feel more stress.

"*This is comprehensible. However, at the same time, the current generation is quite used to being followed all the time or living on the internet, and everything is stored there, and they walk on the streets, and there are cameras everywhere. Also, they have a conversation with their friends through communication lines that can be surveyed. Therefore, the Z generation is used to being in a condition where they can be followed. But for the older generation, it might give more stress because of the invigilation"* (Interviewee, 04).

5.4.3 Performance of the students

In the course of this study, the students were asked in the survey whether online proctored exams affected their performance. According to the data, 47 students were Neutral in the statements. And 24 of the respondents selected the Agree option. Then 12 students disagreed that e-proctoring tools affect performance. Moreover, a previous study showed that students' test scores went down after using e-proctoring tools in online exams (Alessio et al., 2017; Alessio & Maurer, 2018). This will lower the prestige level of the university if the students cannot adequately represent their ability (Delbert et al., 2020).

From the lecturers' point of view, most of the Interviewees mentioned that there was no significant change in the students' performance during the online exam than face-to-face. They claimed that if someone was already great, then the performance is still there. However, one lecturer said that after exams started being conducted online, everybody became just great students. She said that on the one hand, "*it might be okay if they understand the subject. If it is because of cheating or getting help from friends, it is an issue."* (Interviewee, 03).

Furthermore, the lecturer saw that students made mistakes also during the online exam. So, she mentioned that students were making almost the same mistakes during the online exam compared to face-to-face. And grades were the same. The lecturer does not think that students might make mistakes intentionally to hide cheating and getting lower grades.

5.4.4 Lack of technology

Students feel they have available the necessary technology for online exam use, and home conditions are regarded as equal to the university's learning experience. As stated by the interviewees, some students race apprehension because they do not have the microphone on their computer, and some of them said that they do not have a webcam on their laptop. Which was not convincing to the lecturers since now, all the laptops have a microphone and webcam. In addition to this, students also stated that they had an internet access problem during online exams in the survey. James (2016) showed that students had a decent understanding of how technology works in the online world, especially first-year university students but were worried about poor internet access and technological issues (James, 2016).

Woldeab et al. (2017) conducted a preliminary online test study of students' attitudes towards proctored exams before the exam. The findings revealed that 38% of participants (864 students) indicated that they had little confidence in their technology to be suitable for exams, and 52% reported that they were very or not sure in their ability to use technology for exams. Students who feel insecure when asked to respond in front of the mirror do frighten by online tests in general, whereas challenged by being subjected to a second time for doing so in front of a mirror (Woldeab et al., 2017; Woldeab & Brothen, 2019).

5.5 Advantages of Proctorio tool

5.5.1 Distance flexibility

Online proctoring services have flexibility since they can be used from any place via the Internet (Hylton et al., 2016). Students were asked whether online exams using Proctorio give them the flexibility to take exams anywhere during the survey. Most students agreed with the statement, which is 67 students. Moreover, 56 students selected strongly agreed to the statement. Then 22 students stayed Neutral.

According to one Lecturer who used Proctorio and participated in the implementation process of Proctorio at Tallinn University of Technology,

"*If we are talking about certification, especially in the IT field, most certification exams are done using the Proctoring system, and these certification exam guides do not question*

whether you want to use the Proctored tool or not. If you do not use Proctored tools, you will not have a certification. Proctoring tools are very wise from a certification perspective since it gives the flexibility to take exams anywhere. If the certification exam is in London, a person has to travel to London, but otherwise, they can take the exam at home just using Proctoring tools" (Interviewee, 02).

Another lecturer also mentioned that "*If you look at the map students have taken after the exam, you can see that in some places in Estonia. And if, for example, a student has to travel from Tartu to Tallinn to take the exam, the class that he/she has to use for almost two days for only one examination, versus otherwise he can sit in his home in Tartu and take the exam"* (Interviewee, 02). Due to this reason, in Autumn, 187 students chose the Proctorio tool as an option.

According to one lecturer who also participated in the pilot program of the Proctorio, his students were happy with taking Proctor exams. He said that he had students from all over Estonia, from Saaremaa, from southern Estonia. And the exam was only 30 mins.
"So, a person needs to take 4 hours to come to Tallinn and do an exam and go back. It takes too much time and is also uncomfortable. For this reason, taking the proctored exam was a good and convenient option" (Interviewee, 02).

Another Lecturer mentioned that, who has experience in the admission office. He claimed that from an admission perspective, Proctorio is super beneficial and usable. He said that universities are geared more towards foreigners. At university, for example, at Taltech, there is a cybersecurity course. In previous years like 80% were from Pakistan, India, China, Bangladesh lots of foreigners. When the lockdown came, the course crashed because foreigners were not allowed to enter Estonia (Interviewee, 01). Proctoring enabled the continuation of those courses. Because Students can be truly distant learners, and they can take exams from a distance.

5.5.2 Assurance and convenience

During the research, the author did not encounter any article that mentions the Proctorio tools' assurance. However, during the interview, lecturers mentioned the assurance of the Proctorio tools in online exams. According to the three lectures, one of the main

advantages is that it gives full assurance, what was happening in the space or in the room when students did the exam. Additionally, lecturers do not have to see all recorded videos in Proctorio. Teachers just need to pay attention to some particular indications that Proctorio gives, according to its analysis. The lecturer needs to check those indications that Proctorio highlights. Therefore, it is straightforward to use from a teachers' perspective.

5.6 Disadvantages of Proctorio

Mitra and Gofman (2016) discovered most students felt uneasy taking an online test while being observed. Opposition arose due to questions about personal data protection in Australia's universities, and the Netherlands both issued an online petition to combat surveillance apps (Doffman, 2020; Zhou, 2020). Universities are allowed to retain the right to screen their students in tests, enabling them to complete oversight over the institution. However, these are only the two ways they have of keeping a check on their students' independence on campus. (Doffman, 2020; Zhou, 2020).

5.6.1 Disruption

Disruption was another disadvantage of doing online examinations using Proctorio. When students are using Proctorio during an online exam, and if they move, then the system might doubt that students are cheating. Students might move all the time during the exam since they are not robots that can stay stationary, especially when they write during the exam. Additionally, due to students taking exams at home, some of them suddenly were talking with their parents, some with brothers and sisters. One of the Lecturers was getting an email from students, saying, '*sorry my brother/sister came in the room while I am in the exam*,' *despite instructions that please try to be in a quiet place while taking the exam. Otherwise, the Proctorio might doubt that you are getting help and cheating.* It was challenging for the lecturers and students since not everybody has a separate room or comfortable room to do exams (Interviewees, 03, 04). Additionally, if the exam taker takes the exam at home, their acts would be more natural and relaxed. Several illustrations illustrate how difficult it is to establish intent to cheat, like a female student wearing a hijab or if students want to go to the restroom (Jalali & Noorbehbahani, 2017).

5.6.2 Cost

According to the study, the educational institution decided not to continue online proctoring despite the advantages of managing a massive group of students. Additionally, the study stated that the primary factors outweighing the benefits of e-proctoring techniques are the increased expense associated with each exam and technical difficulties (Milone et al., 2017). Hence, lecturers mentioned that extra cost is inevitable when universities introduce new tools, which might give a burden to universities. A couple of the lecturers said that the argument against using Proctorio was the cost of the Proctorio tool. Since universities need to pay for each student per exam, which is a significant argument to avoid Proctorio. The cost argument made them think twice before using Proctorio. They tried to avoid using Proctorio in some courses where the Proctorio tool is not very important.

The table below consists of the findings about the online examination. The data in the table were gathered from the survey and interviews.

Table 5: Presentation of findings and suggestions about online exams. Source: Author

	Findings from Interview and Survey	**Suggestions**
Online examination		
Main challenges	**Teachers' perspective** • Cheating • Identification • Trust • Barriers for some courses • Students want easy credentials.	In order to overcome the challenges of online exams from the teachers' point of view, e-proctoring tools can be used for some courses where cheating is more likely, to prevent cheating and ensure identification. Also, the usage of e-proctoring will solve the trust concerns. Usage of e-proctoring tools will solve the challenges of teachers during online exams. Additionally, teachers should consider offering different types of evaluation methods in their courses.

	Students' perspective • Time management • Internet access problem • Being nervous • Hard to find a quiet place.	Students should train themselves to be more self-driven and better time planning, and Universities should ensure a classroom with the required hardware and software for students who do not have their laptops. Not every student has access to a private, comfortable space in which to do the online exam at home
Advantages	**Teachers' perspective** • Faster results Students' perspective • Faster typing • Social distancing • The low percentage of failing the subject. • Technological sound. • You can use your notebook. • It can take any place on Earth. • No need to get dressed. • A solution to the World pandemic crisis • Minimum health risk • Less grammatical errors • Timesaving • Faster results • You can get help. • More freedom	Universities should not stop using online examinations since it has a tremendous advantage for the lecturer and students. With further experience, the teachers can benefit from the online exam since faster results save the teachers' time and effort and motivate the students to use the online exam. They were mainly facing the problems due to the lack of experience. Most of the lectures and students experienced online exams after the Covid-19 pandemic. Therefore, the continuous usage of online exams will give confidence to the teachers and students.

Disadvantages	**Students' perspective** • More stressful • You can get distracted easily. • Pressure of time • Less interactive • Less competitive • Lack of conversation with the lecturer • Less emotion • Less excitement • Biasedness • Students are responsible for the internet connection. • Irregular grading • Less attention to details • Limited test formats	The usage of online examination should be optional and alternative to the traditional examination, at least for the normal times (No pandemic). Additionally, the assessment and evaluation methods should be student-centric. Furthermore, students should be given sensible and reasonable time for the exam.

The below table consists of the bullet point of the finding from the survey and interview. Additionally, the table consists of a recommendation.

Table 6: Presentation of findings about Proctorio. Source: Author

Proctorio	**Findings from Interview and Survey**	**Suggestions**
Challenges	Stress Performance of the student Lack of technology Privacy concern	Proctorio should not be presented as the primary approach and should be used as an option as some lecturers already do it at Tallinn University of Technology. Usage of e-proctoring tools should be minimized as much as possible, which will be beneficial for the students and university as well since extra usage of e-

		proctoring tools will cause more extra costs since the cost is calculated according to the usage. In case, Universities must use the tool, and the university should ensure a classroom with the required hardware and software for students who do not have their laptops.
Advantages	Distance flexibility Assurance	The advantages of the e-proctoring tool have been experienced when the Covid-19 pandemic started. It was an amazing tool that helped the admission office of the Tallinn University of Technology. In that sense, the e-proctoring tool should be offered as an option for some students who want to take an exam at home.
Disadvantages	Cost Disruption	Usage of e-proctoring tools should be minimized as much as possible, which will be beneficial for the students and university as well since more usage will cause more extra costs since the cost is calculated by the usage and number of students. Furthermore, if some students prefer using an e-proctoring tool, then students should be responsible for the expenses of the e-proctoring tool such universities in the USA are doing. (According to the findings). This

		possibility should be considered by universities also as an option. Not every student has access to a private, well-lit space in which to do the online exam at home. Universities must use the tool, and universities should ensure a classroom with the required hardware and software for students who do not have their laptops + stable network connection.

6 Overview

6.1 Recommendations

The use of ICT in education has faced massive growth in the last decades. New examination techniques and methods emerged with the increase of ICT. Therefore, the applications of online exams should not be neglected, despite some challenges and concerns. Covid-19 pandemic showed us that online examination is inevitable, and it created opportunities for the students and teachers. Furthermore, to reduce academic dishonesty, universities adopted e-proctoring tools, which have both benefits and disadvantages.

Considering all implications and concerns, the author would like to make two recommendations in order to eliminate the challenges of online exams and e-proctoring.

Firstly, the author believes that online examinations should be continued to be considered as a common practice. However, lecturers should consider changing the evaluation methods for their courses. In this study, the survey findings indicated that students' most preferred evaluation method was Project-based Learning (PBL). Therefore, the universities should consider using PBL as an evaluation method for the courses. At least the use of PBL should be maximized, for all courses, as much as possible.

Project-based Learning is indeed a great learning approach in which students gain new abilities and expertise while working on a project to solve real-world challenges (Peterson, 2012; Pellegrino & Hilton, 2012). PBL is a student-centered teaching method accompanied by students' autonomy, proactive inquiry, goal-finding, teamwork, connectivity, and contemplation within real-world activities (Kokotsaki et al., 2016).

Furthermore, Project-based Learning (PBL) not only for specific areas such as technology or engineering; it can be done through the courses such as language courses, arts, social sciences (Chu et al., 2017). Moreover, PBL not only imparts knowledge to the students, but it also helps students develop problem-solving abilities, logical and innovative thinking, teamwork, and lifetime learning (Khoiri et al., 2013). Hartini (2014) stated that when PBL is implemented, the substantial impact was significant on students' academic achievement (Hartini, 2014).

According to numerous studies, PBL fosters deeper learning via authentic engagement of real-life projects, making PBL more learner-centric and critical for training graduates for future job success (Huberman et al., 2014; Condliffe et al., 2017). Additionally, as Lo (2018) said, PBL is achievable in social studies, and it can result in deep learning. Therefore, lecturers need to design learning environments which create opportunity for students to acquire the professional skills and qualifications needed by employers and businesses.

Additionally, another assessment method that can be used during online examinations is the Open book examination. According to the survey findings, most students preferred Open book examinations. Thus, this method of examination has not required any blocking of the browser. Therefore, the author believes that it is usable and convenient in terms of students' perspectives. In addition, open books eliminate using the additional tool, that raises the expenditure for the universities. According to Rakes (2008), exams that allow viewing books to assess student achievement in distance education are also usable—the exams using the open book method test students in higher-order thinking skills (Rakes, 2008).

The overall recommendation is about the usage of e-proctoring tools in the online exam. There are numerous e-proctoring tools available, such as Proctorio, that allow complete digital proctoring without the students' or examiners' physical presence. Educational institutions were compelled to adapt to pandemic requirements to strike a balance between instructional content and the maintenance of required educational processes.

Nevertheless, some crucial points regarding the e-proctoring tools can be pointed: firstly, e-proctoring tools cannot completely eliminate in-person proctoring. Additionally, students have to have access to sufficient technology in the test environment to perform online proctoring, such as internet, camera, and microphone.In addition, there are students who may need assistance when taking online tests. Students still have concerns about how others would see the video captured during the exam. Many of these challenges are expected to persist, which means only offering online proctoring will cause challenges for the particpants of the exams. It should not be presented as the primary approach and should be used as an option as it is done by some lecturers already at Tallinn University of Technology. Considering all concerns and considerations, the following

recommendation should be considered when incorporating online proctoring as part of online exams.

It is vital to assemble suggested protocols for online examinations. Setting up the prescribed procedures for the universities will assist lecturers in administering online exams uniformly. This further clarifies the lecturers' and students' positions and duties.

Students who do not have notebook computers should be able to use a classroom equipped with the required hardware and software. Not every student meets the optimum ergonomics requirements at home to complete the online test, i.e, well-lit room, access to internet.

Furthermore, compliance with these provisions should not be seen only once. This is because students with various disabilities will need additional support to take online-proctored examinations.

6.2 Future Work

This thesis can be repeated in other courses and universities. Furthermore, the various e-proctoring tools must be checked. It may be worthwhile to compare vendors who use human proctors versus those who use fully automated proctoring systems. Though future studies can influence proctoring decisions, these findings emphasize the importance of proctoring softwares in ensuring the integrity of online exams. Additionally, a detailed testing correlation between students' performance and e-examination is worth analyzing deeper.

6.3 Limitations of the study

This research reached its aims, but indeed, there were some limitations. First of all, the author was estimated to get 100 responses from each of the top three universities in Estonia. Despite trying to get that many responses and contacting many groups on Social Media platforms of Tartu and Tallinn universities, the reluctance of the students to fill the survey was challenging and was one of the limitations of this study. Due to that reason, the survey response was lower than the author expected. Therefore, the recommendation

part of the thesis will be much more appropriate and viable for the Tallinn University of Technology since most of the respondents were from there. However, this study will be beneficial for other universities as e-proctoring tools in online exams are increasing everywhere.

6.4 Conclusion

In this research, students' and lecturers' experience and interactions with online exam and e-proctoring tools during the Covid-19 pandemic are investigated. The research looked into students' shortcomings about the e-proctoring method, students' views toward educational integrity in the context of e-proctoring, the effect of e-proctoring tools on students' success and grades, and students' experience using the e-proctoring systems. Moreover, this research looked from the lecturers' perspective in order to examine teachers' perceptions towards the online exam and e-proctoring tools.

The qualitative analysis approach was used to complete the study. Qualitative research strategy allowed the provision of exploratory outcomes, as, from the teachers' perspective, the overall synergy towards online exams was not predicted at all.

The primary data for this research were gathered through the distribution of surveys online of the students of Estonia's top three universities. Furthermore, interviews with four lecturers were conducted. The lecturers were from Tallinn University of Technology, who provided insights into their online examination and e-proctoring tools. The data from the survey gave the basic knowledge, and the qualitative interviews brought out new knowledge during the process.

The used methodology helped to answer the research questions of the study. Firstly, the survey was planned to gain students' insights about their experience in online examination and usage of e-proctoring tools. The advantages and challenges of the online exam were examined and identified both from students' and students' perspectives. According to the findings, the recommendation was given for the future usage of online exams.

The second research question was related to the e-proctoring tools, which became more relevant after the Covid-19 pandemic. The students' perceptions and experiences were analyzed through the data collected by survey. The advantages, disadvantages, and challenges of e-proctoring tools were identified. Through the interviews, the lecturers'

perception towards e-proctoring tools was analyzed. According to the findings of the survey and interview data, the recommendations were given.

According to the lecturers, the online exam's main challenges were cheating, identification and trust issues, and barriers for some courses. In addition to this, challenges for the students were time management, internet access problems, being nervous, and difficulties finding a quiet place while doing exams online. Furthermore, advantages and disadvantages are identified both from teachers' and students' perspectives.

Furthermore, the challenges of using the e-proctoring tool and its pros and cons are analyzed. The main challenges of using e-proctoring tools for the students were stress, performance, lack of technology, and privacy concerns. The students raised a problem that the e-proctoring tool affects their performance, induces more stress, and violates privacy. On the other hand, as lecturers stated, the students' performance remained quite similar with e-proctoring or without any viable proctoring. Moreover, the lecturers' insight contradicts that of the students. Lectures claimed that e-proctoring tools do not violate privacy. In addition, some of the lecturers consider the issue of stress to be a means of escape. According to the lecturers, the primary advantage of the e-proctoring tool was distance flexibility, and the fact that it gave assurance to the lecturers However, the main disadvantage was the cost of the e-proctoring tools.

Despite significant concerns regarding the cumulative experience of e-proctoring methods (e.g., privacy, stress, and technical concerns), the majority of students performed similarly. Academic integrity seemed to be important for both students and lecturers. Additionally, some students seemed to deal with the challenges of the experience due to the possible gains available during the pandemic. Simplistically, the study discovered that the advantages outweigh the disadvantages of online exams and e-proctoring tools. primarily during the pandemic scenerio. The findings of this study will assist in minimizing problems and assuaging students' fears about technology by emphasizing the importance of balancing the advantages of honesty and the ease of execution and increasing educational awareness of the issues students face.

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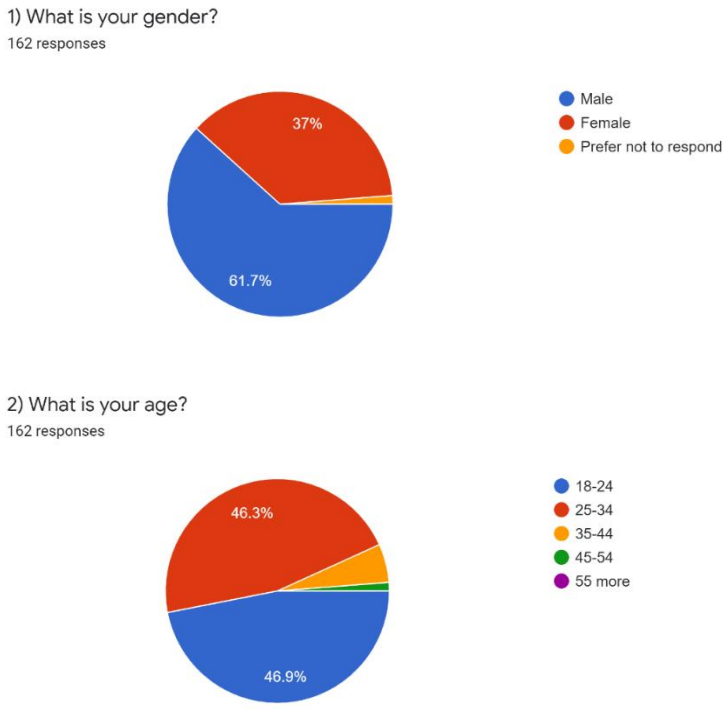
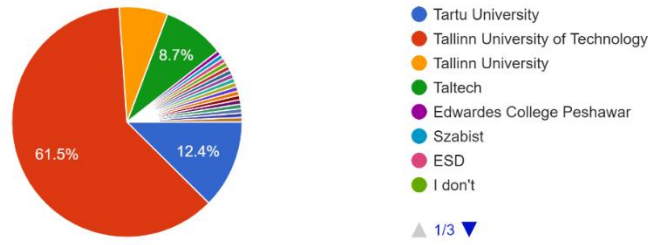
Appendix 1 – Questionnaire



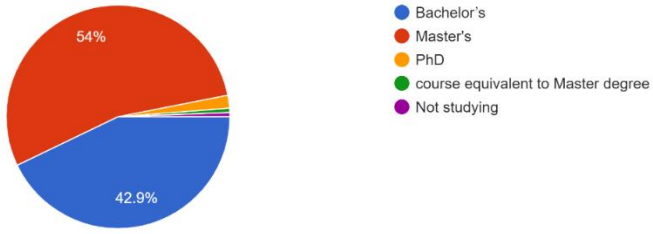
3) Where do you study?

161 responses



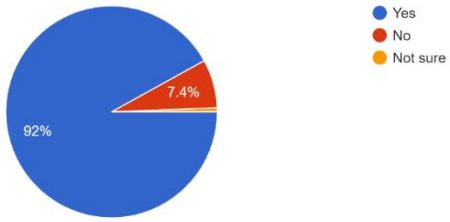
4) What level of education are you studying?

161 responses



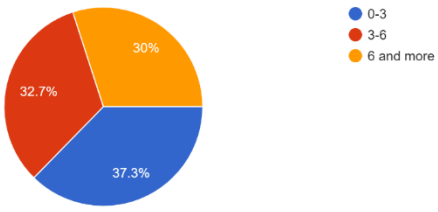
5) Have you ever experienced online examination?

162 responses



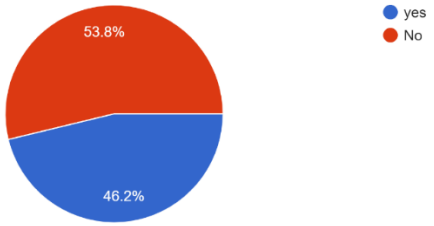
6) If yes, how many times you have experienced online examination?

150 responses

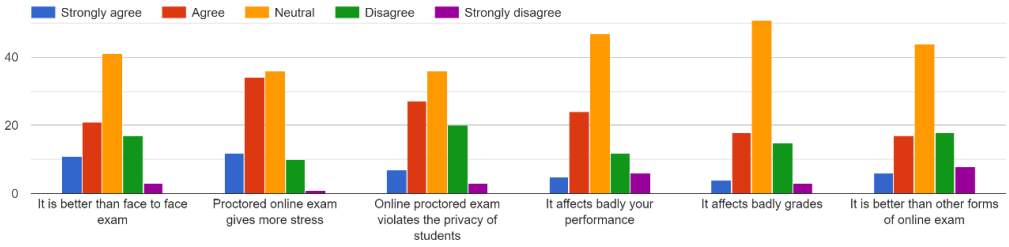


7) Have you ever used Proctored services (video, audio invigilation) during online exam? (If no you skip the Q8)

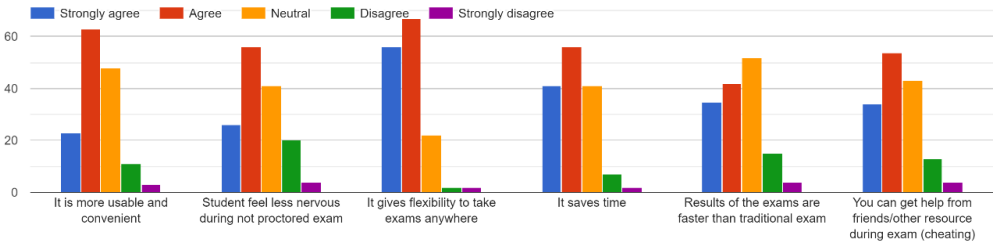
145 responses



8) What is your perception about the proctored online examination?

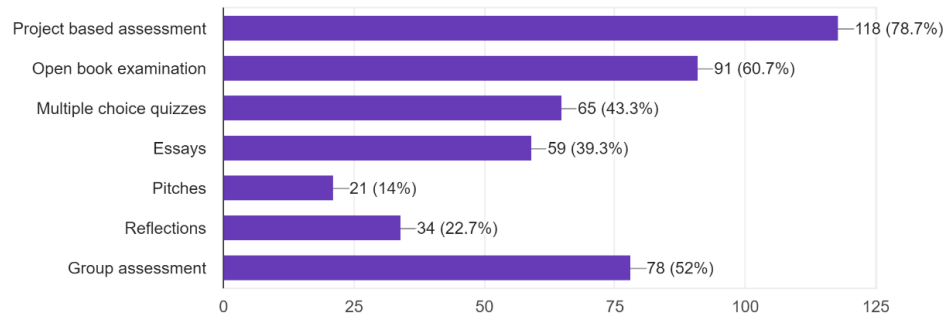


9) Online exam (compare to face to face)

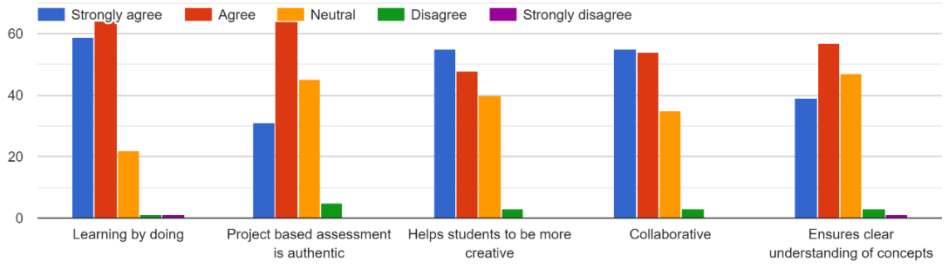


10) What alternative ways of examination do you prefer? (Please choose 3 most preferred ones)

150 responses

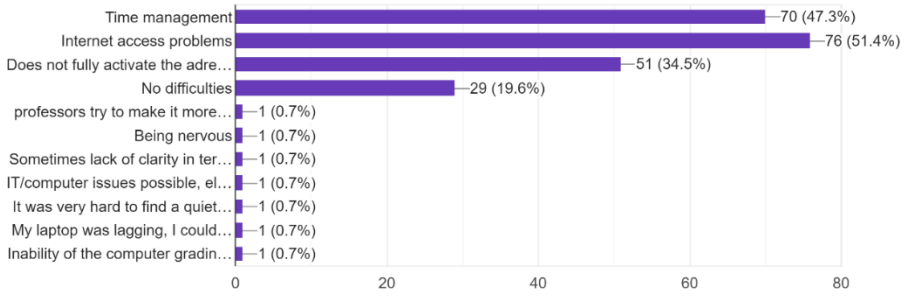


11) Do you agree with those statements about 'Project based assessment'



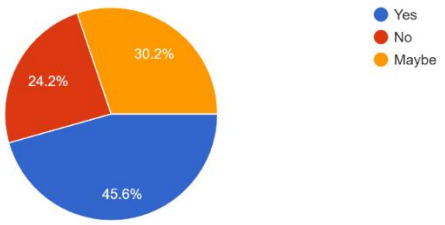
13) What difficulties have you faced during the online exam?

148 responses



14) Do you think exams should conduct online more than traditional way?

149 responses



Appendix 2 – Interview Questions

Section 1: Introductory discussions

a. Please can you introduce yourself briefly?
b. How long have you been using the online exams?

Section 2: Online exam vs. traditional exam

a. How usable is the online exam compared to face-to-face?
b. How was your experience with the online exam?

c. What is your perception about the integrity of an online exam without Proctorio? (Do you think students are cheating more in the online exam than face-to-face)

Section 3: Proctored online exam?

a. How was your experience with the proctored online exam?
b. How effective and convenient is the Proctorio tool?
c. What are the main challenges of using proctored online exams?
d. Were there any differences in students' performance and grades of a student who has used Proctorio? If yes, could you please elaborate on what kind of differences?

Appendix 3- Qualitative coding and thematic analysis in Microsoft Word (tutorials).

https://www.youtube.com/watch?v=vCE6zhdTHAI

https://www.youtube.com/watch?v=sHv3RzKWNcQ

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