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Educator perspective of barriers to Generative AI adoption in Estonian higher education using an IRT-TOE based model

Master's Thesis (30 ECTS)

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Abstract:
The benefits and challenges associated with the adoption of Generative Artificial Intelligence (GenAI) in education have been a source of discussion ever since ChatGPT was made available to the public in late 2022. In the field of information systems, technology adoption research is used to understand the various factors that affect the adoption of a certain technology. Theoretical models, which have been developed and empirically validated over decades, are used to gain an understanding of individual or organisational requirements, challenges, and perception related to the adoption of a given technology.

As educators play a critical role in enabling the use of GenAI in higher education, this thesis aims to uncover the negative factors affecting educators' decision to allow students use Generative Artificial Intelligence (GenAI) in Estonian higher education. This is done by first performing a systematic literature review, followed by the development of a theoretical model based on constructs of Innovation Resistance Theory (IRT) and Technology-Organization-Environment (TOE) framework. The novel theoretical model is later tested with a survey based quantitative methodology that involves 149 participants in various Estonian universities.

The results of this analysis shows that educators in Estonian higher education have generally accepted the use of GenAI in their courses, while academic fraud and the effect on students' critical thinking skills remain primary points of concern. Furthermore, the results highlight that resistance to student GenAI use is associated with challenges in evaluation and skepticism towards the value the use of this technology brings to their courses. The perspective of resistance is generally neglected in research and existing research has generally focused on the adoption of ChatGPT by students, investigating factors that contribute to the acceptance but not barriers that prevent adoption of the technology in question. The study contributes to the evolution of technology adoption research by introducing a novel approach to evaluate resistance to technology based on individual, environmental and organisational factors, which can be used in other settings to evaluate resistance to GenAI adoption.

Keywords: technology adoption, innovation resistance, education, educational technology, higher education, Innovation Resistance Theory, IRT, Technology-Organization-Environment, TOE, generative artificial intelligence, generative AI, GenAI, artificial intelligence, AI, survey

CERCS: P175 - Informatics, systems theory; P176 - Artificial Intelligence; S214 - Social changes, theory of social work;

Kõrghariduses generatiivse tehisintellekti kasutusega seotud takistused tuginedes IRT-TOE-põhisele mudelile Eesti pedagoogide näitel

Lühikokkuvõte:
Hariduses generatiivse tehisintellekti kasutamise teemal on laiem arutelu toimunud alates 2022. aasta lõpust, mil ChatGPT muutus laiemale avalikkusele kättesaadavaks. Infosüsteemide kasutuselevõtu uurimisel rakendatakse teoreetilisi mudeleid, et mõista erinevaid faktoreid, mis mõjutavad isikute ja organisatsioonide otsust mingit tehnoloogiat kasutama hakata.

Haridustöötajatel on haridusvaldkonnas generatiivse TI kasutuselevõtul võtmeroll, sest nemad määravad oma kursuste sisu, struktuuri ja reeglid. Seda arvestades on magistritöö eesmärk kaardistada negatiivseid faktoreid, mis mõjutavad haridustöötajate otsust lubada tudengitel kasutada generatiivset tehisintellekti Eesti kõrghariduses. Esmalt viidi läbi süstemaatiline kirjanduse ülevaade, mille järel loodi teoreetiline mudel tuginedes *Innovation Resistance Theory (IRT)* ja *Technology-Organization-Environment (TOE)* teooriate elementidele. Magistritöö käigus koostatud teoreetilise mudeli täpsust hinnati kvantitatiivse metoodikaga. Selle aluseks on küsitlus, milles osales 149 haridustöötajat viiest erinevast Eesti ülikoolist.

Magistritöö tulemused näitasid, et valdav osa haridustöötajatest lubab üliõpilastel generatiivset TI-d oma kursustel kasutada. Haridustöötajad tõid generatiivse TI hariduses kasutamise põhiliste riskidena välja akadeemilise petturluse ja negatiivse mõju tudengite kriitilise mõtlemise oskusele ning selle arengule. Lisaks näitasid tulemused, et peamised haridustöötajate vastuseisu põhjustavad faktorid on hindamisega seotud väljakutsed ning skeptilisus lisandväärtuse osas, mida generatiivse TI kasutamine kursustel toob. Vastuseisu tehnoloogiale on teaduses piiratult käsitletud ning varasemad teemaga seotud teadustööd on keskendunud tudengite ChatGPT kasutamisele. Selle magistritöö panus teadusharusse on mudel, mille abil on võimalik hinnata vastuseisu generatiivsele TI kasutamisele, võttes arvesse individuaalseid, organisatsioonilisi ning keskkondlikke faktoreid.

Võtmesõnad: tehnoloogia kasutuselevõtt, vastuseis innovatsioonile, haridus, haridustehnoloogia, kõrgharidus, *Innovation Resistance Theory*, IRT, *Technology-Organization-Environment*, TOE, generatiivne tehisintellekt, generatiivne TI, tehisintellekt, uuring

CERCS: P175 - Informaatika, süsteemiteooria; P176 - Tehisintellekt; S214 - Sotsiaalsed muutused, sotsiaaltöö teooria;

Contents

1 Introduction

Generative Artificial Intelligence (GenAI) is a class of artificial intelligence systems capable of generating information or novel output in numerous forms from text to images and music [1]. This technology enables building services that might have been considered unthinkable some years ago, such as chatbots with perceived context awareness [2], voice generation [3], or creating true to life images of people who are guaranteed not exist [4]. These tools provide unprecedented capabilities that not only enhance and simplify many tasks, but radically transform the way people find and interact with information.

Within a very short period of time, tools such as the *Chat Generative Pre-Trained Transformer* (2022), popularly known as ChatGPT, and its competitors Microsoft Copilot (2023) and Google Bard (2023) have taken the world by storm. ChatGPT achieved an active user base of 100 million users within a record-breaking time of two months after its launch in November 2022 [5]. A year after its launch in 2023, the developer of ChatGPT, OpenAI claimed to have attracted the same number of unique users every week [6]. As of early 2024, ChatGPT received 1.9 billion monthly visits, surpassing several entertainment and social media giants [7]. Such an unprecedented growth in active users in such an early stage of any consumer product is testament to the revolutionary nature of the technology.

However, change rarely occurs without concerns or resistance, and the adoption of GenAI is no exception in that regard. Concerns over disinformation, accuracy and information bias, ownership, privacy and even the possibility of an untimely appearance of sentient artificial intelligence have sparked numerous ethical and moral debates in society, academia, and the mainstream media [8, 9]. Additionally, notable individuals from the world of technology have called for a temporary halt in artificial intelligence development to reevaluate our direction [10].

The academic world and educational institutions were quick to respond to the advent of these tools due to fears of misuse, most importantly, the prospect of academic fraud [11]. To help students navigate the potential threat of unintended plagiarism and help harness the potential of this technology, some universities have developed guidelines for students describing the rules for using artificial intelligence tools in their studies [12, 13, 14]. A radically different approach was taken in other parts of the world, for example in Australian states of Queensland and New South Wales [15], and the state of New York in the United States [16], where ChatGPT was prohibited in educational institutions.

On the contrary, digital technology has brought a number of advancements to the classroom and has helped countries tackle problems like the effects of the COVID-19 pandemic in education, reducing teacher workloads, and increasing teacher productivity [17]. AI systems in the educational domain mostly attempt to solve Bloom's two sigma problem [18], according to which students with one-to-one mentoring achieve a twofold standard deviation increase in their tests compared to students with conventional teaching methods [19]. When applied ethically and with caution, AI systems have the potential to enable and enhance several aspects of modern education, such as personalised learning. However, technology in education must be integrated taking into consideration existing practices and knowledge on educational theory in order to harness and maximize the supporting potential of technology in the classroom. This encompasses not only understanding the merits and benefits of technology within the context of education, but taking into account problems, challenges and dangers associated with the use of technology.

As educators determine the structure of their courses and the allowed tools within them, educator perception of GenAI plays a critical role in its responsible adoption in education. This notion is the underlying theoretical premise of this thesis. Existing research has focused on student adoption of GenAI in higher education. As of December 2023, no empirical evidence was available on educator sentiment towards GenAI. Furthermore, no research was found on understanding barriers related to GenAI adoption in higher education from neither perspective at that point with studies emerging on the topic in the following six months. However, understanding barriers that affect GenAI adoption is an important prerequisite to develop a comprehensive understanding of changes necessary to facilitate the integration of GenAI in educational processes.

As such, the primary aim of this thesis is to determine whether academic staff in Estonia remain reluctant to allow students use GenAI tools in their courses and discover concerns related to GenAI adoption in higher education. The theoretical direction of this thesis is based on a systematic literature review, which demonstrates a research gap in the field. To this end, a theoretical model that captures barriers related to GenAI adoption in higher education is developed and empirically explored in the context of Estonian public universities. Model development is based on state of the art technology adoption theory. The thesis aims to develop the theoretical model as country agnostic to allow researchers apply the model in other countries. Hypotheses are defined based on the theoretical model and the current state of the art. To evaluate the hypotheses and the theoretical model, a questionnaire based quantitative study is carried out among educators in Estonian public universities. The developed theoretical model is validated using Structural Equation Modelling (SEM) and statistical analysis techniques. Qualitative insights from open-ended questions in the survey are drawn using response coding.

1.1 Structure

The structure of this thesis follows the guidelines of graduation theses of University of Tartu's Institute of Computer Science. Subsequently, this thesis is divided into five sections, divided into subsections to provide clear structure to this document. This section establishes a general context by introducing the topic, related background, objectives and motivation behind the thesis.

The second section is focused on the theoretical background of this thesis. The section introduces the nature of technology acceptance research, outlines existing theoretical models that focus on technology adoption, and provides an overview of existing research on the topic of GenAI adoption in higher education. A direction for the thesis is selected and substantiated based on these aspects.

The third section introduces the methodology of this thesis. The theoretical model development is described along with the definition of hypotheses associated with the model. In addition, the development of the measurement instrument used to validate this model is described along with the data collection and analysis strategy.

The fourth section provides an analysis of the results of the survey. The survey process, its sample, and the analysis results are deconstructed and explained. Hypotheses formulated in the third section are validated.

The fifth section discusses the results of the study within the context of existing research. The section discusses limitations, as well as presents practical and theoretical implications. The section ends with recommendations for future research.

The sixth and final section concludes this thesis. It briefly reflects on the objectives, process, and results of the conducted study. The document ends with a list of references used in this thesis and a number of appendices, which are described more thoroughly in the next subsection.

The author hereby discloses that Google Gemini was used as a supplementary GenAI tool to improve the conciseness and clarity of selected sentences in this thesis. The author confirms that the tool was not used in any other capacity. Use of the tool has not affected the process or originality of this thesis.

1.2 Appendices

This thesis contains **6** appendices. The appendices are as follows:

- **Appendix I** - research consent form in English as a mandatory step in the survey;
- **Appendix II** - research consent form in Estonian as a mandatory step in the survey;
- **Appendix III** - English version of the survey;
- **Appendix IV** - Estonian version of the survey;
- **Appendix V** - Response coding sheet for open-ended questions of the survey;
- **Appendix VI** - Reproduction license for University of Tartu.

Glossary

Acronyms

AI Artificial Intelligence. 6, 12, 15–17, 23, 36, 37, 39

ChatGPT Chat Generative Pre-Trained Transformer. 2, 3, 6, 13, 15–17, 19, 23, 39, 40, 43, 45, 58

EC Exclusion Criterion. 14

GenAI Generative Artificial Intelligence. 2, 6–8, 10, 11, 13, 16–32, 34–47, 61–67, 74, 76, 77

IC Inclusion Criterion. 14

IRT Innovation Resistance Theory. 2, 3, 12, 17, 18, 24, 28, 39, 40, 44, 46

IS Information Systems. 11

SCT Social Cognitive Theory. 11, 15

SEM Structural Equation Modelling. 7

SLR Systematic Literature Review. 12, 13, 15

TAM Technology Acceptance Model. 11, 15, 40

TOE Technology-Organization-Environment. 2, 3, 11, 17, 22–24, 28, 39, 40, 44, 46

TPB Theory of Planned Behavior. 10, 11, 40

TRA Theory of Reasoned Action. 10

UTAUT Unified Theory of Acceptance and Use of Technology. 11, 15, 40

2 Background

This section provides theoretical background for this thesis by examining technology adoption research. In addition, the section identifies a research gap based on an overview of existing literature on GenAI adoption in higher education.

2.1 Existing theories

Technology adoption research aims to identify the factors that affect an individuals decision to adopt technology. Within this field, *technology acceptance* refers to the perceived usefulness and attitudes towards a given technology. Acceptance is considered a preliminary step to *technology adoption*, which refers to actual use of technology [20]. The field has produced a number of empirically validated theoretical models that have evolved over decades and have been widely utilized in related software engineering research [21]. These foundational theories have found application with qualitative, quantitative or mixed-method approaches to study technology adoption in a variety of domains such as education [20], medicine [22], and digital governance [23]. Some theories focus on perception-based pre-adoption phase of technology acceptance and are mostly based on the Theory of Planned Behavior (TPB), which argues that perceptions drive actions [24]. Schwartz et al. [24] criticise research in the field for overlooking post-adoption perspectives. Furthermore, a contrasting approach of trying to understand why technology adoption is resisted is largely neglected in software engineering research [25]. These issues hinder the development of a holistic understanding of motives and processes affecting attitudes towards certain technologies in different contexts, especially reluctance towards their adoption.

The following subsections briefly describe some of the prominent theories used in technology acceptance research. For each theory, its core theoretical premise and primary constructs are introduced, along with examples of application.

2.1.1 Theory of Planned Behavior

Theory of Planned Behavior (TPB) is a psychological theory suggested by Icek Ajzen in 1991 that attempts to predict and explain human behavior through an individuals perception, attitude and control over the behavior [26]. TPB improves an earlier theory of Ajzen and Fishbein called Theory of Reasoned Action (TRA), which failed to account for behaviors over which individuals have limited volitional control. The theory centers around an individual's intention to engage in a behaviour, claiming that the stronger an individuals intention, the higher the probability of a given behavior. Intention is constituted by three factors, with the first being (1) attitude toward the behavior, which refers to the beliefs and opinions an individual holds towards the behavior and its potential outcomes. The second factor referrs to (2) subjective norm, which describes the social pressure associated with the behaviour. The third factor is (3) perceived behavioral control, which describes the extent to which an individual believes in their capability to perform an action, taking account past experiences, fears and potential difficulties. Ivanov et al. [27] use TPB to study drivers of GenAI adoption in higher education .

2.1.2 Technology Acceptance Model

Technology Acceptance Model (TAM) was introduced in 1985 by Fred Davis [28], who posited that the users attitude towards using a given system is the most accurate predictor of actual system use. The model states that the user attitude towards a system is based on two variables: (1) perceived usefulness and (2) perceived ease of use. Davis defines perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance" [28, p. 26] and perceived ease of use as "the degree to which an individual believes that using a particular system would be free of physical and mental effort" [28, p. 26]. This model emphasises the users perception of a system. Granić shows the wide application of TAM over three decades [20].

2.1.3 Unified Theory of Acceptance and Use of Technology

Unified Theory of Acceptance and Use of Technology (UTAUT) is a theoretical model developed by Venkatesh et al. [29] in 2003 that claims the likelihood of adopting a given technology is dependent on four key factors: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. As its name and common components suggest, the model attempts to unify a number of earlier behavioral and technology acceptance theories, such as TPB, TAM and Social Cognitive Theory (SCT), into a single theoretical model. Venkatesh et al. [30] extended the model in 2012 with three additional factors to tailor the model to a context oriented to consumer technology use. The updated UTAUT2 model added (5) hedonic motivation, (6) price value, and (7) habit to the list of factors that directly or indirectly affect technology use. Williams et al. [31] showed the extensive use of UTAUT in research and identified areas of improvement based on researchers' use of the theory. Tamilmani et al. [32] demonstrated that UTAUT2 has found extensive use within the Information Systems (IS) research domain.

2.1.4 Technology-Organisaton-Environment

Technology-Organization-Environment (TOE) is a theoretical framework introduced in 1990 by Fleischer and Tornatzky [33], according to which the adoption and use of new technologies in organizations are influenced by three factors: (1) the characteristics of the technology, (2) the organisational context in which technology is used, and (3) the external environment in which the organisation operates. Oliviera and Martins

[34] demonstrate that the framework has found thorough application within technology acceptance research in its original and extended forms.

2.1.5 Innovation Resistance Theory

Innovation Resistance Theory (IRT) is a model proposed in 1987 by Ram [35] that aims to explain consumer response to innovation and why some innovations are met with resistance. According to Ram, resistance is a natural response to change and products that respond to the sources of resistance are more likely to overcome the resistance barriers [35]. IRT accounts for functional and psychological barriers, where functional barriers are associated with value, patterns and risks associated with product use, while psychological barriers are related to the traditions, norms and perceptions of the customer [36]. According to IRT, three major groups of factors affect innovation resistance: (1) perceived innovation characteristics, (2) consumer characteristics and (3) characteristics of propagation mechanisms. The theory has its roots in business and marketing research and contrary to the previous models and frameworks introduced in this chapter, IRT attempts to understand why consumers or organisations reject technology instead of embracing it. Talwar et al. [37] found IRT to be the most applied theory in the study of customer resistance to digital innovations and recommend exploring resistance towards up and coming digital innovations, such as AI and smart devices.

2.2 Related works

To understand the current state of research in academic literature regarding adoption of Generative AI through the use of technology adoption models, a Systematic Literature Review (SLR) is conducted. It is composed of three steps: (1) formulation of questions, (2) data collection, and (3) results aggregation .

2.2.1 SLR questions

The goal of this literature review is to gain an overview of existing literature on the study of generative artificial intelligence adoption in academia or higher education based on technology adoption-related theory. To attain this objective, the following research questions were defined:

- **Q1** - Which technology adoption model is used by the research?
- **Q2** - Which academic groups does the research focus on?
- **Q3** - Which generative AI tool is the focal point of the research?

Even though the release of ChatGPT can be considered as the main catalyst for the prevalence of related works, an initial time was set for the beginning of 2015 to include possible studies oriented on earlier GenAI systems, such as DALL-E. The first and the second SLR questions were defined to understand, which methodologies and focus groups have been covered in previous research. The third SLR question follows a similar direction with the purpose of understanding which generative AI systems have been used in studies.

2.2.2 Data Collection

The EBSCO Discovery Service was used for data collection for its capability of querying multiple reputable academic content providers simultaneously along with its extensive filtering capabilities. In addition, the author's positive experience with the service in previous academic work contributed to the selection. The selected databases were queried using keywords associated with the study of generative artificial intelligence use in higher education or academia within the framework of technology adoption theory. The initial query used is shown in Figure 1.

```
("GPT" OR “ChatGPT” OR “large language model” OR "LLM" OR "GenAI"
OR "generative AI" OR "generative artificial intelligence" OR "AI assistant")
AND (“academi*” OR "education" OR "universit*") AND (“acceptance”
OR "adopti*" OR "challenge" OR "problem" OR "barrier" OR "resistance"
OR "reluctance")
```

Figure 1. The initial query string used for data collection.

The initial query produced an exceeding amount of unrelated false positive results. Omitting the keywords "*LLM*" and "*GenAI*" produced significantly more accurate results, thus an altered query string was used to conduct the search. Even though preliminary ad-hoc queries demonstrated that the majority of research uses ChatGPT as their research subject, competitive systems were added to the query along with acronyms of more popular models described in this section. The refined query is shown in Figure 2.

```
("ChatGPT” OR "Google Bard" OR "Bing" OR "AI assistant" OR “large
language model” OR "generative AI" OR "generative artificial intelligence")
AND (“academi*” OR "education" OR "universit*") AND (“acceptance”
OR "adopti*" OR "challenge" OR "problem" OR "barrier" OR "resistance"
OR "reluctance" OR "model" OR "UTAUT" OR "TAM" OR "IRT")
```

Figure 2. The refined query string used for data collection.

To put emphasis on academic works directly related to the topic, the query was performed on three sets of available metadata: subject terms, abstract and the title of the source. The query string was applied to both of these categories with an *"OR"* query.

A set of inclusion and exclusion criteria were defined and applied on the results of the final query to perform quality and content oriented filtering. Inclusion criteria were defined to filter studies based on publishing time, quality, accessibility and source. Studies were included in the pool based on the following criteria:

- **IC1** - Papers published in the period of 2015-2023;
- **IC2** - Papers with full text available;
- **IC3** - Peer reviewed papers;
- **IC4** - Papers published by Springer, IEEE Xplore or Scopus;

Exclusion criteria were defined to ensure the final results are comprehensible and relevant. Studies were excluded from the pool based on the following criteria:

- **EC1** - Papers that are duplicates;
- **EC2** - Papers that are not written in English;
- **EC3** - Papers that are not discussing generative AI in an educational setting;
- **EC4** - Papers that are not focusing on technology adoption;

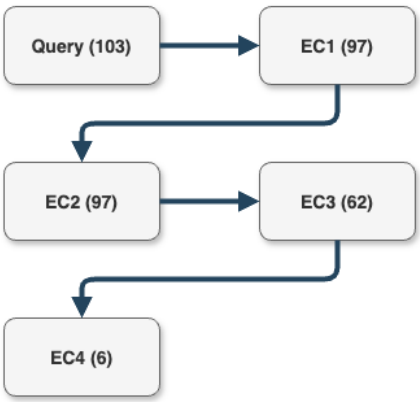

Figure 3. Visual breakdown of the study selection process.

2.2.3 Results of the SLR

This section presents the results for each question of interest, after which the idea of each relevant study is presented. The search was conducted in December 2023 and this section reflects on the results as of that date, acknowledging that additional research on the subject could have been published after. Figure 3 breaks down the study selection process and demonstrates the gradual filtering of studies through inclusion and exclusion criteria. The query yielded a total of 103 studies. A total of 6 studies remained in the final pool after the filtering by exclusion criteria. The following paragraphs present the results found for each of the SLR questions.

Q1 - Which technology adoption model is used by the research?

The most popular technology adoption model in the final pool of studies was UTAUT, with two studies [38, 39] using the new and improved UTAUT2 and another using the original version [40]. Two studies used TAM [41, 42]. One study used SCT as its theoretical foundation [43].

Q2 - Which academic groups does the research focus on?

All but one of the studies in the final pool had students as their main focus group [38, 39, 40, 41, 42]. The outlier study focused solely on academics [43].

Q3 - Which generative AI tool is the focal point of the research?

All of the studies in the final pool used ChatGPT as the generative AI tool of choice [38, 39, 40, 41, 42, 43]. Taking into account the popularity of ChatGPT, this unilateral dominance is unsurprising.

Doung et al. [41] found in their TAM-based study that Vietnamese higher education students are inclined to use ChatGPT when its use is perceived as easy and it contributes to knowledge sharing among students. A recommendation was made to study the technology acceptance of ChatGPT from the perspective of academics, such as lecturers and educators. Using a modified TAM, Tiwari et al. [42] found that students are motivated to use ChatGPT and find it useful in an educational context.

Hernandez et al. utilised UTAUT and found that students intention to use ChatGPT in a programming course was affected by convenience, herding, perceived usefulness and ethical considerations [40]. In turn, intention was least affected by social influence, ease of use and trustworthiness.

Strzelecki [38] applied UTAUT2 and found that behavioural intention toward using ChatGPT is most affected by habit, performance expectancy and hedonic motivation. Strzelecki citeutaut2-2 reaffirmed this result in a follow-up study using UTAUT2 but noted that the results are limited to a single university in Poland and voiced a need for further study.

Bin-Nashwan et al. [43] found that academics negatively influence the use of ChatGPT in an academic environment, presumably due to ethical and legal concerns in an adamant pursuit of transparency. Time saving, self-efficacy, and self-image all had a positive effect toward the attitude of ChatGPT use, as result of beliefs that the tool provides independence, reduces workloads, increases quality and increases an academics confidence in academic success. Academic integrity as a moderator produced intriguing outcomes in the study. The study claims an inverse relationship between academic integrity and ChatGPT use among academics. In addition, academic integrity had a very strong moderating effect on all of the determinants used in the model.

The results of the literature review demonstrate a need for further research in the field of generative AI use in the context of higher education and academia. Research on the subject has solely focused on ChatGPT, but existing and emerging competitive generative AI tools indicate a need for technology adoption research in a more general category. Existing works have focused on the factors that affect accepting generative AI technology with no research on resistance, barriers, and limitations on adoption. This conclusion aligns with the observations of Samhan [25], who has stressed the need for a contrasting approach to understand why technology adoption is resisted, which is largely neglected in software engineering research.

As such, research on the adoption of generative AI tools by academics and educators is limited, with the call for such research made by Doung et al. [41]. This is particularly relevant in the scope of Estonian higher-education, in which the guidelines of Estonian universities [12, 13, 14] indicate that educators have the final say on the use of these technologies in academic activities. As the results are indicative of a research gap, this thesis intends to discover GenAI adoption in Estonian higher education through the lens of resistance and educator perception.

3 Methodology

This section presents the methodology used for this thesis. The research model and its components are introduced, and the context in which it is applied is established. Hypotheses for examining resistance towards generative AI adoption in higher education by academic staff are established based on the model, existing research and assumptions of the author that are based on the current state of the art.

3.1 Model development

This study aims to identify the factors that negatively affect Estonian academics and higher education staff from embracing the use of generative AI tools in classroom settings. By conducting empirical research, this study seeks to identify and analyze the specific barriers that inhibit educators' willingness to integrate such technologies into their teaching practices. To achieve this, a model is developed that captures not only the sentiment of higher education staff that make a decision on the adoption of generative AI in courses, but the environment and organizational context they work in.

To this end, Innovation Resistance Theory (IRT) is used as a foundational model as it provides a theoretical framework for analysing consumer resistance to innovative technology. The model is extended by integrating *Organization* and *Environment* constructs of the Technology-Organization-Environment (TOE) framework to introduce the potential effects of the institution and external environment to the research context. The construct of *Technology* is omitted from TOE to avoid overlap, as IRT captures the potential limitations of the technology from the perspective of the user.

The following subsections introduce the constructs used in the developed model of this study. Each construct is defined and followed by a theoretical discussion, which founds the hypothesis associated with the construct. Nine hypotheses are formulated based on the model, existing research, and assumptions of the author that are based on the current state of the art. The hypotheses are followed by a list of associated measurement items, which are defined based on the underlying constructs and the theory. The development of measurement items and their integration into a measurement instrument is further deconstructed in section 3.3.

3.1.1 Resistance

The initial reception of GenAI by the education community could be perceived as negative due to the several bans and concerns of cheating conveyed through mainstream media [8, 9, 15, 16]. Fütterer et al. [44] found through sentiment analysis of tweets that general sentiment towards ChatGPT use in education leaned towards negative two months after its release. These examples demonstrate a skeptical stance towards GenAI use in education, which leads to the first hypothesis of this thesis:

- **H1** - *More than half of educators prohibit the use of GenAI tools in their courses*

3.1.2 Tradition barrier

The first of the psychological barriers in IRT – the tradition barrier – refers to the psychological impact of an innovations deviation from the established traditions or societal norms of its user [36]. Shills defines tradition as "anything which is handed down from past to present" [45, p. 112]. The intent to maintain existing processes and norms affects openness to change as change presents a threat to the status quo.

Academic institutions are typically proud of their long line of rituals, culture, and heritage which demonstrate the importance of tradition in these institutions. Universities are considered reluctant to change due to efforts to maintain tradition, autonomy-driven teaching staff, workload concerns, and a lack of trust towards administration [46]. A 2023 Organisation for Economic Co-operation and Development (OECD) report on challenges of GenAI tools in the classroom highlights that the technology may challenge traditional forms of teaching, alter expectations towards the educational system, and affect student engagement with course content [47].

This notion leads to the following hypothesis:

- **H2** - *Tradition barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment*

Table 1 shows the measurement items associated with the *Tradition barrier*.

Code	Measurement item
TB1	Student use of GenAI reduces student participation in traditional course delivery methods (e.g., lectures, practical sessions)
TB2	Student use of GenAI makes traditional teaching methods ineffective
TB3	Student use of GenAI creates a need for new teaching methods
TB4	Student use of GenAI conflicts with general academic norms or traditions of my institution

Table 1. Measurement items derived from the Tradition barrier

3.1.3 Image barrier

Innovations are often characterized by their origin, effects, target audience, and other criteria. The image barrier captures a situation in which the user evaluates the innovations effects on their social image or identity [36].

An example of this phenomenon is described by Bin-Nashwan et al. [43], who describes the negative sentiment of academics towards ChatGPT, which is driven by a devotion to academic integrity both on a personal and collective level, an essential component for the personal reputation and self-identity of an academic.

This leads to the following hypothesis:

- **H3** - *Image barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment*

Table 2 shows the measurement items associated with the *Image barrier*.

Code	Measurement item
IB1	Allowing students use GenAI in my courses causes criticism from my colleagues
IB2	Allowing students use GenAI in my courses has a negative effect on my academic reputation
IB3	Not allowing students use GenAI in my courses has a negative effect on my reputation among students

Table 2. Measurement items derived from the Image Barrier

3.1.4 Risk barrier

The risk barrier characterizes the emotions caused by uncertainty, unintended outcomes or side-effects caused by the innovation [36]. It is further categorized into four distinct types: (1) physical risk, (2) economic risk, (3) functional risk, and (4) social risk. *Physical risk* is associated with tangible effects in the physical world, such as potential side-effects of new drugs. *Economic risk* is best described by the unknown performance-to-price ratio of innovations, which causes users to delay the adoption of a innovation to adopt at a more justifiable price point. *Functional risk* characterizes uncertainty around an innovations true capabilities or reliability. *Social risk* is associated with potential social backlash or ridicule from adoption.

A widely discussed fear associated with generative AI in the higher education domain is that of academic fraud and cheating [48, 49]. Kasneci et al. highlight a number of potential issues with GenAI use in education: overreliance by both students and teachers, adaptability, output verification, copyright issues and financial factors [50]. Additionally, GenAI tools are perceived as susceptible to producing inaccurate information and bias [50, 51]. Popular GenAI tools such as ChatGPT, Google Gemini, and Microsoft Copilot include disclaimers around the prompt input that call for the user to verify the accuracy of the output on their own after public critique of inaccuracy, bias, and misinformation. Another risk is the inaccuracy of credit point representations of course. One credit point is equal to 26 hours of student work [52]. Significant assistance gained from GenAI tools impacts the level of student effort required to complete a course, which may render current credit point estimations inaccurate.

This leads to the following hypothesis:

- **H4** - *Risk barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment*

Table 3 shows the measurement items associated with the *Risk barrier*.

Code	Measurement item
RB1	Students using GenAI can become overly reliant on the tools
RB2	Student use of GenAI has a negative effect on the development of problem solving and critical thinking skills
RB3	Students using GenAI in can complete the course with reduced effort
RB4	Students using GenAI risk their academic integrity
RB5	Students using GenAI can receive misleading information from the tools
RB6	Students may have difficulties verifying the accuracy of GenAI outputs

Table 3. Measurement items derived from the Risk barrier

3.1.5 Usage barrier

The usage barrier refers to resistance to innovation in circumstances, where the innovation is incompatible with existing workflows, practices, and habits [36].

One of the issues associated with GenAI use in education is the difficulty in differentiating GenAI outputs from work produced solely by the student [50], i.e., a commonly presented example is the deprecation of the essay as an evaluation method as students can easily generate essays with GenAI tools. This creates difficulties comparing the students knowledge to the learning outcomes of a course. A number of top ranked universities world-wide recommend their instructors to improve their evaluation methods to adapt to potential GenAI use within curricula [53]. Improving evaluation methods to enable GenAI use may, however, require extensive effort from educators, depending on the content and structure of the course. Additionally, the *usage barrier* can be used to capture the incompatibility of GenAI within the scope of a certain course. A teacher of a language course focused on reading and writing may be reluctant to allow generative AI use as the tools capabilities exceed the capacity required for the courses.

This leads to the following hypothesis:

- **H5** - Usage barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment

Table 4 shows the measurement items associated with the *Usage barrier*.

Code	Measurement item
UB1	The contents of my courses are not suitable for GenAI use by students
UB2	Student produced work is difficult to distinguish from GenAI outputs
UB3	Students use of GenAI makes measuring learning outcomes in my courses more difficult
UB4	Current evaluation methods in my courses are less effective when GenAI is used by students
UB5	Improved evaluation methods in my courses are necessary when GenAI is used by students

Table 4. Measurement items derived from the Usage barrier

3.1.6 Value barrier

The value barrier posits that the customer has no incentive to change if the products performance does not justify its financial cost [36]. This ratio should exceed that of the offered products' competitors for the customer to be open to change. Educators are not in control of individual and organisational financial decisions that affect students' access to GenAI tools. For this reason the theoretical model in this thesis considers the *Value barrier* from the perspective of the intrinsic value of the technology in context of education, that is whether using the technology in the course will provide any value to the student at all.

To effectively use technology in education, equal access to technology must be guaranteed for all students in the course, a crucial aspect of digital equity in modern classrooms that integrate technology [54]. The widespread availability of the internet in the educational domain created a shift similar to the adoption of GenAI. The merits of the public internet were understood and recognized by educators but concerns, such as equal availability and access, were strongly voiced [55].

Within this barrier, it is important to consider whether required effort along with the problems and shortcomings of the technology outweigh its potential benefits within a certain course. Consideration of these aspects allows capturing the value barrier more holistically within the context of this thesis.

This leads to the following hypothesis:

- **H6** - Value barrier has an effect on academics' resistance towards the adoption of GenAI within the academic environment

At the time of writing, most of the known GenAI tools have free to use public models. Some Estonian universities, such as the University of Tartu [56] and Tallinn University of Technology [57], have provided all of their students access to Microsoft Copilot, which could potentially influence the results of evaluation of this barrier within Estonian context.

Table 5 shows the measurement items associated with the *Value barrier*.

Code	Measurement item
VB1	Students do not have equal access to GenAI tools that are useful in my courses
VB2	Students do not receive significant value from the use of GenAI tools in my courses
VB3	The risk of misuse of GenAI tools outweighs its potential benefits
VB4	The resources (e.g., time and effort) required to allow the use of GenAI tools outweigh its potential benefits

Table 5. Measurement items derived from the value barrier

3.1.7 Organisation

The organisational context within the TOE framework describes the effects of an organisations staff, internal structure, and internal processes on the adoption of technology [33].

Organisation within the context of this thesis refers to the educational institution that educators work in. Webb and Cox identified that to adopt technology within the classroom teachers first need to acquire knowledge on how to integrate these technologies to the classroom effectively [58]. To this end, educators may need additional support from their institutions in the form of knowledge, experience sharing, training, and guidelines to facilitate these changes. Furthermore, educators may feel pressured by allow the use of these tools due to the rise in their popularity and common advertisement as the future of education, which may lead to resistance.

This leads to the following hypothesis:

- **H7** - *Organisational context has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment*

Many Estonian and top-ranking universities in the world have developed guidelines for responsible GenAI use in academic work [12, 13, 14]. This indicates that Estonian higher-education institutions have generally adjusted to the appearance of GenAI tools and favor their use, which is why H7 is expected to be rejected. The hypothesis was phrased to have a positive effect on resistance to maintain a general applicability of the developed model.

Table 6 shows the measurement items associated with the *Organisation* construct.

Code	Measurement item
O1	Institutional policy is required to allow student GenAI use
O2	Current institutional policy does not support student GenAI use in courses
O3	My institution does not promote student GenAI use
O4	My institution does not provide me support (e.g., guidance, training, access) to allow students GenAI use in my courses
O5	My institution does not provide students support (e.g., guidance, training, access) to allow them use GenAI in my courses

Table 6. Survey statements derived from the Organisation construct.

3.1.8 Environment

The environment context of the TOE framework encompasses the effect of a number of external variables, such as regulation, market conditions, and the effects of societal and cultural factors [33].

Various governmental restrictions have been imposed on ChatGPT use since its public availability, e.g., Italy initially prohibited ChatGPT use over privacy concerns [59] along with Australian and American local governments that imposed restrictions for use in education [15, 16]. These examples illustrate GenAI technology's susceptibility to government regulation. In addition, educators may feel pressured to allow GenAI tools in their courses due to the popularity of this technology and the rising utilization of GenAI tools in other fields, which may cause resistance on their part.

These observations led to the following hypothesis:

- **H8** - *Environment context has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment*

The Estonian Ministry of Education and Research [60] has published AI guidelines thereby supporting GenAI adoption at governmental policy level, which is why H8 is expected to be rejected. The hypothesis was phrased to have a positive effect on resistance to maintain a general applicability of the developed model.
Table 7 shows the measurement items associated with the *Environment* construct.

Code	Measurement item
E1	Government policy is required to allow the use of GenAI tools by students
E2	Current government policy does not support student GenAI use
E3	My institution expects me to allow students use GenAI tools in my courses
E4	Students expect me to allow them use GenAI tools in my courses

Table 7. Survey statements derived from the Environment construct.

3.2 Model

The developed model (see Figure 4) uses the constructs of the IRT and and the *Environment* and *Organisation* constructs of the TOE models to capture the potential resistance sentiment of educators towards GenAI tools use in the classroom. The model uses demographic variables – gender, age, university, academic field – as control variables.

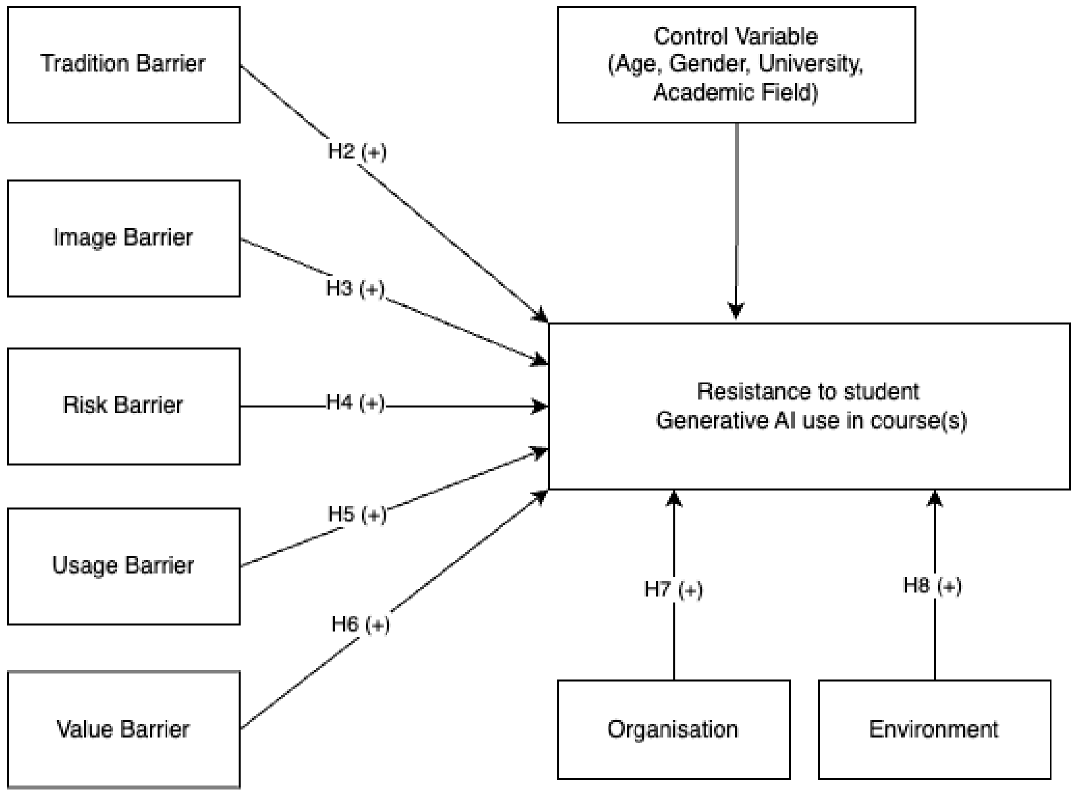

Figure 4. Consolidated theoretical model

3.3 Research method

This thesis uses a quantitative method to validate the hypotheses and the accuracy of the developed theoretical model and identify potential aspects for refinement. To this end, a questionnaire is developed and used as a data collection instrument, which also gathers qualitative insights from educators on stances associated with GenAI use. The following subsections provide more details on the methodology by describing the measurement instrument, data collection, and analysis.

3.3.1 Instrument

The survey is divided into three sections: demographic profile (1), core measurement instrument (2), and additional questions (3). Closed-ended questions are used to capture the demographic profile of the respondents and collect information for answering H1. The measurement instrument consists of 31 measurement items (see Table 8) derived from associated theory, wherein measurement items are measured using a five-point Likert scale. Instrument development draws on existing research with similar intent [61, 62, 63, 64, 65]. The questionnaire is complemented with open-ended questions to gain a descriptive insight into the general sentiment of educators towards GenAI. The questions cover multiple aspects of educators' personal experience with GenAI from personal use to necessary adjustments in courses. This allows educators to contribute to the discussion on GenAI use by students.

The demographic profile section is focused on collecting demographic data related to this study. The demographic variables collected in this study are gender, age range, university, and the general academic field, where the academic field is pre-defined based on the Common European Research Classification Scheme (CERCS) [66]. In addition to initial closed-ended questions, aimed at recording the demographic profile of the respondents, two additional closed-ended questions were added to the general information section. The additional questions are:

- **CEQ1** - Do you allow students use GenAI in your courses?
- **CEQ2** - Do you use GenAI in your academic work?

The first closed-ended question (CEQ1) is used to capture data for the first hypothesis (H1). To more accurately capture the nature of general sentiment towards using GenAI tools in courses, the possible answers for CEQ1 were: "*No*", "*Allow*", and "*Recommend*". The second closed-ended question (CEQ2) is used to get information on the number of educators using GenAI in their academic work. This question helps distinguish between respondents that have prior experience using the tools for their own benefits, and respondents whose perception may be explained by the lack of familiarity with GenAI.

The second part of the questionnaire contains the measurement instrument consisting of measurement items, which are derived from the constructs they are associated with based on existing research and underlying theory. Following Nemoto's guidelines [67] for Likert-scale questionnaire development, the items are closely tied to their underlying construct, where each item measures a single construct in concise and straightforward language, and measurement items are unidimensional, meaning they only measure the construct they are tied to. Positively worded measurement items are generally recommended but not mandated. The measurement items in this study explore the implications of GenAI technology in higher education from a negative sentiment, taking into account the objective of this thesis which is understanding the resistance towards allowing students use GenAI in higher education. Sentiment of the measurement items is inspected to avoid introducing polarity. Measurement items for each construct use a 5-point Likert scale with anchors of "Strongly disagree" to "Strongly agree". The core measurement instrument is provided in Table 8.

The third and final section of the study is composed of optional open-ended questions, which are added to offer an additional platform to the respondents and to allow for a more nuanced discussion and interpretation of the results. The additional questions used in this section are:

- **OEQ1** - Are there any additional challenges associated with letting students use GenAI in your course(s) that were not covered by this study?
- **OEQ2** - What kind of tasks in your courses are most affected by the use of generative AI?
- **OEQ3** - How would you describe your own experience of using GenAI tools?
- **CEQ3** - Have you already integrated the use of generative AI in your course(s)?
- **OEQ4** - What were the adaptations you already did to integrate generative AI use in your course(s)?

The first open-ended question (OEQ1) is defined to allow educators point out any additional challenges or problems associated with GenAI use in their courses. This allows to identify any additional aspects that were overlooked during the measurement instrument development, which can later be used to refine the theoretical model. In addition, the OEQ1 gives educators a platform to voice their opinion on student GenAI use. The second question (OEQ2) asks educators to reflect on which tasks in their courses have been affected the most by GenAI. The third open-ended question (OEQ3) asks educators expand on their experience using GenAI tools. This question is displayed only if the educators indicate they use GenAI tools in their work in CEQ2 in the first section of the questionnaire. This question is used to gain further insights into educators thoughts regarding the use of GenAI. The third question (CEQ3), which is a closed-ended question, acts as a conditional for a follow up open-ended question (OEQ4), which inquires educators about the adaptations made to facilitate integration of GenAI in their courses. These two questions are used to understand how many Estonian educators have already integrated GenAI tools in their courses and what sort of preparations and adjustments they have made to allow the use of GenAI in their courses.

The instrument was subject to iterative expert review throughout its development process to improve the quality of the measurement items. Reviews were performed by two experts from the domains of technology acceptance research and modern educational theory. Expert review resulted in improvements in the accuracy and clarity of the measurement item and question phrasing, and adding the option "Other" as an opportunity to elaborate the answer of CEQ1. Initially, the study was developed and expected to be available only in English, as English can be considered the primary academic language in the world. However, as many Estonian university curricula are taught in Estonian only and many educators are native speakers of Estonian, the survey was translated to Estonian language, thereby distributing it in both languages. This was also intended to increase the participation rate and accuracy of the results, as thinking and expressing in their native language may be preferable to participants. The English and Estonian versions of the survey can be found in Appendix III and Appendix IV, respectively.

3.3.2 Population

The targeted participants of this study are academic staff of Estonian public universities (University of Tartu, Tallinn University of Technology, Tallinn University, Estonian University of Life Sciences, and Estonian Academy of Arts), who are in teaching positions such as academics, teaching assistants, and researchers, irrespective of institutions and fields of these universities. These universities were selected for having "signs" of discussion regarding GenAI on the internet in the form of guidelines of use for either students or employees. Based on this, it can be thought that the targeted sample frame has at the very least a basic understanding of GenAI or awareness of its existence. According to the Ministry of Education and Research of Estonia, the total number of academic workers in higher education in the 2023/2024 academic year was 4896 [68]. This number includes staff of other higher educational institutions, such as colleges or private universities. The population of educators in higher education has a very even gender distribution (2445 men and 2451 women), with the average educator in Estonian higher education being predominantly in the 40-49 age range and having obtained a PhD [68]. To provide relevant cultural context of the population, it may be beneficial to outline that Estonia is often described as a tech-savvy digital society [69, 70].

3.3.3 Data Collection

University of Tartu's LimeSurvey platform is used to develop the online questionnaire. LimeSurvey is a free open source platform that allows the quick creation of online surveys [71]. The content of this research is coordinated with a Research Integrity Counsellor of University of Tartu. The survey is anonymous, which makes an informed consent to be the only prerequisite to study participation. Appendix I and Appendix II provide the participation consent form adapted from Davis [72] for English and Estonian surveys, respectively.

3.3.4 Analysis

Although this thesis uses a quantitative methodology, the nature of this research is exploratory due to the limited nature of existing and validated models describing resistance to generative AI use in education using IRT or TOE. For this reason, this thesis uses a partial least squares structural equation model (PLS-SEM) to validate the developed model according to procedures adapted from Hair et al. [73]. The measurement instrument is tested for Common Method Bias (CMB) using Variance Inflation Factor (VIF) based collinearity assessment. The model validation includes reliability analysis using Internal Consistency Reliability (IRE), evaluation of Convergent Validity using Average Variance Extracted (AVE), and evaluation of Discriminant Validity using the Fornell-Lacker Criterion. Response coding is performed on open-ended questions to extract themes in order to gain qualitative insights on the topic.

Construct	Measurement item
Tradition barrier	**TB1**: Student use of GenAI reduces student participation in traditional course delivery methods (e.g., lectures, practical sessions)
	TB2: Student use of GenAI makes traditional teaching methods ineffective
	TB3: Student use of GenAI creates a need for new teaching methods
	TB4: Student use of GenAI conflicts with general academic norms or traditions of my institution
Image barrier	**IB1**: Allowing students use GenAI in my courses causes criticism from my colleagues
	IB2: Allowing students use GenAI in my courses has a negative effect on my academic reputation
	IB3: Not allowing students use GenAI in my courses has a negative effect on my reputation among students

Construct	Measurement item
Risk barrier	**RB1**: Students using GenAI can become overly reliant on the tools
	RB2: Student use of GenAI has a negative effect on the development of problem solving and critical thinking skills
	RB3: Students using GenAI in my courses can complete the course with reduced effort
	RB4: Students using GenAI risk their academic integrity
	RB5: Students using GenAI can receive misleading information from the tools
	RB6: Students may have difficulties verifying the accuracy of GenAI outputs
Usage barrier	**UB1**: The contents of my courses are not suitable for GenAI use by students
	UB2: Student produced work is difficult to distinguish from GenAI outputs
	UB3: Students use of GenAI makes measuring learning outcomes in my courses more difficult
	UB4: Current evaluation methods in my courses are less effective when GenAI is used by students
	UB5: Improved evaluation methods in my courses are necessary when GenAI is used by students

Construct	Measurement item
Value barrier	**VB1**: Students do not have equal access to GenAI tools that are useful in my courses
	VB2: Students do not receive significant value from the use of GenAI tools in my courses
	VB3: The risk of misuse of GenAI tools outweighs its potential benefits
	VB4: The resources (e.g., time and effort) required to allow the use of GenAI tools outweigh its potential benefits
Organisation	**O1**: Institutional policy is required to allow student GenAI use
	O2: Current institutional policy does not support student GenAI use in courses
	O3: My institution does not promote student GenAI use
	O4: My institution does not provide me support (e.g., guidance, training, access) to allow students GenAI use in my courses
	O5: My institution does not provide students support (e.g., guidance, training, access) to allow them use GenAI in my courses
Environment	**E1**: Government policy is required to allow the use of GenAI tools by students
	E2: Current government policy does not support student GenAI use
	E3: My institution expects me to allow students use GenAI tools in my courses
	E4: Students expect me to allow them use GenAI tools in my courses

Table 8. Developed measurement instrument

4 Results

This section presents the outcomes of the survey and the data analysis process. The results are described along with the data analysis results for each of the constructs defined in the theoretical model developed in the Methodology section. Hypotheses defined in the Methodology section are evaluated based on the findings using empirically established guidelines.

4.1 Survey

The survey was distributed to targeted official e-mail addresses of universities, namely, University of Tartu, Tallinn University of Technology, Tallinn University, Estonian University of Life Sciences, Estonian Academy of Arts, on early April 2024 and it was available for a month until May 2024. Out of 215 openings of the survey, 149 forms were completed, making the participation rate 69,3%. 26 participants (17.4%) filled the survey in English and 123 responses were received (82.6%) in Estonian.

The predominant age group in the sample is 45–60 with 60 responses (40.3%), followed by 30–45 with 54 responses (36.2%). Across universities, most of the responses were received from Tallinn University of Technology with 56 responses (37.6%), followed by University of Tartu with 54 responses (36.2%). Social Sciences and Technological Sciences were the most represented academic fields with 51 (34.2%) and 42 (28.2%) responses, respectively. With a population of 4896, the result attains a confidence rate of 95% and margin of error of 8% ($N > 146$). The demographic distribution of the survey respondents is presented in Table 9.

Throughout the survey period, the survey completion process was monitored to reduce dropout and find points of improvement to increase the participation rate. The majority of dropouts occurred at the consent form of the survey, which is a mandatory step to take part in the survey. As such, no adjustments to the survey were found necessary during the survey period from the perspective of dropout. However, participant feedback lead to a semantic improvement in the Estonian phrasing of a response option.

Outside of the PLS-SEM based analysis frame of the measurement instrument, it should be highlighted that there were four measurement items, on which respondents showed strong consensus: O1, TB3, RB5, and RB6. O1 highlights the necessity of institutional policy for student GenAI use. TB3 indicates the necessity for new teaching methods. RB5 denotes that students may receive misleading information from GenAI. Finally, RB6 claims students have difficulties verifying GenAI outputs. These measurement items had more than 75% of respondents that selected "*Agree*" or "*Strongly agree*", which is a median indicator of consensus [74].

Variable	Values	N	%
Gender	Male	64	43.0
	Female	82	55.0
	Prefer not to say	3	2.0
Age group	18–30	8	5.4
	30–45	54	36.2
	45–60	60	40.3
	60–75	26	17.4
	Prefer not to say	1	0.7
University	University of Tartu	54	36.2
	Tallinn University of Technology	56	37.6
	Tallinn University	31	20.8
	Estonian University of Life Sciences	7	4.7
	Estonian Academy of Arts	1	0.7
Academic Field	Humanities	28	18.8
	Biomedical Sciences	5	3.4
	Social Sciences	51	34.2
	Physical Sciences	23	15.4
	Technological Sciences	42	28.2
Do you allow students use GenAI in your courses?	Allow	85	57.0
	Recommend	29	19.5
	No	13	8.7
	Other	22	14.8
Do you use GenAI in your academic work?	Yes	109	73.2
	No	40	26.8
TOTAL		**149**	**100%**

Table 9. Demographic Distribution

4.2 Model validation

The results analysis is based on PLS-SEM, which was performed in two steps: (1) measurement model analysis and (2) structural model analysis. The process was performed using SmartPLS4 [1]. The results of each step are described in the following subsections.

4.2.1 Measurement model

The measurement model is analysed from the perspective of validity and reliability, with the first step being the examination of the factor loadings of individual items [73]. First, in line with Hair et al. [75], items with indicator loadings below 0.4 were removed from

[1]https://www.smartpls.com

Construct	E	O	RB	TB	UB	VB
E	**0.832**	0.398	0.176	0.143	0.260	0.302
O	0.398	**0.892**	0.119	0.388	0.346	0.343
RB	0.176	0.119	**0.727**	0.452	0.452	0.492
TB	0.143	0.388	0.441	**0.718**	0.443	0.443
UB	0.260	0.346	0.452	0.443	**0.629**	0.590
VB	0.302	0.343	0.492	0.443	0.590	**0.810**

Table 10. Discriminant Validity (DV) using Fornell-Lacker Criterion

the model. This resulted in the removal of 7 measurement items, namely - UB5, IB3, RB5, RB6, VB1, O1, O2. Removal of IB3 had a significant negative impact on the remaining item loadings in *Image barrier* construct, which lead to the construct being discarded from model. Loadings between the range of 0.4 to 0.7 can be considered for removal only if it improves the reliability or Average Variance Extracted (AVE) outcomes of the construct [76]. This lead to UB4 (0.475), UB3 (0.517) and TB2 (0.474) being retained, as removing them did not provide any statistical benefit. AVE values higher than 0.5 are indicative of Convergent Validity [73]. Table 11 indicates that this criterion is satisfied for all constructs but *Usage barrier* (UB). Table 10 demonstrates Discriminant Validity is supported for all constructs using the Fornell-Lacker Criterion.

Reliability of the measurement model is evaluated with measurements of Cronbach's Alpha and Composite Reliability (ρ_a and ρ_c). The acceptable lower bound of Cronbach's Alpha in exploratory research is 0.6 [73]. As Cronbach's Alpha (α) is a conservative measure of reliability and Composite Reliability a lenient one, a ρ_a value between the lower bound of α and upper bound of ρ_c can be considered indicative of reliability [73]. As shown in Table 11, these criteria are supported for all constructs but *Usage barrier* ($\alpha = 0.437$, $\rho_c = 0.319$, $\rho_a = 0.647$), which did not pass the acceptable α margin.

Additionally, analysis for Common Method Bias (CMB) was performed by collinearity assessment using Variance Inflation Factor (VIF) values. VIF values of the measurement items were below the 3.3 threshold as recommended by Kock [77], which indicates the absence of CMB.

4.2.2 Structural model

Structural model assessment was performed using the bootstrapping feature of SmartPLS - a non-parametric procedure that allows testing the statistical significance of various PLS-SEM results such path coefficients, Cronbach's alpha, HTMT, and R^2 values [78]. The subsample size chosen for bootstrapping was 5000. Out of the control variables (Gender, Age, University, Academic Field) used in the developed model, Age is the only variable to have a small positive impact towards resistance ($\beta = 0.066$, $\sigma = 0.066$, $T = 2.015$, $p = 0.0444$). Table 12 exhibits the results for structural model analysis.

Construct	α	ρ_a	ρ_c	AVE
TB	0.614	0.757	0.750	0.515
RB	0.707	0.775	0.810	0.529
UB	0.437	0.319	0.647	0.395
VB	0.746	0.801	0.850	0.656
O	0.743	0.745	0.886	0.796
E	0.559	0.568	0.818	0.693

Table 11. Measurement model reliability indicators - Cronbach's alpha (α); Composite Reliability (ρ_a, ρ_c); Average Variance Extracted (AVE)

Hypothesis	Path	β	σ	T	P	Support
H2	$TB \rightarrow R$	0.054	0.039	1.376	0.169	No
H3	$IB \rightarrow R$	-	-	-	-	No
H4	$RB \rightarrow R$	-0.004	0.037	0.109	0.913	No
H5	$UB \rightarrow R$	0.110	0.048	2.278	0.023	Yes
H6	$VB \rightarrow R$	0.089	0.039	2.268	0.023	Yes
H7	$O \rightarrow R$	0.030	0.034	0.893	0.372	No
H8	$E \rightarrow R$	0.050	0.032	1.558	0.119	No

Table 12. Structural model indicators - Path Coefficients (β); Standard Deviation (σ); T-statistic; P-value. Support condition p < 0.05.

The developed model explains 36.4% of variance in resistance to GenAI use by students ($R^2 = 0.364$), which can be considered moderate according to Chin and Marcoulides ($R^2 >= 0.33$) [79] or leans towards moderate ($R^2 >= 0.5$) per Hair et al. [80]. However, it is important to consider that R^2 is indicative of model performance in the sample and acceptable thresholds vary depending on the field of research [73].

4.2.3 Hypotheses testing

H1 aimed to determine whether educators in Estonian universities remain reluctant to allow students use GenAI in their courses. As shown in Table 9, 57% of respondents allow and 19,5% of respondents recommend students use GenAI in their courses. Of the 22 respondents that elaborated on their CEQ1 answer by choosing "*Other*", 8 respondents allow the use of GenAI conditionally, 13 have taken no action to regulate GenAI use, and a single participant elaborated on their plan to allow GenAI use in their courses. When combining all of these options, an overwhelming majority of 135 respondents (90,6%) either allow (87 responses), conditionally allow (6 responses), recommend (29 responses), or do not regulate GenAI use (13 responses) in their courses. Based on this data, H1 is rejected.

Additionally, the results demonstrate that 73,2% (102) of respondents use GenAI in their academic work. Some of the respondents elaborated on their experience with the technology in OEQ2. These insights are covered towards the end of the results section.

According to H2, the *Tradition barrier* (TB) was expected to have a positive effect on resistance. The construct (TB) displayed insignificant positive effect ($\beta = 0.054, T = 1.376, P = 0.169$) towards resistance. As such, H2 is rejected.

According to H3, the *Image barrier* (IB) was expected to have a positive effect on resistance. However, the construct was discarded from the model due to poor factor loadings in the model preparation stage. As such, H3 is considered inconclusive.

According to H4, the *Risk barrier* (RB) was expected to have a positive effect on resistance. The construct (RB) displayed an insignificant negative effect ($\beta = -0.004, T = 0.109, P = 0.913$) towards resistance. As such, H4 is rejected.

According to H5, the *Usage barrier* (UB) was expected to have a positive effect on resistance. The construct (UB) did display a significant positive effect ($\beta = 0.110, T = 2.278, P = 0.023$) towards resistance. As such, H5 is supported.

According to H6, the *Value barrier* (VB) was expected to have a positive effect on resistance. The construct (VB) did display a significant positive effect ($\beta = 0.089, T = 2.268, P = 0.023$) towards resistance. As such, H6 is supported.

According to H7, the *Organisation* (O) was expected to have a positive effect on resistance, but rejected in Estonian settings considering that Estonian higher-education institutions have generally adjusted to the appearance of Generative AI tools and favor their use. The construct (O) displayed an insignificant positive effect ($\beta = 0.030, T = 0.893, P = 0.372$) towards resistance. As such, H7 is rejected, which supported assumption for its rejection for Estonian case (see Section 3.1.7).

According to H8, the *Environment* (E) was expected to have a positive effect on resistance. The construct (E) displayed an insignificant positive effect ($\beta = 0.050, T = 1.558, P = 0.119$) towards resistance. As such, H8 is rejected, which supported assumption for its rejection for Estonian case (see Section 3.1.8).

An overview of the hypotheses and their outcomes is presented in Table 13.

4.3 Qualitative insights

To get insights from open-ended questions (OEQ1-OEQ4) and questions, where additional specification was provided by participants using the "*Other*" option (CEQ1), the responses were categorised using a response coding strategy. The content of the answers were coded according to their main themes, after which the themes were categorized to find the common denominator. This approach allows discovering themes and trends in the open-ended responses. Responses unrelated to the question were discarded from the coding samples. The response coding sheet is provided in Appendix V.

The additional questions in the survey (OEQ1-OEQ4) were optional. Regardless, about one in two respondents shared their opinion on additional aspects related to GenAI

ID	Description	Outcome
H1	More than half of educators prohibit the use of GenAI tools in their courses	Rejected
H2	Tradition barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	Rejected
H3	Image barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	N/A
H4	Risk barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	Rejected
H5	Usage barrier has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	Supported
H6	Value barrier has an effect on academics' resistance towards the adoption of GenAI within the academic environment	Supported
H7	Organisational context has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	Rejected
H8	Environment context has a positive effect on academics' resistance towards the adoption of GenAI within the academic environment	Rejected

Table 13. Hypotheses

use in higher education, which demonstrates interest in the topic. Furthermore, this assertion is supported by the observation that a number of the optional answers were thorough, multi-faceted, and promote discussion. The following paragraphs present the results for each of the open-ended questions.

OEQ1: Are there any additional challenges associated with letting students use GenAI in your course(s) that were not covered by this study?

This additional (optional) question was shown to all of the participants of whom 49% (73) responded. The following themes (7) were discovered in the answers of OEQ1: (1) academic fraud, (2) AI literacy, (3) critical thinking, (4) ethics, (5) evaluation & teaching, (6) GenAI inaccuracy, and (7) student attitudes.

In this question, the most commonly covered themes were academic fraud and critical thinking, with 18 and 13 respondents, respectively. Additionally, 10 educators highlighted the importance of AI literacy to promote the correct use of GenAI both by students and educators. These points were followed by ethics (7 responses), student attitudes (6 responses), and GenAI inaccuracy (4 responses). 4 responses were discarded from the pool due to irrelevance to the question.

OEQ2: What kind of tasks in your courses are most affected by the use of generative AI?

This additional question was shown to all of the participants of whom 60,4% (90) responded. The following themes (7) were discovered in the answers of OEQ2: (1) programming, (2) analysis, (3) writing, (4) creativity, (5) practical tasks, (6) all tasks, (7) and none. This question had thorough answers and as such, multiple themes have been allocated to some responses.

46 responses point out the effect GenAI has had on writing tasks in all of their forms, such as essays, reports, overviews, and theses. 21 responses indicate that tasks related to analysis (e.g., argumentation and discussion, text analysis) have been affected. 9 responses were gathered for programming tasks. 7 responses indicate an effect on tasks related to creativity. 5 responses state that practical tasks (e.g., homework, presentations, routine tasks) have been affected. 4 responses state all tasks of the course(s) have been affected. On the contrary, 2 claim that all tasks have been unaffected due to the type and uniqueness of the course content. 8 responses were discarded from the pool due to irrelevance to the question.

OEQ3: How would you describe your own experience of using GenAI tools?

This additional question was conditionally displayed to 73,1% (109) of respondents, who answered positively to CEQ2 (*Do you use GenAI in your academic work?*). The question was answered by 49% (73) of participants. This question had a two-fold response coding process. First, the responses were categorized by emotion using adjectives, experience descriptions, and general sentiment of the text as indicators. This resulted the responses being categorized into four categories: (1) positive, (2) negative, (3) mixed, and (4) neutral.

Out of these responses, 33 expressed positive experiences with GenAI, 9 experiences were neutral, and another 9 experiences expressed mixed views. 22 of the respondents used neutral language to explain the extent and experience of GenAI use in their work. Positive experiences focused on the time saving, assistive properties of the technology. Mixed and negative views highlighted two issues: (1) plagiarism by students and (2) critique of the accuracy. An opinion outlined by respondents in this question is an effect similar to the Matthew effect [81] - the tools are believed to unequally amplify the outcomes students based on their intellectual capabilities.

Following sentiment analysis, the responses were categorized by the method of

GenAI application by educators. The methods of use (6) were categorised as follows: (1) language, (2) analysis, (3) ideation, (4) querying, (5) class preparation, and (6) programming. Most commonly, respondents use GenAI for tasks related to language, with 20 respondents applying the tools for translation, text editing, rephrasing, or overviews of text. Additionally, GenAI is used for analysis by 13 respondents and querying by 5 respondents. Class preparation and ideation were highlighted by 8 and 3 respondents, respectively. 30 respondents did not specify the scope of their GenAI use, but described the use more generally. Many respondents highlighted their limited experience with the tools and plan to learn more about them. This is further highlighted by the data as the scope of use for GenAI tools is very limited.

OEQ4: What were the adaptations you already did to integrate generative AI use in your course(s)?

This additional question was conditionally displayed to 29,5% (44) of respondents, who answered positively to CEQ3. The question was answered by 25,5% (38) of participants. Four themes were discovered in the answers of OEQ4: (1) evaluation, (2) integration, (3) task adaptation, and (4) guidelines.

Out of this subset of respondents, 10 have changed evaluation methods in their courses to adapt to GenAI use. The means of the change vary: exam questions have been made more GenAI resistant, a shift to pair evaluation or project based learning, deprecation of essays, and the return to closed-book exams. 14 educators have integrated GenAI in the tasks of their courses. Integration is done by automating prerequisite work to a task, recommending GenAI use where appropriate, or performing a task with GenAI and later collectively discussing and criticizing the result. Rules and guidelines have been adjusted in the case of 7 respondents, usually by explicitly stating the allow extent of use and requiring citation according to university guidelines. 3 respondents state that they have created new or adapted existing tasks. 4 responses were discarded from the pool due to irrelevance to the question.

5 Discussion

This section discusses the results of this thesis by analysing and comparing the outcomes with existing research. First, the model developed in the Methodology section and results drawn from its analysis in the Results section are discussed. Then, insights gained from qualitative open-ended questions are presented and discussed in the context of existing research. Finally, limitations and implications of the thesis are presented. Recommendations for future research are outlined throughout the section.

5.1 Model

Technology adoption research related to GenAI use in higher education is limited, as evidenced by the systematic literature review conducted as part of this study (see Section 2). The few existing studies have focused on student acceptance of GenAI, but not the educator perspective, whereas the latter plays a decisive role in GenAI adoption in higher education. Furthermore, all existing studies have focused on ChatGPT even when competitive systems exist, and are actively adopted by universities, as demonstrated by some Estonian universities that provide students access to Microsoft Copilot.

This thesis took a novel, exploratory approach of using constructs from IRT and TOE to create a model capable of assessing educator resistance to student GenAI use. While the developed model was tested in the environment of Estonian higher education, the model itself remains country-agnostic, meaning it is independent from country-specific context and therefore is applicable in alternative settings.

Analysis of Estonian educators' resistance to the adoption of GenAI in higher education was conducted in the form of a survey that was developed based on the developed integrated IRT-TOE model. The results of the survey indicate that educators in Estonian universities have generally accepted the use of GenAI tools in their courses by allowing or, in some cases, even recommending their use. Such an outcome may be explained by multiple factors. First, Estonian universities have developed guidelines for student GenAI use [12, 13, 14], which may be indicative of organisational consensus towards allowing the use of the tools. However, this can not be generalised, as universities such as Estonian University of Life Sciences and Estonian Academy of Arts have not developed such guidelines for students, or at the very least, publicly published them. AI guidelines have been published by the Estonian Ministry of Education and Research [60] that indicates support towards GenAI use at governmental policy level. Additionally, Estonia is considered a technologically advanced society [69, 70], which may indicate increased willingness to adopt innovative technologies in its educational practices, contrary to countries where ChatGPT was initially banned, such as Italy [59]. As such, the inherently supportive environment around GenAI use in Estonian higher education does not constitute an ideal case study for validating a theoretical model that attempts to explain educator resistance to GenAI use in higher education.

Existing studies so far have focused mostly on the acceptance of ChatGPT by students using traditional technology adoption models such as UTAUT [38, 40] and TAM [41, 42]. A recent addition is the work of Ivanov et al. [27], who use TPB in their multi-perspective study to evaluate the effects of perceived strengths, benefits, weaknesses, and risks towards factors influencing GenAI use intention. This thesis focused on an alternative perspective: proposing a novel approach by drawing from IRT and TOE to study educator resistance towards student GenAI use, being the first known use of such a synthesised model.

Hypotheses covering the usage barrier and value barrier were found to have a significant positive effect towards resistance to GenAI use in higher education, and as such were accepted. Other constructs covered in the model mostly displayed positive effects towards resistance, but were rejected due to the statistical insignificance of the results and therefore can not be discussed with a strong basis.

Items of the usage barrier focused on the effects of student GenAI use to the relevance and accuracy of course evaluation methods. As such, this result highlights that student GenAI use has had a negative impact on existing evaluation methods and educators may need to undertake significant changes to evaluation methodology. Although an optional question, only 38 respondents (25.5%) highlighted adjustments made to courses in light of GenAI. The low number of adaptations is further demonstrated in an article of University of Tartu's magazine, which claims that only 13% of educators have made changes in evaluation methods to adjust to GenAI reality [82].

The value barrier aimed to capture a potential value conflict behind GenAI use in higher education through the lens of resources required and value provided to educational workflows. The positive effect of this construct towards resistance is indicative of GenAI tools not justifying their use in terms of the value they bring to the course compared to the required resources (e.g., time and effort), risks, and challenges brought on. Such a result might be tied with the acceptance of the usage barrier - educators may feel that sheer scope of the changes necessary to adjust their courses to a reality with GenAI are not justified.

The only control variable to show a significant positive effect towards resistance was age, meaning the older the participant, the higher the resistance towards GenAI use. While this is compliant with the popular stereotype, Wandke et al. [83] show that the idea of older people being uninterested and dismissive of novel technology by default is largely a myth prevalent among software communities. It can be speculated that this result may rather be explained by increased teaching experience gained with age as older teachers may have more exposure to challenges associated with the integration of technology into teaching practises.

The measurement model developed in this thesis showed satisfactory results for exploratory research. Developed measurement items were shown to accurately measure their underlying constructs through factor loadings, which is a positive result considering the measurement items were not adapted from other studies due to the lack of similar research focused on GenAI, regardless of domain. Construct reliability was demonstrated using the measures of Cronbach's Alpha and Composite Reliablity. The results of Discriminant Validity analysis showed that constructs remained distinct in category. According to these indicators, the developed measurement model can be considered somewhat accurate, however, this must be validated by future research in alternative settings, i.e., countries or regions that demonstrate more resistance.

5.2 Insights

Core themes explored in the qualitative part of the survey were educator experiences with GenAI use, the effects of GenAI on existing tasks and evaluation methods, and the adaptations made in course content or structure due to the emergence of GenAI.

The effect of GenAI on critical thinking and problem solving skills of students is a commonly discussed theme in related research. Kasneci et al. [50] emphasise that GenAI significantly simplifies the acquisition of answers or information, which can have negative effects on the development of critical thinking and problem solving skills. In turn, this may lead to over-reliance on the tools, as highlighted by an excerpt from an answer in the study: "*The main problem is 'over-reliance'. If the student has weak critical thinking or is in a hurry (and is aiming for a 'quick-and-dirty' approach), AI output seems sufficient in itself. In this way, however, the AI answer is often detectable in the exam.*" [2]. Alternatively, Hughes argues that GenAI helps develop critical thinking as it is, in its essence, an increment in the abundance of information available to people since the inception of the printing press [84]. Nevertheless, the discussion around impact on critical thinking - like with most of the perceived risks around GenAI - remains speculative and has yet not found empirical support.

Participants in the study highlighted tasks related to writing (e.g,. essays, reports, and literature reviews), discussion, and coding to be the most affected by GenAI. These findings align with Smolansky et al. [85], who found in their work encompassing student and educator perspectives that writing and coding tasks are considered most affected by the emergence of GenAI. At their core, these tasks are closely tied to written language and thus are easily completed by language models. The discussion around the effects of GenAI to different types of tasks is primarily based on their susceptibility to automated completion, which constitutes academic fraud. However, such a view is based on the assumption that the tasks were not at risk for academic fraud or outright cheating before the emergence of GenAI tools.

An additional angle unveiled by respondents was the adaptations educators have made to facilitate the use of GenAI tools in their courses. Educators have taken different approaches to either mitigate perceived risks related to student GenAI use or harness

[2]This response has been translated from Estonian using DeepL (https://www.deepl.com/en/translator)

the capability of the technology in their courses. Risk mitigation is done by introducing course-specific rules and guidelines related to GenAI use and adapting evaluation methods by changing or replacing constituent tasks. One participant highlighted the strain introduced by such an approach: "*However, re-doing all the teaching is quite a lot of extra work and no one will give you extra time, money or resources to do it. The subjects I teach are also evolving rapidly themselves and AI also affects their form and content. I don't see the time and resources for a quick readjustment.*" [3]. Alternative strategies more accepting of GenAI are the integration of GenAI into tasks, discussing GenAI capabilities and outputs within the context of the course, and recommending GenAI use for appropriate tasks.

Another point outlined by educators is the risk of both intentional and unintentional academic fraud. This is due to the lack of reliable methods to verify whether an output is AI-generated, as existing solutions produce false-positive results on human-generated inputs and false-negatives on machine-generated inputs [86]. This problem is echoed in the opinion of one educator: "*Grading is impossible because there is no way to ascertain that the students' work is plagiarism or not, and they do use AI for 100% of their assignments already. We can recognize the issue but we have no tools to control and justify our feedback.*". This can become even more complicated in the light of systems referred to as 'EdGPT' systems, which are fine-tuned language models trained with specific data for educational purposes, that are currently being developed [87]. Unreliable detection tools and simultaneous rapid advancement of language models require considering a potential future in which GenAI outputs become indistinguishable from human generated text. Another complicating factor is the increasing integration of GenAI models into popular services, such as search engines [88], word processors [89], or Integrated Development Environments (IDE) used for programming [90]. As these integrations become more seamless over time, it significantly increases students' risk for unintentional breach of academic regulations.

However, currently there is no substantial empirical evidence that suggests an increase in plagiarism or breaches of academic conduct directly as a result of GenAI use. Stanford University researchers Pope and Lee claim that the emergence of GenAI has had no impact on cheating rates measured by anonymous surveys conducted among students [91]. A poll conducted among undergraduates in the United Kingdom indicates that about 5% of students use GenAI without editing the output [92]. Although academic fraud is a significant issue with serious ramifications, the risk of misconduct by few should not eclipse the benefits gained by many.

Benefits of the GenAI tools, such as improved agency and always available feedback can be properly harnessed only when GenAI is used as an auxiliary tool in the learning process, not as a substitute. Additionally, both educators and students must be introduced to basic concepts, capabilities, challenges and risks associated with GenAI use to promote

[3]This response has been translated from Estonian using DeepL (https://www.deepl.com/en/translator)

ethical and effective use. The importance of AI literacy is highlighted by existing works and guidelines [93, 87, 94] and must remain a priority in this fast changing environment to increase awareness and mitigate risks.

The discussed points reflect educator opinions on GenAI use by students in their courses. On the contrary, when asked about their own experience with GenAI tools, respondents expressed positive experiences and outlined benefits gained from using the tools in their work. Additionally, a majority of educators in Estonian higher education use GenAI in their academic work and allow the tools to be used in their courses. These findings contrast those of Iqbal et al. [95], who found in early 2023 that teacher perception and attitudes towards ChatGPT are negative. This positive shift may be explained by the possibility that perceptions related to GenAI use have matured over time through positive exposure. Nonetheless, it must be considered that these results have been obtained in different cultural settings.

5.3 Limitations

This study has several limitations. First, this study was aimed at investigating resistance to student GenAI use in the setting of Estonian higher education. Therefore, the survey was distributed among public Estonian universities, which have taken public measures to discuss or regulate the use of GenAI by students. Unfortunately, the targeted universities were not equally cooperative in survey distribution for reasons that can only be speculated.

This was an expected challenge, which led the employment of an alternative distribution strategy of sending individual invitations to educators based on public university contact lists. This alternative approach, however, was not equally effective. The difference in distribution strategies led to significantly smaller participation rates in two of the contacted universities, which affects the generalisability of the results in the Estonian context. Therefore, the results are more applicable to universities with higher amounts of participants. At the same time, although well represented, participation rate in University of Tartu might have been affected by a similarly themed survey carried out by a research group of University of Tartu in March 2024, which may have caused reduced interest in participation. Additionally, participation rate might have been affected by the lack of incentives and the less authoritative nature of student research among educators. The statistical significance of the results could have been improved with an increased number of participants.

Additionally, due to the objective of the thesis to explore resistance towards GenAI adoption in Estonian higher education, the results of the thesis are reflective only of Estonian higher education, and as such are heavily tied with the cultural, technological, and educational background of the country. As the results reflected that a majority of educators are not against the use of GenAI tools in their course, Estonia might not have served as the optimal case study to validate a resistance theory oriented model to study the subject. Future research is recommended to validate and further developed the theoretical model in countries where resistance to GenAI use in education is more evident.

Furthermore, the scope of this thesis is limited to the perspective of educators. This direction was taken knowingly to target a research gap identified through the systematic literature review in this body of work, in which it was determined that all the existing research examines the student, but not the educator perspective, which is integral for studying adoption of the phenomenon. Considering that perspectives of both actors – students and educators – would form a more holistic understanding of GenAI adoption, future research could benefit from a multi-perspective approach. A multi-perspective scope was considered for this thesis, but it would have exceeded the work capacity of a thesis and as such was deemed unfeasible in the preparatory stages of this research.

The supplementary qualitative part of the study contained optional open-ended questions, which demonstrated that many of educators have a very limited scope of experience with GenAI. This means that even though a majority of educators use GenAI in their academic work, the extent to which they harness the capabilities of this technology remains limited. Therefore, unawareness may have effected the versatility of the results, which is why it could be beneficial to repeat similar research when awareness of GenAI tools and their capabilities have significantly improved.

Another limitation of this thesis are the effects of potential language inconsistencies in the survey. The initial development of the model and measurement instrument was based on English sources, however, the results exhibit that a majority of respondents filled the survey in Estonian. Before the roll-out of the study, the measurement instrument was translated from English to Estonian by the author to provide the opportunity of Estonian educators to participate in the survey in their native language. Although the translation was carried out by a native Estonian speaker, translation may have introduced potential semantic inconsistencies, which may have had an effect on the perception of the items, potentially causing indirect effects on the outcomes of the study.

Finally, the environment surrounding the discussion of GenAI use in higher education remains highly dynamic - debates remain ongoing, instances of empirical research are surfacing, and universities are seen adapting their guidelines to better fit the current reality. As such, the results of this thesis reflect a snapshot of educator sentiment towards GenAI, not its absolute form. GenAI remains rapidly evolving and as such, the limitations, risks and challenges of today may not be relevant in future iterations of the technology.

5.4 Implications

The review of the existing research (see Section 2) identified a research gap on educator perspective based GenAI adoption research, highlighting a need for research in the area. Furthermore, a direction to resistance was taken to contribute to information systems research by accounting for a perspective that is neglected by researchers in the field [25]. This thesis is the first known work to draw on IRT and TOE to develop a theory that aims to simultaneously capture individual, organisational and environmental aspects of resistance to technology, as such, contributing to the evolution of technology adoption research. Future research is recommended to further develop the theoretical model, taking into account the limitations and shortcomings of this work (see previous sub-section).

As GenAI remains a highly relevant and debated topic in society, especially in the education domain, this thesis reveals educator sentiment on student GenAI use after an extended period time, revealing more nuanced perspectives compared to previous research that emerged shortly after the release of ChatGPT. Universities and institutions can leverage the results of this study to gain basic benchmarks and insights regarding educator GenAI use and understand perceived risks and challenges related to student GenAI use, which may be used in future policy-making.

6 Conclusion

This thesis aimed to uncover whether academic staff remain reluctant to allow students use GenAI tools in their courses and discover concerns related to GenAI adoption in higher education domain. To achieve this, a novel theoretical model was developed that draws on the constructs of Innovation Resistance Theory (IRT) and Technology-Organization-Environment (TOE) to capture the individual, organisational and environmental aspects that empirically examine potential resistance to GenAI use by students in higher education.

The developed model was validated using a measurement instrument grounded in existing research and the assumptions of the author. Data collection was performed using a survey distributed among Estonian public universities, which collected 149 responses across 5 Estonian universities. The developed theoretical model was validated using partial least squares structural equation modeling (PLS-SEM) and qualitative insights were extracted from open-ended questions included in the survey using response coding techniques. The study tested 8 hypotheses associated with different aspects of resistance towards GenAI use by students in higher education.

Results exhibited that educators in Estonian higher education are predominantly accepting of GenAI tools, with a vast majority allowing the use of the tools in their courses and using them in their academic work. Accepted hypotheses indicated that educators' resistance towards student GenAI use was positively affected by challenges associated with evaluation and scepticism towards the value student GenAI use brings in education. Qualitative insights gained from the survey highlighted that educators perceive academic fraud and effects on critical thinking as primary risks associated with student GenAI use. Additionally, the results highlighted the necessity for action that promotes GenAI literacy to ensure ethical and transparent use that aligns with the goals of modern education.

The findings of this study are limited to the context of Estonian higher education. Outcomes of the study may have been affected by institutional and governmental support to GenAI use, language inconsistencies in the survey introduced through translation, and lower than expected survey participation. Future research is recommended to extend and validate the developed model in an alternate setting more demonstrative of resistance.

A novel, country-agnostic theoretical model that draws on the constructs of IRT and TOE to study resistance to GenAI adoption is the primary theoretical contribution of this work. As this thesis studied resistance to technology, it focused on a commonly neglected perspective in technology adoption research, which predominantly examines factors affecting technology acceptance but not barrier preventing its adoption. To substantiate points commonly presented in discussive literature, empirical evidence is required to evaluate GenAI risks commonly discussed in existing literature, such as the effects on critical thinking and academic fraud rates. Furthermore, research in the field would benefit from works that unify student and educator perspectives to understand both positive and negative factors affecting GenAI adoption in higher education.

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Appendix

I. Consent Form

Title: A study of educator resistance to generative AI use in higher-education

Purpose of the Study: This study aims to understand why educators choose to allow or disallow the use of generative artificial intelligence (GenAI) tools like ChatGPT, Google Gemini, and Microsoft Copilot in their courses. The study uses a theoretical model that consolidates constructs of Innovation Resistance Theory (IRT) and Technology-Environment-Organisation (TOE) as a framework for analysis. Your participation in this study will help establish empirical evidence on educator sentiment towards ChatGPT use in higher-education.

Procedures: If you choose to participate, you will rate statements associated with GenAI use in your courses on a scale of “Strongly disagree” to “Strongly agree”. You will also have the option to provide insights to any additional barriers and effects of generative AI use in your courses and higher-education in general. The study is expected to take approximately 15 minutes.

Potential Risks and Benefits: It is unlikely that you will experience any risks or discomforts beyond what would be experienced in everyday life by participating. There are no specific individual benefits associated with participating, however, your insights will contribute to understanding the adoption of generative AI tools in academia and resistance to student use of generative AI in Estonian higher education.

Confidentiality: The data collected in this study are completely anonymous. No personal data or identifiable information will be collected and the information you choose to provide in this study cannot be connected back to you. Results from this study will be aggregated and may be used in scientific articles to be published in a journal or presented at scientific conferences.

Voluntary Participation: Your participation in this study is voluntary and you may choose to not participate or end your participation at any time without penalty.

Questions or Concerns: If you have any questions or comments about this study, you may contact: Jan-Erik Kalmus, student researcher (jan-erik.kalmus@ut.ee) or Anastasija Nikiforova, supervisor (anastasija.nikiforova@ut.ee)

For questions regarding your rights as a participant in this research, contact: Jan-Erik Kalmus, student researcher (jan-erik.kalmus@ut.ee) or Anastasija Nikiforova, supervisor (anastasija.nikiforova@ut.ee)

Consent: I have read and understand the above consent form. I certify that I am 18 years old or older and I am currently employed by an Estonian university in a position that includes teaching students as a responsibility. By clicking the “Next” button to enter the survey, I indicate my willingness to voluntarily take part in this study.

II. EE Consent Form

Uuringu pealkiri: Uuring generatiivse tehisintellekti rakendamisest Eesti kõrghariduses

Uuringu eesmärk: Uuringu eesmärk on mõista, millised faktorid mõjutavad õppejõudude otsust lubada tudengitel kasutada generatiivset tehisintellekti (TI) (nt. ChatGPT, Google Gemini, Microsoft Copilot) oma õppeainetes. Uuring kasutab teema analüüsimiseks teoreetilist mudelit, mis koosneb Innovaton Resistance Theory (IRT) ja Technology-Organization-Environment (TOE) teooriate elementidest.

Protsess: Uuringus osaledes palutakse Teil hinnata erinevate väidetega nõustumist skaalal "Ei nõustu üldse" kuni "Nõustun täielikult". Lisaks on Teil võimalus jagada oma kogemusi ja arvamusi generatiivse TI kasutamise kohta Teie õppeainetes ja kõrghariduses üldiselt. Uuringus osalemine võtab aega orienteeruvalt 15 minutit.

Riskid ja hüved: On ebatõenäoline, et kogete uuringus osalemise tulemusena rohkem ebamugavusi või riske kui igapäevaelus. Uuringus osalemisega ei ole seotud hüvesid, kuid Teie osalemine aitab mõista tudengite generatiivse TI kasutamise mõjusid Eesti kõrgharidusele.

Konfidentsiaalsus: Uuringus kogutavad andmed on anonüümsed. Uuringu raames ei koguta Teie kohta isiklike andmeid ning Teie vastuseid ei saa peale vastuste esitamist Teiega siduda. Uuringu tulemusi käsitletakse kogumina ning võidakse kasutada teadusartiklites või esitada teaduskonverentsidel.

Osalemine: Teie osalemine uuringus on vabatahtlik. Teil on võimalik uuringus osalemisest loobuda või soovi korral ankeedi täitmine katkestada. Uuringu katkestamisel ei ole tagajärgi.

Küsimused: Kui Teil tekib küsimusi või tähelepanekuid uuringu kohta, pöörduge: Jan-Erik Kalmus (jan-erik.kalmus@ut.ee), tudeng või Anastasija Nikiforova, juhendaja (anastasija.nikiforova@ut.ee).

Kui Teil uuringus osalejana tekib küsimusi oma õiguste kohta, pöörduge: Jan-Erik Kalmus (jan-erik.kalmus@ut.ee), tudeng või Anastasija Nikiforova, juhendaja (anastasija.nikiforova@ut.ee).

Nõusolek: Olen tutvunud uuringut kirjeldava infoga. Kinnitan, et olen vähemalt 18-aastane ning töötan Eesti ülikoolis õpetaval positsioonil. Vajutades nupule "Edasi" nõustun uuringu tingimustega ja kinnitan, et osalen uuringus vabatahtlikult.

III. EN Survey

Section	Questions
Demographics	**DEM1**: Gender *Male; Female; Prefer not to say* **DEM2**: Age group *18-30; 30-45; 45-60; 60-75; 75-90; Prefer not to say* **DEM3**: University *University of Tartu; Tallinn University of Technology; Tallinn University; Estonian University of Life Sciences; Estonian Academy of Arts* **DEM4**: Academic field *Humanities; Biomedical Sciences; Social Sciences; Physical Sciences; Technological Sciences* **CEQ1**: Do you allow students use GenAI in your courses? *Allow; Recommend; No; Other* **CEQ2**: Do you use GenAI in your academic work? *Yes; No*

Section	Questions
Tradition	**TB1**: Student use of GenAI reduces student participation in traditional course delivery methods (e.g., lectures, practical sessions) *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **TB2**: Student use of GenAI makes traditional teaching methods ineffective *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **TB3**: Student use of GenAI creates a need for new teaching methods *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **TB4**: Student use of GenAI conflicts with general academic norms or traditions of my institution *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*
Image	**IB1**: Allowing students use GenAI in my courses causes criticism from my colleagues *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **IB2**: Allowing students use GenAI in my courses has a negative effect on my academic reputation *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **IB3**: Not allowing students use GenAI in my courses has a negative effect on my reputation among students *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Risk	**RB1**: Students using GenAI can become overly reliant on the tools *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **RB2**: Student use of GenAI has a negative effect on the development of problem solving and critical thinking skills *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **RB3**: Students using GenAI in my courses can complete the course with reduced effort *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **RB4**: Students using GenAI risk their academic integrity *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* newline **RB5**: Students using GenAI can receive misleading information from the tools *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **RB6**: Students may have difficulties verifying the accuracy of GenAI outputs *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Usage	**UB1**: The contents of my courses are not suitable for GenAI use by students *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **UB2**: Student produced work is difficult to distinguish from GenAI outputs *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **UB3**: Students use of GenAI makes measuring learning outcomes in my courses more difficult *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **UB4**: Current evaluation methods in my courses are less effective when GenAI is used by students *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **UB5**: Improved evaluation methods in my courses are necessary when GenAI is used by students *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Value barrier	**VB1**: Students do not have equal access to GenAI tools that are useful in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **VB2**: Students do not receive significant value from the use of GenAI tools in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **VB3**: The risk of misuse of GenAI tools outweighs its potential benefits *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **VB4**: The resources (e.g., time and effort) required to allow the use of GenAI tools outweigh its potential benefits *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Organisation	**O1**: Institutional policy is required to allow student GenAI use *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **O2**: Current institutional policy does not support student GenAI use in courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **O3**: My institution does not promote student GenAI use *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **O4**: My institution does not provide me support (e.g., guidance, training, access) to allow students GenAI use in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **O5**: My institution does not provide students support (e.g., guidance, training, access) to allow them use GenAI in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Environment	**E1**: Government policy is required to allow the use of GenAI tools by students *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **E2**: Current government policy does not support student GenAI use *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **E3**: My institution expects me to allow students use GenAI tools in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree* **E4**: Students expect me to allow them use GenAI tools in my courses GenAI use in my courses *1 - Strongly disagree; 2 - Disagree; 3 - Neither agree or disagree; 4 - Agree; 5 - Strongly agree*

Section	Questions
Optional questions	**OEQ1**: Are there any additional challenges associated with letting students use GenAI in your course(s) that were not covered by this study? *Optional text field* **OEQ2**: What kind of tasks in your courses are most affected by the use of generative AI? *Optional text field* **OEQ3**: How would you describe your own experience of using GenAI tools? *Optional text field* **CEQ3**: Have you already integrated the use of generative AI in your course(s)? *Yes; No, but do plan; No and do not plan* **OEQ4**: What were the adaptations you already did to integrate generative AI use in your course(s)? *Optional text field*

IV. EE Survey

Section	Questions
Demographics	**DEM1**: Sugu *Mees; Naine; Ei soovi jagada* **DEM2**: Vanus *18-30; 30-45; 45-60; 60-75; 75-90; Prefer not to say* **DEM3**: Ülikool *Tartu Ülikool; Tallinna Tehnikaülikool; Tallinna Ülikool; Eesti Maaülikool; Eesti Kunstiakadeemia* **DEM4**: Valdkond *Humanitaarteadused; Biomeditsiin; Sotsiaalteadused; Reaalteadused; Tehnikateadused* **CEQ1**: Kas Te lubate tudengitel kasutada generatiivset TI oma õppeainetes? *Luban; Soovitan; Ei; Muu* **CEQ2**: Kas Te kasutate generatiivset TI oma akadeemilises töös? *Jah; Ei*

Section	Questions
Tradition	**TB1**: Tudengite generatiivse TI kasutamine vähendab osalemist tavapärastes kontaktõppe vormides (nt. loengud, praktilised tunnid) *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **TB2**: Tudengite generatiivse TI kasutamine vähendab tavapäraste õpetamismeetodite efektiivsust *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **TB3**: Tudengite generatiivse TI kasutamine loob vajaduse uute õpetamismeetodite järele *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **TB4**: Tudengite generatiivse TI kasutamine on vastuolus minu institutsiooni akadeemiliste tavade või reeglitega *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*
Image	**IB1**: Minu kolleegid kritiseerivad tudengitel generatiivse TI kasutamise lubamist *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **IB2**: Tudengitel generatiivse TI kasutamise lubamisel on negatiivne mõju minu akadeemilisele mainele *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **IB3**: Generatiivse TI kasutamise keelamisel on negatiivne mõju minu mainele tudengite seas *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Risk	**RB1**: Tudengid võivad muutuda generatiivse TI kasutamisest liialt sõltuvaks *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **RB2**: Generatiivse TI kasutamisel on negatiivne mõju tudengite kriitilise mõtlemise ja probleemide lahendamise oskuste arenemisele *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **RB3**: Tudengitel on võimalik generatiivset TI kasutades õppeaine lihtsamalt läbida *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **RB4**: Tudengid riskivad generatiivset TI kasutades oma akadeemilise aususega *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **RB5**: Tudengid võivad generatiivselt TI-lt saada eksitavat informatsioon *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **RB6**: Tudengitel võib esineda raskusi generatiivse TI väljundite täpsuse hindamisega *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Usage	**UB1**: Minu õppeainete sisu ei ole sobilik generatiivse TI kasutamiseks *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **UB2**: Tudengite tööd on keeruline eristada generatiivse TI väljunditest *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **UB3**: Tudengite generatiivse TI kasutamine teeb õpiväljundite hindamise keerulisemaks *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **UB4**: Tudengite generatiivse TI kasutamise korral on minu õppeainete hindamismeetodid vähem efektiivsed *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **UB5**: Tudengite generatiivse TI kasutamise korral on minu õppeainetes vaja täiustatud hindamismeetodeid *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Value barrier	**VB1**: Tudengitel puudub võrdne ligipääs generatiivse TI tööriistadele, mis on minu õppeainetes kasulikud *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **VB2**: Tudengid ei saa minu õppeainetes generatiivse TI kasutamisest lisandväärtust *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **VB3**: Generatiivsete TI tööriistade väärkasutuse risk on suurem kui selle kasutamise eelised *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **VB4**: Generatiivsete TI tööriistade kasutamiseks vajalik ressurss on suurem kui selle kasutamise eelised *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Organisation	**O1**: Asutusesisesed eeskirjad on vajalikud, et võimaldada tudengitel generatiivset TI kasutada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **O2**: Praegused asutusesisesed eeskirjad ei võimalda tudengitel generatiivset TI kasutada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **O3**: Minu institusioon ei soosi tudengite generatiivse TI kasutamist *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **O4**: Minu institutsioon ei paku mulle piisavalt tuge (nt. juhised, kursused, ligipääsu), et tudengitel generatiivse TI kasutamist võimaldada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **O5**: Minu institutsioon ei paku tudengitele piisavalt tuge (nt. juhised, kursused, ligipääs), et tudengitel generatiivse TI kasutamist võimaldada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Environment	**E1**: Riiklikud eeskirjad on vajalikud, et võimaldada tudengitel generatiivset TI kasutada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **E2**: Praegused riiklikud eeskirjad ei võimalda tudengitel generatiivset TI kasutada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **E3**: Minu institutsioon eeldab, et luban tudengitel generatiivset TI kasutada *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult* **E4**: Tudengid eeldavad, et luban neil generatiivset TI kasutada GenAI use in my courses *1 - Ei nõustu üldse; 2 - Pigem ei nõustu; 3 - Ei nõustu ega ole vastu; 4 - Pigem nõustun; 5 - Nõustun täielikult*

Section	Questions
Optional questions	**OEQ1**: Millised probleemid või takistused, mida selles uuringus ei käsitletud, on Teie arvates seotud tudengite generatiivse TI kasutamisega Teie õppeainetes? *Optional text field* **OEQ2**: Milliseid ülesandeid mõjutab generatiivse TI kasutamine Teie õppeainetes kõige rohkem? *Optional text field* **OEQ3**: Kuidas Te kirjeldaksite oma senist generatiivsete TI kasutamise kogemust? *Optional text field* **CEQ3**: Kas Te olete sidunud generatiivse TI kasutamise õppetööga oma õppeainetes? *Jah; Ei, kuid plaanin; Ei ja ei plaani* **OEQ4**: Milliseid muudatusi olete Te oma õppeainetes teinud, et generatiivse TI kasutamist võimaldada? *Optional text field*

V. Response coding

OEQ1: Are there any additional challenges associated with letting students use GenAI GenAI in your course(s) that were not covered by this study?

Theme	**Subthemes**
Academic fraud	*Clear rules and guidelines; Verification difficulties; Fraud due to ignorance; Extent of use; Copyrights; No citations; Cheating;*
AI literacy	*Limited knowledge; Courses for teachers; Courses for students; Understanding potential in different domains;*
Critical thinking	*Over-reliance; Students do not verify outputs; Reduced critical thinking; Independent thinking; Source verification; Reduced analytical skills; Incapable of solving problems;*
Ethics	*Data protection; Security; Equal access for students; Equal skills for students; Matthew effect;*
Evaluation & Teaching	*Obsolete teaching methods; Obsolete evaluation methods; Increased teacher workload; Measuring course outcomes;*
GenAI inaccuracy	*Broad answers; Wrong answers; Incapable in novel domains; Mistakes with a lot of data; Poor output quality;*
Student attitudes	*Motivation; Overestimating skills; Student views and acceptance; Laziness;*

OEQ2: What kind of tasks in your courses are most affected by the use of generative AI?

Theme	**Subthemes**
Analysis	*Analytical texts; Article analysis; Processing preparatory material; Revising questions; Presentations; Argumentative tasks; Discussions;*
Creative	*Creative writing; Idea generation; Marketing strategies;*
Practical tasks	*Group tasks; Homework; Routine tasks; Presentations;*
Programming	*N/A*
Writing	*Essays; Reports; Reviews; Literature reviews; Articles; Term papers; System requirements;*

OEQ3: How would you describe your own experience of using GenAI tools?

Theme	***Subthemes***
Analysis	*Data analysis; Thesis analysis; Discussions;*
Class preparation	*Exam generation; Idea generation;*
Ideation	*Task generation;*
Language	*Writing; Editing; Translations; Refinement; Paraphrasing;*
Programming	*Code generation; Fixing bugs; Optimisation;*
Querying	*Finding articles; Questions; Knowledge gaps;*

OEQ4: What were the adaptations you already did to integrate generative AI use in your course(s)?

Theme	**Subthemes**
Evaluation	*Closed book exams; Removing essays; Project-based learning; Exam redesign; Course redesign; Pair evaluation;*
Guidelines	*Citation guidelines; Adjusting rules to allow use; Explaining use;*
Integration	*Discussing GenAI outputs; Preparation for tasks; Recommend use;*
Task adaptation	*New tasks; Adapted tasks; Flipped-classroom;*

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