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Vilnius University

11th International Doctoral School on Education Research

Organisers:
Prof. Dr. Lilija Duoblienė
Prof. Dr. Valentina Dagienė

December 8–11, 2021,
Druskininkai, Lithuania

11th International Doctoral School on Education Research

Vilnius University Institute of Educational Sciences together with Institute of Data Science and Digital Technologies organize a doctoral consortium on December 8-11, 2021 in Vilnius and Druskininkai, Lithuania. Chair: Prof. dr. Lilija Duobliené and Prof. dr. Valentina Dagienė

The aims:

- To offer a friendly forum for doctoral students to discuss their research topics, research questions and design in the field of education.
- To receive constructive feedback from their peers and senior researchers, to help with choosing suitable methodology and strategies for research.
- To support networking with other researchers.
- To discuss any relevant questions related to research and academic life.

Participants

The consortium is designed primarily for students who are currently enrolled in any stage of doctoral studies with a focus on education research (pedagogy, didactics, teacher training, formal and non-formal education, higher education, educational technology, computational thinking, STEM) or with a focus on other areas of research in connection to globalization, modern technologies and education. Senior researchers in the field will provide feedback and suggestions for improvement of the research proposals.

Requirements

The doctoral student:

1) prepares a short introduction of herself / himself;
2) submits a research plan for their thesis project in general, including motivation, any relevant background and main literature (3-5 items) also to contextualize the research, research questions, methodologies used or planned, and possible results obtained;
3) prepares a poster presentation of their project, to be presented on day 1;
4) reads plans of their fellow students and prepares review / feedback on two of these.

Requirements for the research plan and the poster are described in a separate document.

Participating students of the Doctoral Consortium will have many opportunities for intercultural exchange, both within the international student group and meeting local students and teacher. This will enable them to gain rich intercultural experience.

Lectures and hands-on activities will be held by international professors from various countries (Austria, Estonia, Finland, Hungary, Italy, Portugal, North Macedonia, Netherlands, Serbia, Slovakia, Ukraine, United Kingdom, and Lithuania).

All participated students will be granted 3 ETCS credits from Vilnius University, with certificates of participation.

Contents

The effectiveness of online learning in higher education system

Kamila Alshinbayeva

PhD-candidate	
Name, titles	Kamila Alshinbayeva
University	Vilnius University
Institute	Educology Department

Motivation, any relevant background (max 200 words)

I am on my way of writing a PhD thesis. And sometimes I feel that I am alone. The life of young researcher is consisting of library, reading, writing, analysis and etc. We communicate with books and librarians. What I need more in my PhD student life is live communication.

My main expectations about this conference are listen to different experiences, speak to the students that have the same period of life as me, network and discussion with scientists and Professors from different countries, share and get new ideas.

I believe that this conference will strengthen my thesis, open new perspectives for me, spread my wings and strengthen my confidence. And I hope that I also can make a contribution.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	*Professor Rimantas Želvys
University	Vilnius University
Role in project	Main Supervisor
Name, titles	Kamilla Rollan
University	Cambridge University
Role in project	Practical Advisor and Assistant

Title of your research project

The effectiveness of online learning in higher education system

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The COVID-19 pandemic has affected all areas of social and economic life, including education. More than 1.3 billion students worldwide have switched to online/distance learning.

Unfortunately, the significant increase in the number of students studying online has not been associated with corresponding advances in the preparation of educators to teach online, in pedagogy for online learning, or in other efforts directed toward improved learning outcomes and the overall quality of the online educational experience.

Research efforts in this area to date have concentrated mostly on students and instructional strategies. As a result, we now have a better understanding of the way that online learning changes learners and learning, as well as teaching practices. What is lacking, however, is an understanding of the way that online education and its attendant technologies, are changing teachers.

Within the field of distance education itself, prior research has focused on students and instructional approaches. Issues related to teachers' experiences are generally under-researched, although the shift in roles and responsibilities experienced by online teachers does not decrease their importance in the online classroom.

Findings from the literature review also revealed that higher education faculty experience the transition to the online classroom in different ways. While some are able to find equal, although different levels of professional fulfillment online and face-to-face, others appeared to be unable to fully enact their teaching selves online.

Pedagogy and Technology

Acquiring adequate pedagogical and technical skills are two elements crucial to a successful transition to the online classroom. The educational community generally agrees that the success of online courses and curricula depends largely on the use of student-centered pedagogical practices (Duffy & Kirkley, 2004; Grabinger, 2004; Polin, 2004).

Thus, the role of the online teacher is to design, create and facilitate rich interactions among learners in order to keep them motivated. In well-designed online courses, students are frequently asked to take on additional responsibilities, some of which used to be the prerogative of teachers. This is the reason why the shift has often been described as a shift from being "the sage on the stage to the guide on the side" (King, 1993, p30)

In addition to the pedagogical challenge of adjusting to online learning environments, and regardless of the technical assistance they may receive from their institutions, teachers need to be proficient in the technologies of distance education in order to be able to select the tools that will allow them to carry out their instructional goals. This requirement represents a significant challenge for teachers who entered the profession at a time when technological expertise was not required.

Although perhaps effective in the classroom, teacher-centered practices do not translate well when directly ported to the online classroom. The isolated nature of online learning calls for practices that engage students strongly, and that help them to remain motivated throughout the duration of the course (Duffy et al., 2020).

In order to successfully teach online, this professional identity must adapt to new technologies, new modalities of instruction, and a new division of responsibilities between teacher and student.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will

take to achieve this aim?

This research will explore how online learning is changing both teachers and the teaching profession in higher education. And what benefits teachers get from online teaching. As part of this research, I would like to investigate the impact of online teaching on the professional identity of teachers who have transitioned to the online classroom. I also would like to considere the role played by technology in this process.

The main goal of the research to investigate experience and identify factors of success and growth of the online teacher in higher education. who (1) teach online successfully and, (2) derive high levels of professional fulfillment from this teaching modality.

Specific questions:

How to identify the measures of success in online teaching?

What is the role of technology in this process?

What tools do online teachers use?

How satisfied are they with these tools?

Are today's technologies adequate?

This study thus wil be designed to inform how to prepare teachers to teach online.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

This research will identify how online learning is changing both teachers and the teaching profession within higher education, why many faculties remain ambivalent about online teaching, and suggests ways to address these challenges.

The changes brought upon teachers by online teaching are transformative rather than incremental. Those teachers who are resistant to these changes tend to adjust poorly to the online classroom, and often blame their lack of satisfaction on the shortcomings of the modality.

This research also will show, highlight and draw attention the increasingly important role that technological proficiency plays in the teaching profession. Historically, being technology inclined was never a requirement to enter the academy and succeed as a higher education faculty member. However, just as technology has become an essential part of the way we socialize, work and communicate, it is becoming an essential part of the way we teach and learn, and by extension, an important part of faculty's professional identity.

Finally, this research will reveal the importance of institutional and peer support in the process of a successful transition online. The identity of a community and the individual identities of its

members are mutually constitutive. Thus, for faculty to be willing to integrate online teaching with their professional identities, higher education institutions need to offer support for this modality by making online education a part of their institutional identity.

While an increasing number of institutions have signaled their intention to include online education in their strategic planning, very few have taken significant steps to actually do so. In January 2020, the US News and World Report offered its classification of the best online schools and programs. Just as it important to learn from those faculties who successfully transitioned online, it is crucial to learn from those institutions that appear to have successfully integrated online education with their institutional identity, without sacrificing academic standards or reputation.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

PHENOMENOLOGICAL STUDY; QUALITATIVE RESEARCH DESIGN; CASE STUDY; DEEP INTERVIEWS, DEEP FOCUS GROUP INTERVIEWS; DOCUMENT ANALYSIS

The main goal of the research to investigate experience and identify factors of success and growth of the online teacher in higher education. who (1) teach online successfully and, (2) derive high levels of professional fulfillment from this teaching modality. It placed special emphasis on the role played by current and emerging technologies.

Participants for the study will recruit selectively.

All participants:

- had prior face-to-face teaching experience,
- enjoyed teaching offline and online
- demonstrated evidence of online teaching excellence: teaching awards, peer recommendations, and/or a record of publication in teaching practices.

The way to investigate online teachers' success is to prompt teachers to talk about the way they make sense of their own teaching experience using semi-structured interview questions, and then to use additional methods of data collection such as observations, study of programs, the teaching practices and documents used.

The strategy of inquiry most appropriate to the central research questions is the case study. As Stake observes: "Case studies, in which the researcher explores in depths a program, an event, an activity, a process, or one or more individuals. The cases are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time (Stake, 1995)." (Creswell, 2003)

In order to obtain information about the various ways in which online teaching affects teachers and to explore success cases, I would like to conduct case study on educators respectively, who

are using both current and emerging technologies to teach online in innovative and successful ways.

A totally 15 higher education teachers will be selected to participate in this study.

Selection criteria:

- Participants possess classroom teaching experience
- Participants possess at least two years of online teaching experience
- Participants are currently teaching fully online courses
- Participants are highly successful online teachers: they have received outstanding evaluations, teaching awards or come highly recommended by their peers; they are conducting action research on their classes, and presenting their work at national conferences.
- Participants enjoy teaching online
- Participants use both current and emerging technologies.

Following Creswell, three types of qualitative data are going to be collected in this study 1) interviews, 2) face-to-face and virtual class observations, 3) document and audio-visual material (Crewsell, 2003).

Document Analysis

I would like to ask to the access to the online courses taught by the respondents and analyse the content of these online courses

Achieved results (so far):

This title was chosen at the beginning of my study, now after my academic leave I am thinking how I can narrow it down. Now I want to study experience and identify factors of success and growth of the online teacher in higher education.

Now I am doing my literature review and determining the methodology.

Anticipated project duration

Duration (years) 4

Start date: 2019/10/01
End date: 2024/09/01

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
The new plan is under discussion with supervisor		

The role of robotics in the teaching of natural science subjects

Bence Gaál

PhD-candidate	
Name, titles	Bence Gaál
University	Eötvös Loránd University
Institute	Faculty of Informatics, Department of Media & Educational Informatics

Motivation, any relevant background (max 200 words)

As a teacher of informatics and geography Im willing to make the children's learning process more effective in Hungary. I realized that I can amalgamate the two sciene fields of mine in the frame of the MTMI. It has already a quite long tradition in other European countries. I met the micro:bit during my studies. I was amazed how this little microcontroller can affect the motivation of the children after just one lesson. So after my graduation I decided to applied my University's doctoral program. Currently Im a part time teacher too and I teach informatics and natural science. I have the opportunity to work together with my students. With them I can try my new, expreimental natural science lessons infused with robotics. I would like to improve their experience which they get from school and science subject itself. One of my main goal is to make the study process more interesting. I will do my best to make learning a joy instead of a burden for the children so they will have enough motivation to learn natural science, which is one of the most important skill in the 21st century.

Supervisors (indicate your 'daily supervisor' with an *)

Name, titles	Andor Abonyi-Tóth Dr.
University	Eötvös Loránd University
Institute	Faculty of Informatics, Department of Media & Educational Informatics
Role in project	supervisor

Title of your research project

The role of robotics in the teaching of natural science subjects

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Interest in natural sciences in hungarian education is decreasing, as students age and as the topics become more abstract.[1] And the preparation for over-accountability further worsens this interest, while making it impossible to explore correlations and the whole system. Students' attitudes are closely related to how important the subjects are to the students. This is why, during the secondary school years, the subjects of the final exam and languages come to the fore.

Unfortunately, the assessment of science subjects falls into the non-important category for students, especially in the physics subject. In addition, measurements show that the attitude of students who have programmed in high school is mostly uninteresting or explicitly hostile, which using robots and coding them can make much more enjoyable.

Integrating robotics into a science subject or IT class can provide students with the right motivation and bring abstract approaches to the subject closer to students. Learn the knowledge of a given discipline through everyday examples, while developing many important competencies with robot programming. Examples of such areas of competence are system approach, critical thinking, which greatly facilitate problem detection and problem solving, helping students to examine the matter as part of a whole, interpreting its effects with regard to the entire system.

According to a Russian study, those who studied a certain science subject within the framework of robotics for many years have significantly improved the object's willingness to learn, the professional aspiration in the field of natural sciences, and their subsequent attitude to further

education has also moved towards STEM subjects.
Robotics can help students create a real-world environment in the physical world, which also makes learning easier by collecting new information through primary. Robotics also has a positive effect on students' motivation and attention, as they can establish and create new things on their own. With the right motivation, the effectiveness of learning can be greatly improved.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?
In the first step of my research, I mapped the possible interfaces of science with robotics, where it can be used to integrate it. In the second semester of my doctoral degree, I prepared an overview and analysis that presented and compared robots that are easy to use even for teachers who do not have a deeper knowledge of IT and physics. The emphasis here was on compactness and extensibility, as well as on the complexity of the programming language and the manageability of the environment. On this basis, I also selected the tool used for the rest of my research, for which my future pedagogical program will also be built. Although it was not fully suitable at the time of publication, the appearance of several extensions since then has made the micro:bit suitable for the focus of my research and I will work with this tool in the future.
Due to the pandemic, the question arose as to whether robotics could be taught in distance learning. This was examined in an online course. The course has produced positive results.
My other big goal would be to develop a pedagogical program and related material through which students can learn the basics of programming in an experiential way, while presenting different topics of natural sciences. The sessions are being developed and tested. So far, every occasion has proved successful, and the students have given positive feedback on both working methods and demonstration with robotics. During pedagogical material, critical thinking, problem solving and understanding of system approach and context play a particularly important role.
The primary concern would not be the transfer of ready-made knowledge, but the effective use of methods of problem-finding provided by problem-based education. With these I would like to prepare students for the challenges of the 21st century and to draw their attention to the extremely important role of both information technology and natural sciences, which characterizes the present age. I do not want to pass on specific solutions to students through the material, but rather the movements of mapping a particular problem, for which robot programming can be an excellent basis.
Hypotheses:

- Hungarian curriculum frameworks provide an opportunity to integrate robotics.
- Robotics has a positive effect on motivation and interest in children not only in attendance education, but also in any form.
- With robotics education linked to unplugged activities, students will be able to distinguish between parts of micro:bit and learn some basic concepts that only older children know.
- Even a piece of robotics session can attract children's interest and strengthen their motivation to engage in robotics in IT and natural science classes, as well as in their spare time.
- Science classes supported by robotics make the curriculum easier to understand for the children.
- Children like to work in pairs and prefer not only frontal forms of education.

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

The passage between subjects in Hungary is not really realized now. Transforming and reforming the education system is a key issue for the success of modern education. In my opinion, this

requires a passage between subjects and for children not to think of each discipline as separate parts, but to regard it as a coherent part of the world around them. My research may be relevant to all science and informatics teachers who care about children's acquisition of knowledge and motivation in these disciplines. As part of my research, I intend to create a new pedagogical resource that integrates IT and robotics in science in a well-established, proven, and unprecedented way.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

In many places in the foreign literature, the possibility of integrating robotics and their beneficial effects have appeared. However, LEGO robots played a major role in these, while I am using the extensible and cheaper alternative tool in my research, the micro:bit.

However, I have not yet found a scientific publication in Hungary that deals in detail with how robotics can be used as a motivating factor within the framework of science classes. Only this year, robotics has been included in the national curriculum as a mandatory element of IT education, so I think that I can create a product that can be a breakthrough in the extension of Hungarian robotics education. Currently, robots are not widely used anywhere in Hungary in science education and based on my experience, the robot programming is also a novelty among IT teachers.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

As an IT teacher and head teacher, I could try out the developed educational materials with my own class. The group consisted of 22 people, 11 girls and 11 boys. I do most of my research with them.

Developing and fine-tuning the new teaching materials mentioned above is one of my main tasks in my doctoral research. After the lessons, there will be a success test, which will take the form of a questionnaire. I did questionnaires with other classes and with my own class before I became their head teacher. Education is an integral part of my research when we try the developed educational materials. After the first hour, a structured interview with the group was also conducted. The interview will be repeated at the end of the year when we reach the end of the annual natural science curriculum.

The data collection was followed and will be followed by data analysis. The interviews have been recorded, but they need to be described accurately. In addition to data processing, continuous communication with the group takes place, this allows me to react immediately if some parts of the materials still need to be refined.

I see an obstacle in the pandemic, because the implementation of science education supported by robotics would be extremely difficult if we had to close our schools and switch to online education, for example because children do not work with their own micro:bits.

Achieved results (so far):

Published**:**

- Online robotics sessions during the quarantine period - challenges and experiences (hun) In: Zsakó, László; Szlávi, Péter (szerk.)

INFODIDACT 2020 Paper: 7. , 11 p.

- An overview of robotics kits for public education (eng)
  In: Abonyi-Tóth, Andor; Sto□a, Veronika; Zsakó, László (szerk.)
  New Methods and Technologies inEducation, Research and Practice : Proceedings of XXXIII. DidMatTech 2020 Conference Budapest, Magyarország : ELTE Informatikai Kar(2020) 507 p.pp. 281-300. , 20 p.
- Opportunities to integrate robotics into science subjects (hun)
  In: Szlávi, Péter; Zsakó, László (szerk.)
  InfoDidact2019 pp. 59-72. Paper: 7, 14 p.

Not yet published:

- The curriculum of 7 science classes on various topics is developed.
- Two of the developed materials have also been put into practice.
- After the first lesson, interviews with 22 students are awaiting evaluation.
- Bit:bot extension curriculum for learning about the extension itself.
- Python curriculum with an emphasis on game creation.

Anticipated project duration

Duration (years)	4
Start date:	2019
End date:	2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
5.-6. semester	• Auditing of elaborated tasks • Continuous development and practical development of occupations • Teaching robotics instead of Scratch in the 5th grade • Evaluating and publishing differences • End of 6th semester/summer start of the development of a complex pedagogical program	• 2022 spring • 2023 spring
7.-8. semester	• Writing the dissertation Continuing the practical implementation of the completed tasks • Fine-tuning and finishing of the complex program • Extensive trial of my unplugged method	• 2023 spring

Promoting pedagogical content knowledge in mathematics teachers' education

Monika Grigaliūnienė

PhD-candidate	
Name, titles	Monika Grigaliūnienė
University	Vytautas Magnus university
Institute	Institute of Educational Research
Motivation, any relevant background (max 200 words)	
Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Professor Erno Lehtinen
University	Vytautas Magnus university (University of Turku)
Institute	Insititute of Educational Research (Department of Teacher Education)
Role in project	Supervisor
Title of your research project	
Promoting pedagogical content knowledge in mathematics teachers' education	
Description of your research project (max 2000 words total)	

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Lithuania's "National Education Strategy for 2013-2022" (ŠSM, 2014) presents vision of an education system that is constantly improving with teachers' education being high-quality, integrating the latest knowledge of education and training. While Strategy's realization time is at its end, the vision is yet to be fulfilled. Unfortunately, mathematics teachers' education is no exception at lacking attention of researchers to improve its quality.

In the pursuit of improving mathematics teachers' education, it is very important to acknowledge that school mathematics is unique and differs from more general understanding of mathematics. While sharing the same fundamentals, school mathematics is inevitably shaped by teaching programs and desired outcomes defined by curriculum (Watson, 2008), it is also always related to the age and abilities of students. Therefore, knowledge of pure mathematics is not enough when it comes to teaching mathematics. There are a lot of difficult mathematical concepts for students to be explained by their teachers. There is no formula to suit all, so teachers must be able to adapt and evaluate learning experiences throughout teaching processes (Hill et al., 2008; Watson, 2008). While some teachers try to ensure deeper understanding by enriching learning experiences with projects, workshops etc., some might prefer formal teaching methods because they feel inevitably restricted by curricula, expected to aim for best testing outcomes etc. To be capable of creating valuable activities or simply swiftly adapting as they work, teachers must have a deep conceptual

understanding of mathematics (Hitt, Barrera-Mora & Camacho-Machin, 2010; Hill et al., 2008) as only then they would be able to successfully teach that to pupils (Lee, 2007, Hill et al., 2008).

Aiming towards constant improvement in education, teachers are required to be innovative, have good explanation skills and be able to see their subject through students' eyes (Cheredeko & Shahbazi, 2013; Hardre et al., 2014, Waldrop, 2015). This distinct type of knowledge is unique to teachers as it defines synthesis of pedagogical knowledge (general knowledge of instructional methods) and content knowledge (subject matter) meaning that teacher can organize their knowledge from teaching perspective and use it as a basis for helping students to understand specific concepts (Cochran, 1997). Shulman (1986) distinguished this type of knowledge from content knowledge and general pedagogical knowledge and called it as pedagogical content knowledge. Pedagogical content knowledge is related to teachers' skills to notice important features on students' learning and to decide about relevant teaching activities which is called teachers' professional vision (Stürmer, Seidel & Könings, 2013). **The aim on this PhD research is to make use of the current state of the art research on mathematics teachers' pedagogical content knowledge and professional vision in creating and experimenting new methods for mathematics teacher education.**

Research problem – ensuring high quality content for preservice mathematics teachers to learn from.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The aim on this PhD research is to make use of the current state of the art research on mathematics teachers' pedagogical content knowledge and professional vision in creating and experimenting new methods for mathematics teacher education.

Object – preservice mathematics teachers' education.

Purpose of the research – experiment with newly crafted teaching methods for mathematics teacher education.

This PhD study focuses on following **research questions**:

1. How effectively current in-service training programmes enhance teachers' pedagogical content knowledge and which training approaches have strongest effects?
2. How recognize expert teachers and how pedagogical content and professional vision is manifested in their teaching?
3. Can analysis and reflection of expert teachers' teaching practices be used in teachers' pre- and inservice-training?

Objectives:

1. Perform meta-analysis to overview the field of interest. (Meta-analysis)
2. Determine who are experts among all mathematics teachers and define their

distinctiveness. (Social Network study)
3. Collect video-based data to analyse how expert mathematics teachers work. (Eye-tracking video)
4. Create video-based learning environment for preservice mathematics teachers and try it out. (Case study)

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

In today's ever-changing world, individuals are required to be able to quickly adapt and meet the needs of modern society. The set of skills that are desirable includes critical and analytical thinking, creative problem-solving, effective information processing, reasoning and other skills (Trei, 2015) that are associated with mathematical literacy (Gravemeijer, Stehhan, Lin & Ohtani, 2017; Peters et al., 2017).

While there is no denying that mathematical competence is essential (Council of European Union, 2018), it is true that quite a lot of students link mathematics with negative emotions (Hersh ir John-Steiner, 2011; Larkin ir Jorgensen, 2016; Askew ir Venkat, 2017; Willis, 2010) or even admit to believing mathematics are simply not for them (Palmer, 2008). Undoubtedly, the feelings students develop towards mathematics is due to their learning experiences in schools, core of it being teacher practices (ES, 2019).

Knowing teacher to be a center figure in education, it is important to improve teachers' education so that new teachers would be able to enrich learning experiences with projects, workshops, and, more importantly, have a deep conceptual understanding of mathematics (Hitt, Barrera-Mora & Camacho-Machin, 2010; Hill et al., 2008) as only then they would be able to successfully teach that to pupils (Lee, 2007, Hill et al., 2008).

One of the biggest changes that can be done is creating a new mathematics curriculum that will be implemented with a series of programs aiming towards mathematics teacher's professional development. Knowing that only the most capable, most innovative teachers are truly effective in changing students' perception and, with it, their achievements (Cheredeko ir Shahbazi, 2013; Hardre et al., 2014, Waldrop, 2015), focus on teachers' professional development seems to be the answer towards improvement.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

The most common topic of Lithuanian researchers related to the teaching mathematics is integration of mathematics into another subject (e.g., Viržonienė, 2016; Rauckienė & Simaškaitė, 2002; Pečiuliauskienė et al., 2012; Cibulskaitė & Kurienė, 2015; Cibulskaitė, 2012, etc.). Researchers involved in teaching mathematics or training mathematics teachers state that

the most important thing in an educational situation is the teacher and, of course, his training (Indrašienė, 2000, Malaukytė, 2017). Further research on mathematics teacher education emphasizes information technology competencies (Lipeikienė, 2008), discusses the importance of pedagogical practice (Cibulskaitė, 2012), and developed didactic advice for teachers (Balčytis, 2000, 2001, 2003 and previous B. Balčytis works). There is clearly a lack of focus on research related to the successful education of mathematics teachers.

To provide quality education to students, it is necessary to start with teacher training, as their contribution to student learning is the greatest (Borko, 2004; Emmer & Sabornie, 2015; Pianta, Hamre, & Allen, 2012). Knowing how important teacher figure is, more emphasis should be put on the quality of their training. It is known that deep subject proficiency does not make a student a good teacher (Palali, Elk, Bolhaar, & Rud, 2018) meaning that content knowledge is not enough. New teachers that lack pedagogical content knowledge face trouble when trying to innovate, they also tend to use traditional teaching methods in the learning process (Ball, Thames & Phelps, 2008; Berlin & White, 2010; Lederman & Lederman, 2013). Therefore, valuable teachers' training is crucial towards ensuring high quality teaching skills.

Question of how to efficiently train teachers has been asked by various researchers. As of recently, there is an increasing awareness of teachers' professional vision. Talks about professional vision started back in 1986 by Erickson and colleagues and it was mostly related towards teachers seeing and making sense out of classroom events; in other words, they suggested noticing and its relation to teacher's effectiveness when working. Mason (2002) suggested that experts are aware of their actions in ways that novices are not and thus, experts are sensitised to notice things that novices overlook. To add, Sherin (2007) proposed that professional vision consists of selective attention (as of where to pay attention) and knowledge-based reasoning (ways in which the teacher reasoned about what was noticed based on his or her knowledge and understanding). This means that professional vision is directly related to being an expert in the field.

Even though it is generally accepted that expertise in the field comes naturally throughout years of teaching practise (e.g., Jacobs et al. 2020), some researchers, such as Mason (2011) and Schoenfeld (2011) disagree. Mason (2011) noted, that "noticing something significant retrospectively, after the event, is how most sensitivities begin" (p. 75) meaning that professional vision can be trained, and video-based learning environment could possibly be great field for training professional vision.

Based on these insights, further research can be directed towards more efficient ways to teach preservice teachers so they would be able to fully develop students' mathematical literacy.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

This study is based on cognitive constructivism and socio-cognitive approaches to learning (e.g. Berger & Luckmann, 1966; Piaget, 1966; Vygotsky, 1978, etc.). Although in most cases cognitive

constructivism is applied in studies about teachers in their classrooms and their interactions with students, here emphasis is on communication between teachers and their ability to learn from each other.

For this research, mixed methodology approach is used meaning elements of both quantitative and qualitative methodologies are used. Depending on the stage of research project, participants are either working teachers or preservice teachers.

To ensure ethical standards for the subjects, these ethical principles are in order:

1. Respect for persons autonomy – all participants in research would take their part voluntarily, free from any coercion.
2. Beneficence and non-maleficence – research value outweigh any risk or harm.
3. Justice – equal treatment for all participants.
4. Informed consent – all research staff and participants would be given information about research in a correct manner. Information would include research procedures, purposes, risks and anticipated benefits and statement offering the participant to ask question and to withdraw at any time form the research.
5. Confidentiality and data protection – research data would be stored securely; all preferences regarding anonymity would be respected.
6. Integrity – research would be designed to ensure standards of integrity.

Four stages of the research:

1. Meta-analysis. First stage of the research is based on the approach of scientific realism, that is described as believing science is at least approximately true and it there is possibility, using science, to explain the world how it really is (Ozmon & Kraver, 1996). As pointed out by Levine and others (2008), the benefits of a meta-analysis lie in the larger sample size and greater statistical power than could be found in any one study, therefore meta-analysis is a great tool to overview field of interest. In this case, meta-analysis would be used to compare students' achievements in mathematics based on their teachers' professional development programs that include pedagogical content knowledge, content knowledge or both. Findings of this meta-analysis would provide an important insight about mathematics teachers' professional development programs as it would at least partly answer what content of professional development program is the most impactful towards increasing students' knowledge of mathematics.

2. Social Network questionnaire. Second stage of the research is aimed at finding expert teachers. To know who experts amongst all teachers are, mathematics teachers would be asked questions related to their collegial interactions. Most importantly, who they ask for advice when dealing with work-related troubles, who is the one that is would know how to improve teaching strategies and other related questions. This questioning would lead to finding teachers who are exceptional when it comes to teaching practice. Mathematics teachers of at least five schools would participate at this stage of research meaning it is expected to find at least five expert teachers.

3. Content analysis – video recorded lessons of expert mathematics teachers. Having determined who expert teachers are, it is important to analyse the way they work – what

they notice (professional vision), how they react, how they explain concepts to students, how they make examples, etc. To extract the most information out of their working practices, normal camera to track students and mobile eye-tracker to track teachers would be used. When considering what lessons to videotape, topics that are traditionally more difficult for students to comprehend would be chosen e.g., introducing fraction addition. Collected information would be analysed to answer the questions how experts work and what makes them so good at their job.

4. Action research. Based on data analysed in previous stages of research, video-based learning environment would be created to teach preservice teachers using videotaped lessons of expert teachers. Action research is chosen as it is most often directed at helping educators improve their learning techniques and the general goal of it is to create a simple, practical, repeatable process of iterative learning, evaluation, and improvement that leads to increasingly better results for schools, teachers, or programs. Action research is divided into four stages and is cyclical (Altrichter, Posch & Somekh, 1993). Action research begins with ideas for action. For the first cycle, ideas based on previous stages of research project would serve as a basis for action ideas. On to stage two, these ideas would take place while testing them practically. After that, data would be collected to find out how effective action stage was and finally these findings would be interpreted to start another cycle of implementing renewed ideas. At some point, having reached satisfactory results, action research would come to an end.

Achieved results (so far):

Gathered majority of the data for meta-analysis. Re-established study approach on learning.

Anticipated project duration

Duration (years)	4
Start date:	2021 autumn
End date:	2025 spring

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
1.	Writing the meta-analysis paper	Semester I
2.	Submitting the meta-analysis paper, collecting social network analysis data	Semester II
3.	Analysis of social network analysis data, writing based on social network analysis	Semester III
4.	Collecting expert teachers‘ eye-tracking data, data analysis	Semester IV
5.	Writing and submitting based on eye-tracking data	Semester V

6.	Piloting expert modeling in teacher education (case study)	Semester VI
7.	Main experiment with expert modeling, analysis and article writing	Semester VII
8.	Submitting based on case study	Semester VIII

The development of dialogical cultural literacy in pre-school children

Vaiva Juskiene

PhD-candidate

Vaiva Juskiene, Phd student
Mykolas Romeris University
Faculty of Human and Social Studies

Motivation, any relevant background (max 200 words)

I want to participate in the training because it is very important to clarify the research plan, to hear how other PhD students are working, to gain experience and to share my experiences. At the moment, there are still uncertainties about a lot of things related to the research.

Supervisors (indicate your 'daily supervisor' with an *)

Odeta Merfeldaite, prof.
Mykolas Romeris University
Faculty of Human and Social Studies
Head of the work

Title of your research project

THE DEVELOPMENT OF DIALOGICAL CULTURAL LITERACY IN PRE-SCHOOL CHILDREN

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The dissertation database of the Lithuanian Council of Sciences was consulted in the process of selecting the dissertation topic. Since 2010, a total of 19 dissertations have been defended (pre-school education), 8 dissertations (pre-school education). The main focus is on the management of the institution and child health. Unfortunately, there are hardly any theses on children's education, let alone education for children. Probably the only Lithuanian researchers of recent years who pay attention to child development are O. Monkevičienė and M. Brėdikytė.

In particular, there has been no research on the development of cultural literacy in pre-school and/or pre-primary education. Nor has the actual expression of dialogical education been studied. It is therefore clear that there is no study of the real situation in Lithuania when child-centred education is declared. My challenge as a researcher is therefore to provide insights into what are the traditions and experiences in pre-school educational institutions in (non-)dialogical cultural literacy development of students.

It should be noted that there is very little applied development research in Lithuania related to a particular curriculum, textbook, teaching tool, didactic system or ICT. Although there is a long tradition of linguistic, ethnographic and anthropological research in Lithuania, there are few scientific works in education that apply the innovative qualitative research methodologies and epistemologies that are more widespread in the world, and there is little examination of the application of curricula or teaching materials to the educational process in the natural environment.

It is important that the teacher is not just a passive observer, but actively participates as a helper in the child's creation of his/her own educational environment and content, not as a know-it-all, but as a fellow grower and learner.

Cultural literacy has not been widely studied in Lithuania. Still taught to follow the rules of a world that no longer exists. Learning to focus on oneself and one's achievements. Learning to obey rather than to innovate and think independently.

For many years, cultural literacy has been understood in terms of Hirsh's notion that it is knowledge of a finite list of facts, dates, authors and phenomena.

In the late 20th and early 21st centuries, a changing concept of cultural literacy was beginning to emerge. It is now seen as encompassing the attitudes and skills that help individuals to achieve coherence in everyday life. Empathy becomes the basis of cultural literacy, helping to better hear and understand the different perspectives and values of others. To foster cooperation, individuals should appreciate diversity, respect others, seek compromise and seek to eliminate prejudice (European Parliament, Council of the European Union, 2006).

There is no research on how diealogical cultural literacy education in pre-school age manifests itself. This is important because we need to develop independent thinkers, responsible people living in a responsible world.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The aim of the study is to find qualitatively different ways in which pre-school children express their cultural literacy through dialogic activities. The research aims not only to understand the peculiarities of pupils' development, but also to provide the preconditions for a successful collaboration between teachers and pupils based on dialogicality.

How does dialogic education manifest itself: who initiates and who is responsible for dialogue?

What is the expression of students' cultural literacy?

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen

if the problem is not solved? Does the problem have wider relevance?

For years I have been working with future educators and I have observed a situation where, as the educational paradigm changes from a focus on the subject or the educator to a focus on the child and his/her education, unfortunately, the message of the paradigm shifts and the efforts to overcome it in real life are often met with the inexplicable inaction of the new paradigm by educators. Although it is widely and at all levels talked about that we should not raise the child but help him to grow and develop as a person, to allow him to discover, understand and construct his own personality and its growth in a form or way that suits him best, unfortunately this is not happening as effectively and purposefully as we would like. According to L. Duoblienė (2018), this is not possible without the creation of a mutual dialogue, without arguing one's own thoughts, without non-committal communication, without understanding that it is not only the result of the action that is important, but also the child with his/her own thoughts and deeds.

Researchers are increasingly talking about the rise of the 'image' generation, whose education should be based on different methodologies and educational approaches, based on empowering the individual to act. L. Duoblienė (2018) states "Images are gaining power, they are beginning to construct the way people and society think and live. "

We are still talking about education, even though it is the pupils who are already inhabitants of another world, in which we teachers are aliens. There is still the traditional idea that education is carried out by the older and more knowledgeable person, not by the younger and less knowledgeable one, even though he or she is the real inhabitant of the present world. Is it worth breaking down this convention, or is it simply a matter of changing our perception that we should educate students for the future and not for the past, and not be afraid to listen to their attitudes and understanding? "Perhaps through shared interactions, there will be a realisation that we can no longer impose the attitudes and rules of a world that no longer exists, but that we must learn to be together and create a shared world", as L. Duoblienė (2018) argues.

It is therefore very important, when it comes to the education of pre-school children, that the educator is not just a passive observer, but actively participates as a helper in the child's creation of his or her own educational environment and content, not as a know-it-all, but as a co-grower and a learner together.

There is a gradual move away from stagnant forms of personal education and towards a renewed concept of the educational process that allows each child to express and visualise his or her own thoughts, and to perceive not only himself or herself but also the other in a way that is acceptable to him or her. This is not possible "without the creation of a mutual dialogue, without arguing one's own thoughts, without non-committal communication, without understanding that it is not only the result of the action that is important, but also the child himself, with his own thoughts and deeds" (Duoblienė, 2018). There is not yet enough space for such pedagogy to flourish in Lithuanian schools. Let alone in teacher training institutions.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how

your project will fit in.

The pioneer of the concept of cultural literacy is the philosopher of education, E. D. Hirsch Jr (1988), who argued that literacy is directly linked to cultural literacy. He formulated the so-called 'canonical' knowledge, which consisted of 5 000 facts covering the arts, traditions, facts, dates, names of famous people, literary works and concepts that every American should know, in other words, the information that he considered necessary to live in the modern world. Hirsch was convinced that literacy was determined by the possession of the cultural knowledge he defined as "(in)possession. It was important to him that knowledge be stable, traditional and reliable, that it be accessible to all.

For a long time, this list developed by Hirsch has been the subject of teaching in the USA and, indeed, it is still used today.

However, as the educational paradigm changes and the focus shifts from the subject and knowledge to the child, there are scholars who are trying to broaden the concept of cultural literacy. Increasingly, cultural literacy is being seen as not only about specific knowledge but also about the ability to communicate, to argue, etc. Hirsh's focus on knowledge and its replication, and the notion that early childhood education should be content-focused and that all pupils should develop cultural literacy in this way, is fundamentally at odds with John Dewey's (2013) view that education should be child-centred and based on experiential learning.

Naturally, cultural literacy is understood quite differently by scholars. Here, Nassimbeni and Desmond (2011) argue that "Cultural literacy is the knowledge of the history, contributions and perspectives of different cultural groups, including one's own group, necessary for understanding reading, writing and other media. Cultural literacy requires interaction with culture and its reflection. In a changing society around the world, the development of communication, acceptance and understanding requires a great deal of shared knowledge and the use of that knowledge. According to L. Duoblienė (2010), "cultural literacy is not only about knowledge of cultural phenomena and phenomena and the expression of ideas, but also about the relationship with the thing being created". Lithuanian education policy makers, when designing the general education curriculum, emphasise that it includes "the knowledge of art, music, literature, and other arts of one's own country, and the formation of civic attitudes". This concept is too narrow in the global context, so the thesis plans to present a broader concept and to disseminate this concept in Lithuanian educational contexts.

According to some Lithuanian cultural literacy researchers (Duoblienė (2016); Mažeikis (2016); Zaleskiene (2014)), cultural literacy, communication, and active citizenship are the key competences of a modern person, which contribute to the construction of one's own identity in the contexts of cultural diversity. Therefore, the complex development of tools for the development of these competences and the assessment of their achievements is recognised as a highly topical issue at international level. Researchers from a consortium of nine European and Israeli universities, led by the Faculty of Education at the University of Cambridge, are proposing a newly constructed, socially-oriented concept of cultural literacy, which is based on the three key attitudes of empathy, tolerance and engagement, and which is expressed in terms of social responsibility, knowledge of one's own and others' cultural heritage and identity, multiculturalism, intercultural dialogue, and responsible civic engagement.

Thus, one of the areas to be discussed in the thesis is the concept of cultural literacy. Thus, the

dissertation will include a discussion on the concept of cultural literacy and how this concept is changing. In Lithuania, the discussion is just beginning, so it is important at the national level. Whether it is worthwhile or necessary to define the concept of cultural literacy universally. Or is it possible that each community can and should have its own understanding of cultural literacy? The following authors will be used for this discussion: Hirsch E.D., Ochoa G.G., McDonald Sara, Duoblienė L. and other researchers on cultural literacy. The national documents on pre-primary education (2014), which regulate the holistic education of the child, will undoubtedly play an important role in the debate.

It is interesting to note that the curriculum for pre-primary education (2014) emphasises all of these things, yet still does not empower the pupil enough. Teachers often construct not only pupils' attitudes, but also activities, and develop educational content in a one-sided way that is not necessarily attractive and relevant to pupils.

Dialogic education. It is therefore becoming important not only to develop cultural literacy, but also to develop it not just by indoctrinating pupils, but by creating and sustaining dialogic education. It is impossible to expect child-centred education without dialogicity. It should be noted that the term is used quite extensively in Lithuanian educational documents, but it is never defined what dialogic education is. So far, I can only say, based on my personal experience, that dialogical education is often understood too narrowly by Lithuanian educators.

Dialogic education is a range of conversation-based teaching and learning activities. However, it is important to pay attention to the creation of dialogue. Aleksander R. (2017) presents five main principles of dialogic learning:

- Collectivity: teachers and children carry out tasks together in a group or classroom;

- reciprocity: teachers and children listen to each other, share ideas and express alternative views;

- supportive: children are free to formulate their own ideas without fear of 'wrong' answers; they help each other to reach a common understanding;

- Cumulative: teachers and pupils build on their own and each other's ideas and organise them into coherent lines of thinking and investigation;

- directionality: teachers plan and guide the classroom conversation according to specific educational objectives.

Dialectical education is also explored in Dawes, Mercer and Wegerif (2004), Phillipson, N. and Wegerif, R. (2017). Dialogic Education: Mastering Core Concepts through thinking together. Abingdon: Routledge. Thus, the work of these scholars will also guide the definition of dialogic education.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Phenomenological Phenomenographic Study

The dissertation will be guided by the philosophy of social constructivism and the views and attitudes of one of the founding fathers of this philosophy, L. Vygotsky, towards child development. Social constructivism is directly linked to phenomenology in the search for connections and similarities. The dissertation will use a phenomenographic approach.

In essence, phenomenography has grown out of phenomenology. F. Marton is considered to be its founder. It is not by chance that this approach has been chosen, as the knowledge of phenomenographic research conveys the different meanings of phenomena, highlighting their similarities and differences. Phenomenography enables the study of the qualitatively different ways in which people experience, conceptualise, understand, perceive and interpret phenomena and/or the world in which they exist. And when it comes to children's education, highlighting their individuality, and thus their difference, is crucial. According to V. Žydžiūnitė (2017), in phenomenological phenomenographic research, the focus will be more on the study of the learning experience rather than on the analysis of learning outcomes. The focus is on what is happening in the consciousness of the subject rather than on the phenomenon itself.

Marton (1986), a pioneer of phenomenography, identifies three main strands of phenomenographic research: 'research to understand the results of different teaching methods; research to try to understand the results of learning in specific disciplines (...); and research to understand people's personal experiences in a social, but not an educational, setting'. It is this latter orientation that will be the reference for the research.

V. Žydžiūnaitė, paraphrasing Stenfors - Hayes et al., states that "the results of phenomenographic research describe different ways of perceiving a phenomenon and show their interrelationships."

The study aims not only to understand the expression of students' cultural literacy, but also to uncover the preconditions for successful cooperation between teachers and students based on a dialogical approach.

Research questions:

1. How do teachers perceive dialogic cultural literacy education?
2. How are dialogic communication skills manifested?
3. How is cultural literacy manifested in children?

Participants: pre-school children aged 5-6 from different kindergartens. The study is planned to be carried out in 10 different groups of children.

Focus group interviews with teachers and active observation. Teachers will be provided with activity plans, the researcher will observe and record the activities, record the voices, and then transcribe and analyse the collected material,

The biggest obstacle is the pandemic situation, and educational institutions are reluctant to allow outsiders in.

Parents do not agree to video recording, but do not object to steam recording.

Achieved results (so far):

Defining what is meant by dialogicality.

Defines what is meant by the expression of cultural literacy.

Observations and audio recordings of 5 preschoolers' activities.

All activity recordings were transcribed.

Anticipated project duration

Duration (years) - 6
Start date: 2019-10-09.
End date: 2025-10-09.

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Setting up a survey instrument	Prepare for the research	2021 -12
Conduct activity monitoring	Conduct a reaserch	2022-12
Transcribe material	Selecting research material	2022-12
Conduct data analysis	Determine whether the data is sufficient	2023-06
Conduct focus group interviews	Conduct a reaserch	2023-06
Data processing	Selecting research material	2023-12
Conduct data analysis	Determine whether the data is sufficient	2024-06
To summarise the data from both parts of the study and to present summary conclusions and recommendations	Present the results of the research	2024-12

Development and Assessment of Computational Thinking Skills with Physical Computing

Oliver Kastner-Hauler

PhD-candidate	
Name, titles	Oliver KASTNER-HAULER, Ing. MMag.
University	University for Education Lower Austria, Baden
Institute	Department IT/Media Pedagogy

Motivation, any relevant background (max 200 words)

I am co-author of an OER textbook for computational thinking with the BBC microbit. To disseminate and foster problem-solving abilities in Austrian middle schools, in-service teacher trainings and supporting materials including pre-/posttests with Bebras examples were designed. Over 100 Austrian schools used the material and took part in the project.

During the design of assessment tests, Bebras tasks difficulty levels were not consistent for testing. Some tasks needed reassignment to categories (Easy, Medium, Heavy), and some age classifications needed also a change. A very similar problem showed up when trying to classify the OER textbook examples and trying to measure “how much” CT is contained in any programming task with MakeCode, the block-based environment.

Currently, I am investigating Roman-Gonzalez’s approach for assessment of CT where CT tasks difficulty levels are linked to levels of Bloom’s taxonomy.

Research in PhD is needed to produce good and usable material for teaching, even for teachers with a weak background in Computer Science. Accompanying assessments of CT and problem-solving are used for fine-tuning difficulty levels and approval of material.

Supervisors (indicate your ‘daily supervisor’ with an *)	
Name, titles	Barbara SABITZER, Univ.Prof. MMag. Dr.
University	Johannes Kepler University Linz
Institute	Linz School of Education, Director of MINT Didactics
Role in project	1st supervisor *
Name, titles	Zsolt LAVICZA, Univ.Prof. PhD
University	Johannes Kepler University Linz
Institute	Linz School of Education, Prof. in STEM Education Research Methods
Role in project	2nd supervisor
Name, titles	Gerald FUTSCHEK, ao.Univ.Prof. DI Dr.
University	Technische Universität Wien
Institute	Institute of Information Systems Engineering
Role in project	3rd supervisor

Title of your research project

Development and Assessment of Computational Thinking Skills with Physical Computing

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

CT has reached the classrooms worldwide, in Austria since 2018 in lower secondary (10-14 years). Trained teachers, good material, and a broad understanding of CT are still missing. In addition, the definition of CT is not uniform in research and it is still developing in schools.

How can the situation be improved and CT use in- and outside informatics be increased?

How can teachers be (self-)trained and made fit for CT to increase awareness and action in the classroom?

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

Development and evaluation of learning environments for Computational Thinking with physical computing and the BBC microbit, assessment of scaffolding material and interventions.

Main questions

Can CT skills of students be promoted by block-based coding interventions?

To what extent does the project training on coding and making with a physical computing device promote problem-solving abilities and CT skills?

Hypothesis

The intervention with the project training leads to a significant increase in the assessment score.

Sub-questions

How can tasks containing CT be compared across different student ages and varying difficulty levels by teachers?

What are viable measuring instruments for problem-solving abilities and CT skills?

Concrete Steps

Design and evaluation of learning environment (LE) 1

- 6-8 weeks intervention with OER-book examples
- Pre- and posttest with Bebras tasks
- Interviews with Students and Teachers

- Preliminary results published for Austrian Education Ministry website
  → paper planned, publication TBD

Design and evaluation of LE 2

- 3 weeks intervention with flipped classroom and an extended making example from OER textbook
- Tutorial with videos for teacher training
- Evaluation with teachers, roll-out TBD
- Paper published → FIE2021

Design and evaluation of LE 3

- 3 weeks intervention
- Pre- and posttest with Beginners Computational Thinking test (BCTt)
  → Zapata, resp. Roman-Gonzalez
- Evaluation with students
- Paper planned for early 2022

Design and evaluation of LE 4

- Bloom's taxonomy for classification of difficulty levels
- Paper → TBD

Write theoretical framework and cumulation of individual papers.

- Discuss and explain findings in cumulative dissertation.

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

CT has great potential for preparing students for tomorrow's world in work, social, and private aspects. The need for the subject of Informatics is often stated but scarcely implemented in action or curricula. With CT as part of new curricula in an integrative way, an impulse in this direction can be achieved.

Thus, trained teachers, teaching material, and scaffolding guidelines are needed to achieve widespread use in schools. What CT is and what facets it comprises needs to be clearly communicated to teachers. This ensures that teachers feel confident when using CT in the classroom.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

Bloom's (revised) taxonomy (Krathwohl 2002; Román-González, Pérez-González, and Jiménez-Fernández

2017)

CT assessment toolset(Román-González, Moreno-León, and Robles 2017, 2019)

Computational Thinking Test (CTt) (Román-González et al. 2018)

Beginners CTt (Zapata, Martín, and Román-González 2021; Zapata-Caceres, Martin-Barroso, and Roman-Gonzalez 2020)

Dr. Microbit, a version of Dr. Scratch (Moreno-León, Robles, and Román-González 2015)

→ planned to be used for eval of intervention

Physical computing with a hands-on approach is in line with Papert's constructionism theory. Block-based coding supports tinkering what works and what doesn't. Computer Science concepts need to be understood away from the computer but can be applied by using computers. Physical computing moves the focus away from the computer to a small device using CS and CT concepts.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Design-research-based development and assessment of different learning environments.

Mixed-methods approach in multiple cycles of refinement and rework of designed and derived learning environments for CT teaching and learning.

Students from intervention grade 3 to 8 → different assessments (quant.), interviews (qual.)

Teachers → interviews (qual.)

BCTt /CTt, Dr. Microbit/ Dr. Scratch (quant.)

Block-based coding with MakeCode

Achieved results (so far):

Bebras score after LE 1 intervention is slightly higher. The Mother tongue of students influences markable achievements with Bebras task assessment.

BCTt score after LE 3 is higher. 4th graders did better than 3rd graders in primary at pretest, higher gain for 3rd graders than 4th graders at posttest. The same assessment for 2 different grades favors higher grades at pretest and the learning effect of lower grade after posttest.

Teachers were confident to use LE 2 as designed for the flipped classroom in the tutorial, small enhancements already re-implemented. Larger scale roll-out with flipped classrooms to come.

Anticipated project duration	
Duration (years)	6
Start date:	Feb 2018
End date:	Oct. 2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
LE 3	Intervention in primary, BCTt assessment Paper	Feb 2022
LE 1	Re-work of Bebras score data, Paper	Jun 2022
LE 4	Bloom classification framework for teachers Paper	Dec 2022
Dissertation Theory	Theoretical framework	Apr 2023
Dissertation Discussion	Explain and discuss findings	Aug 2023
Dissertation Defence	Presentation of work	Oct 2023

References:

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Teaching How to Fix Errors in Code Through Interactive Examples

Olli Kiljunen

PhD-candidate	
Name, titles	Olli Kiljunen, M. Sc.
University	Aalto University, Finland
Institute	School of Science (SCI) Department of Computer Science Learning+Technology Research Group (LeTech)

Motivation, any relevant background (max 200 words)

Fixing errors in program source code, that is, *debugging*, is a challenge with which every computer programmer must wrestle over and over again. Despite that, many professional programmers report they have got no explicit training in it (Perscheid et al. 2017). The overlooked status of debugging in programming education is well-noticed in the academic literature, but so are many challenges in teaching systematic debugging processes to novice programmers (Whalley, Settle & Luxton-Reilly 2021, Michaeli & Romeike 2019).

Our research aims at designing an educational software tool that helps novice programmers to learn debugging. Compared to formerly suggested solutions (see Carter 2014, Luxton-Reilly et al. 2018; also Li et al. 2019), the novelty of our approach is to apply ideas of *situated learning* and *scaffolding* to the learning of debugging in a way that positions the learning in an environment fully resembling that in which programmers actually work and at the same time support students with software-realized scaffolds showing as visual cues in their computer screen.

Using the methodology of *design-based research*, our research project also aims at solidifying the scientific community's theoretical understanding of how the ideas of situated learning can be applied in introductory programming education and, especially, teaching of debugging.

Note: This research plan is a modified version of the research plan I wrote earlier this year at my home institution.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Lauri Malmi, Professor
University	Aalto
Institute	SCI, Dept. of CS, LeTech
Role in project	Supervising professor
Name, titles	Otto Seppälä*, D. Sc.
University	Aalto
Institute	SCI, Dept. of CS, LeTech
Role in project	Advisor
Name, titles	Juha Sorva, D. Sc.
University	Aalto

Institute	SCI, Dept. of CS, LeTech
Role in project	Advisor
Name, titles	Mika P. Nieminen, D. Sc.
University	Aalto
Institute	SCI, Dept. of CS, Strategic Usability Research Group (STRATUS)
Role in project	External member in the doctoral student supervisory committee

Title of your research project

Teaching How to Fix Errors in Code Through Interactive Examples

Description of your research project (max 2000 words total)

Problem statement:

How to teach novice programmers to efficiently debug code is a question to which programming educators have been looking for an answer. Especially—in our study—the solution should be applicable in the university-level computer science education and scalable to courses of multiple hundred students: effectively requiring use of automated tools instead of close teacher-student interaction.

Researchers of computing education have suggested solutions to the problem (see the citations in the background section). However, we find those former solutions non-ideal because of their high level of artifice in the learning environment: these solutions set a student to learn debugging in programming environments solely designed for teaching debugging.

This kind of instruction that happens in a highly decontextualized setting poorly resonates with the sociocultural understanding of learning that sets the focus on the interaction between a learner and tools which mediates the learning (see, e.g., Säljö 2004). From this perspective, it is justified to ask to which extent students will be able to apply practices learnt in an 'artificial' learning environment to their work in an actual programming context.

We want to bring the learning of debugging in the environment where professional programmers actually do it, that is, within industry-level software tools such as IntelliJ IDEA or Netbeans. However, as noted by Becker (2019), these tools are extremely beginner-unfriendly in how they report errors to the programmer and also show a lot of unrelated information that is easily misinterpreted by a novice. Therefore, special attention must be paid to enable students to focus on correct pieces and gradually grow their debugging skills.

Aims and objectives (research questions):

To facilitate a student's learning in such a setting, we apply the idea of *software-realized scaffolding* (see Guzdial 1994) and design interactive examples that enable students to go through various debugging processes within an IDE. Our aim is to show that this is a practical and advisable way to teach novice programmers to fix errors in code.

While the exact formulations of our research questions are still incubating, I list here some candidate questions that we would like to find answer in this study:

• How can interactive examples facilitate novice programmers to learn to fix errors in code?

• How does this approach compare to other methods that are used to teach debugging?

• What is required of an educational software system so that it can be used for this purpose?

In the early phase of the project we focus designing a set of interactive examples and evaluating them first from the technical, secondly from the usability point-of-view. Later on, we proceed in evaluating the pedagogical value of them as an instruction method putting them in use in our programming courses and studying their impact in learning.

Relevance and importance of the research:

The relevance of this study is twofold: Firstly, it will provide computing educators with a new viable method of instruction they can incorporate in their teaching of debugging. Secondly, it will increase the theoretical understanding of how situated methods of learning can be applied in programming courses. This understanding will guide computing education researchers when they design new instructional methods in the future, and possibly inspire them to apply this approach to other topics, too.

Theoretical framework:

The approach of our study bases primarily on *sociocultural theories of learning* highlighting the importance of the context in which the learning takes place. We apply ideas from the theory of *situated learning* that calls for the learning to happen in the same actual environment where the learned content is later put into use. We do not, however, follow this philosophy in its fullest extreme (taking the learning totally out of educational institutes and into actual communities of practice) but in such an extent and sense suggested by Ben-Ari (2004): programming tools and languages used in education should be the same that professional programmers use in their work. Similarly, the assignments should be reality-inspired and resemble the problems that programmers, in reality, face.

Research design and methods (planned or used):

The study is carried out with methodology of *design-based research* (see, e.g., Barab 2005): We develop a new instructional tool, the design of which reflects the theoretical knowledge about learning. Then we study the practical usefulness of it using various methods (possibly including: observations, interviews, surveys, quasi-experiments as well as heuristic evaluation) and building a rich picture of how our tool functions in practice.

Although it probably also goes without saying, Barab (ibid., p. 158) points out that “[m]aking convincing arguments when conducting DBR is challenging”. According to him, to be able to produce conclusions with scientific rigor, design-based research demands “developing complex narratives” and “building rich models of interaction” (ibid.).

Achieved results (so far):

We have developed an educational software tool on which interactive examples can be designed and used. This software tool integrates with both the programming environment (IntelliJ IDEA) and the e-learning system (A+) used in introductory programming courses at Aalto University (among

some other institutes of higher education in Finland and beyond).

A poster presentation of the research plans was presented at Koli Calling 2021 international conference on November 18th.

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Anticipated project duration

Duration (years)	4
Start date:	6/2021
End date:	6/2025

Research Schedule		
Outline Research Plan for the Remaining Years of the Project		
Research phase	Objectives	Deadline
Initial design	Design the tool	Jan 2022
First evaluation	Evaluate the tool from the usability perspective	August 2022
Second evaluation	Evaluate the tool from the pedagogical perspective	May 2023
Modelling phase	Constructing understanding of how the tool affects learning	October 2024
Wrapping-up phase	Combining the results into a dissertation	June 2025

Alienation in Catholic education

Juozapas Labokas

PhD-candidate	
Name, titles	Juozapas Labokas, phd candidate
University	Vilnius University
Institute	Educational Science Institute

Motivation, any relevant background (max 200 words)

I have more than 4 years of experience in working as a high school teacher. Analysing this particular experience, I have come up to realize that interrelation among school community members in which person is being actualized is the fundamental pathway to educational success and personal growth. I would describe this experience as a core element of my motivation to venture into educational research field as such.

Supervisors (indicate your 'daily supervisor' with an *)

Name, titles	*Prof. Lilija Duoblienė
University	Vilnius University
Institute	Educational Science Institute
Role in project	Phd supervisor

Title of your research project

Alienation in Catholic education

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Alienation is one of the most popular and at the same time heavily criticized sociopsychological concept of 20-th century. While much debated in philosophy, sociology, psychology and theology, it still lacks a conceptual consensus among its proponents. Despite the fact, alienation gains more and more attention in the educational field. Recent empirical and theoretical researches' reveal, that school alienation and its negative consequences to students' wellbeing (delinquent and suicidal behaviors etc.), their academic achievements (amotivation, non-involvement etc.) and overall educational project are one of the most debated topics in contemporary educational discourse.

While not having a unifying theoretical approach to alienation, empirical findings in educational field reveals that school alienation could be seen as an agent-centered relational phenomenon, which a) is *facilitated or reduced by* particular relational aspects in different school realms and b)

manifests itself *in* various relational dimension of an agent. The relationality of alienation draws our attention to one of the prominent relational thinkers - Martin Buber's philosophical thought, which stresses the fundamentality of relationship as a prerequisite of Being. Reconstructing Buber's account as a theoretical background of this research, we interpret alienation as a process where the agent is *withdrawn from* person-actualizing ("I"- "Thou") and being put *to* person-objectifying ("I"- "It") relation. After defining alienation in this manner, we take a closer look to a Catholic school. Despite the fact, that Catholic school conceptually promotes personal authenticity, equivalent interpersonal relationship and inalienable dignity of a person, it is not immune to school alienation. This contradiction has been revealed in pilot interview research and in personal experience as a high-school teacher. Accordingly, this research is being carried out for seeking to understand, why and how school alienation appears in Catholic school practice, which conceptually contradicts the very essence of alienation phenomenon.

Alienation research in education field is not new. A decent number of quantitative researches has been carried out over the last two decades which revealed that alienation manifesting itself in three main domains: I) Peer relations, II) relationship with teachers and school staff, III) relation with studying activity. School is seen as one of the most important actors which has a potential to reduce or to enforce alienation. It is worth mentioning, that there is only a minor number of qualitative researches about school alienation are made up to date and virtually no research has been made about alienation in Catholic school setting. While quantitative researches propose some valuable insights with empirically sound data, it generally fails to introduce a deeper and more sophisticated understanding of the structure and experience of intersubjective alienation phenomenon. In other words, quantitative outlook towards alienation does not offer in-depth view about what structural and individual level variables and how they enhance or reduce the manifestation of alienation in schooling practice.

Up to date Catholic schooling has not been analyzed in school alienation conceptual context. Taking into account the conceptual background of Catholic school project, which is informed and acts according to Catholic faith doctrine and its educational thought, emphasizing its orientation towards personal relationship and personal actualization, presupposes that alienation in Catholic school setting must be dealt with exceptional attentiveness.

Since we do not have any reliable data about the phenomenon in Catholic school, it is worth asking, wheather, if at all, we can speak about school alienation in Catholic school? If yes, what are the core aspects of alienation phenomenon experienced in school? What individual and/or structural level variables enforces it? How does the Catholic school deals with alienation problem? How does school alienation in Catholic school setting fit into contemporary theoretical debate? These are the main questions addressed in this project.

It is hoped to fill this gap with qualitative research approach, which would allow to gain an in-depth, empirically thick understanding of alienation in Catholic school. Questioning alienation in Catholic school setup is also reasonable due to fact, that Catholic educational thought since the second Vatican council (1962-65') has strongly shifted from institutional, "top-bottom" vision of education, towards a more communal and interpersonal relation-based understanding of school and education as such. These conclusions are drawn from Holy Sees' documents on education qualitative analysis which was carried out by the researcher. It is worth noting, that researching

alienation in Catholic school setting, would also contribute to contemporary debates towards Catholic educational identity, which according to some leading education researchers, is in crisis today. In other words, researching alienation theme would inspire some further considerations on Catholic school identity subject.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

How school alienation manifests in Catholic school atendees experiences?

What phenomenological description about school alienation phenomenon could be made out of these experiences?

What effects alienation had in personal experiences of pupils?

What are the structural and individual level variables that inforces and/or reduces alienation and how do they work?

How does the Catholic school deals with alienation problem?

How does school alienation in Catholic school setting fit into contemporary theoretical debate?

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

→Public intellectuals in contemporary educational discourse plea for authentic education stressing the need for conceptual educational change (or even revolution). Vivid pedagogical relation, human authenticity, creativity are show as an opposition to long-lasting educational mechanics, its standardizing effects and instrumentalization. It is considered, that analysis of alienation phenomenon could fruitfully contribute to this debate in search for better education.

→Catholic schooling is one of the oldest and numerous educational paradigm globally, which has a highly developed institutional and organizational system, world-wide communication capacities with a large and in some areas even increasing numbers of students and educators. Analyzing Catholic school would truly benefit to the development of this paradigm.

→Researching alienation in Catholic school setting would also contribute to ongoing debates about Catholic school identity and its mission in contemporary world.

→Despite the fact, that alienation theme is one of the main sources of inspiration for Martin Buber, his philosophical considerations on alienation has not gained much of attention, let alone in educational field. It is hoped that by reconstructing and reinterpreting Buber's philosophical thought on alienation would benefit to actualization of this author.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

Long lasting debate on alienation since J.J. Russeau could be seen in horizontal axis, where on the one side we see essentialist-normativist thinkers (Hegel, Marx, Dostoyevsky etc.) proposing a pre-given or ideal human nature from which he is deprived (i.e. alienated) due to external forces and on the other side structuralist-existentialist thinkers (Sartre, Derrida, Camus etc.) negating any ideal condition, or even subjectivity as such, stating that alienation is human *status naturalis* condition. This briefly sketched theoretical opposition reveals a deeper underlying conflict about anthropological question, i.e., what is human. Here Martin Buber with his Jewish philosophical and theological thought adds a new dimension in this long-lasting western discussion about personhood, stating that person can only exist in a relation in which "I" participate. Stating that person is only actualized in a relation between "I" and "Thou" Buber then shows that the immanent movement from this relation to "I"- "It" relation which is considered as dehumanizing, categorizing and definite, and could be called alienation. But on the other hand, according to Buber, there is always a potentiality of a person-actualizing relation "I"- "Thou" which may spontaneously occur in various everyday situations, thus returning one's person from alienated state to actualization. In this manner, Buber's account to alienation seems to be a sophisticated, but at the same time an intriguing theoretical innovation, which enables the researcher to deal with relationality as a main topic in alienation theme. Worth mentioning, that Buber's philosophical thought and its application offers a new ground for considering the alienation phenomenon. Moreover, the choice of Martin Buber as a theoretical background is reinforced by quantitative and qualitative research findings which clearly shows the relationality as a core aspect of alienation theme.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

It is estimated to take qualitative phenomenological approach with Catholic high-school students (16< year old) and its alumni as a research participants. It is still not clear wheather to make a case or small "n" study. So far I have not concidered any particular instruments, tools and procedures.

Achieved results (so far):

→Studies of Martin Bubers philosophical thought; a paper present in which Bubers alienation concept is reconstructed.

→Qualitative document analysis is being prepared which analyzes Churches discourse on education in 20-th century (reconstruction of Catholic educational concept).

Anticipated project duration	
Duration (years)	4
Start date:	2019
End date:	2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Literature analysis	Sound literature review of related theoretical concepts.	End of 2021
Theoretical part of phd project	Theoretical and methodological part of PhD prepared.	1st quarter of 2022
Empirical part of phd project	Empirical data gathering and analysis. Conclusions.	End of 2022/ 1st quarter of 2023

Computational Thinking in secondondary education

Martina Landman

PhD-candidate	
Name, titles	Martina Landman, Med
University	TU Wien
Institute	Institute of Information Systems Engineering

Motivation, any relevant background (max 200 words)

I studied computer science and mathematics for my teaching degree and have several years of teaching experience in both my subjects.

Through my work as a computer science teacher, I soon realized that the curriculum "Digitale Grundbildung", which can be translated to "Basic Digital Education", has problems to be implemented in the Austrian education system. It was included in the curriculum in 2018, but no separate subject was created for it. It should be integrated into the other subjects during the 4 years from 5th to 8th grade. I specify on the "Computational Thinking" part of this curriculum because it is a term that many non-computer science teachers are not familiar with. And how are they supposed to teach a topic if they don't know what it is? My basic motivation for my research is this lack of Computational Thinking in schools. I would like to take a step to improve this situation, for both the teachers and the students.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Dr. Gerald Futschek
University	TU Wien
Institute	Institute of Information Systems Engineering E194
Role in project	Supervisor

Title of your research project

Computational Thinking in secondondary education

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

As Janette Wing introduced the term of Computational Thinking in her article in 2006: “This kind of thinking will be part of the skill set of not only other scientists but of everyone else.”(Wing, 2006)

This leads us to the skills teachers need, to teach Computational Thinking. The curriculum is enshrined in the law and must be fulfilled. The curriculum of "Digitale Grundbildung" (DG) has to be implemented in all subjects in grade 5 to 8, but it is not defined which parts of the curriculum have to be implemented in each specific subject. Computer Science and Informatics are no subjects in these grades. There are some schools that created an informatics subject autonomically, which is allowed in Austria, if the school has the resources and teachers to do so. Sadly, there is no data available how many schools implement the curriculum in an integrative way or as an own subject.

From experience it seems like more schools are taking the integrative way of teaching DG to lack of resources and it is up on teachers of non-computer-science subjects. The curriculum contains many fields of digital competences and many of them, like office programs, can easily be integrated in any subject. Computational Thinking is one topic and it is listed with the description "Algorithmic Thinking" and "Creative use of programming languages".

There are plattforms to collect and provide teaching ressources for DG: eduthek, eeducation Austria and other organisations. Most of the material is focused on office programs, but there is material on any topic of the DG-Curriculum. There are some attempts to create material for the CT-part of DG but they are meant for computer science teachers or teachers, that know how to program. Generally, the focus of the provided CT content is on programming.

In 2020 Li et al reviewed 789 articles of STEM education research" The results suggest that CT research and instruction were dramatically lacking" (Li et al., 2020). This means, that the connection between CT and STEM subjects need to be improved and transported to teacher education.

Li, Y., Schoenfeld, A. H., diSessa, A. A., Graesser, A. C., Benson, L. C., English, L. D. & Duschl, R. A. (2020). On Computational Thinking and STEM Education. *Journal for STEM Education Research*, *3*(2), 147–166. https://doi.org/10.1007/s41979-020-00044-w

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33–35. https://doi.org/10.1145/1118178.1118215

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The overall purpose of the research is to improve and provide teaching material aiming to teach CT in non-computer science-subjects and even further not only through programming activities to fulfill the national curriculum of "Digitale Grundbildung".

More specific questions are:

- How is DG in Austria taught, especially the CT part?
- What is non-informatics teachers' understanding of CT?

  Interviews with teachers from different subjects, that are teaching parts of DG in their subjects can help answering these questions.

- What parts of the DG Curriculum are taught more often, which are not?
- What knowledge and skills do non-computer-science teachers need to competently teach CT in the context of DG?

  This question can be answered with a quantitative questionnaire.

- How can teaching CT be improved in non-computer-science subjects?

  Developing, analyzing and evaluating teaching material, especially through action research.

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

As mentioned before, it is a problem that teachers do not know what CT is, but they have to teach it because of the curriculum. Through research on this topic, it is possible to show how the implementation of CT currently works in Austria and to identify ways in which CT teaching in grades 5 to 8 can be continued in the future. If they problem is not solved teachers will not start to teach CT and this part of the curriculum remains ignored.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

The definition of CT is one of the main topics in the theoretical part. There are some definitions, but the one that will be used in this project mainly will be the one of Selby and Woollard 2013, which contains 5 abilitys: abstraction, algorithmic thinking, decomposition, generalization and evaluation (Selby & Woollard, 2013).

The second theoretical part is about learning setting and which teaching form will be used to teach CT. There are some main points to be mentioned when it comes to the part of “thinking”. As Dewey already said in 1910, it is important to recall on past experiences also as exploration and testing (Cf. Dewey, 2008), only to mention some of his ideas To incorporate experience, hands-on application, and exploration, it is necessary to use a student-centered form of learning such as project-based learning or project-based learning. In order to reach the optimum of a CT learning

unit, different learning theories that include constructivist elements have to be compared.

Dewey, J. (2008). *How We Think*. *Cosimo classics*. Lightning Source Incorporated. https://books.google.at/books?id=3V3pUE1yApwC

Selby, C. & Woollard, J. (2013). *Computational thinking: the developing definition*. University of Southampton (E-prints). https://eprints.soton.ac.uk/356481/

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Methods that are planned to use:

- Interviews with teachers from different subjects, that are teaching parts of DG in their subjects can help answering the question. Evaluating the experience of the past years teaching CT can help to find issuses.
- A quantitative questionnaire will help to identify
- Developing, analyzing and evaluating teaching material with the method Action Research.

Achieved results (so far):

The project has not started yet, so there are no results so far.

Anticipated project duration

Duration (years)	3,5
Start date:	March 2022
End date:	August 2025

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Collecting Data	Get information about teaching CT, CT Skills of teacher, teaching experience “Digitale Grundbildung”	October 2022
Evaluation of Data	Get results of the teaching habits of CT	January 2023
Using results and creating teaching material	Creating of innovative material to help teachers and students learning	August 2023

	and understanding CT in a practical way	
Piloting created content	Getting information in a practical context an use the material, evaluate it, adapt it, reflect it and do it again (action research)	August 2024
Evaluation	Evaluation of the whole process	August 2025

Development of the NMT Post-editing Competences in Translator Training in Lithuania

Karolina Levanaitė

PhD-candidate

Karolina Levanaitė
Vilnius University
Institute of Educational Sciences

Motivation, any relevant background (max 200 words)

My area of reasearch covers translator training with particular interest in post-editing of neural machine translation (NMT). I received an MA degree in translation at the Department of Translation Studies at Vilnius University in 2021, with my Master Thesis focusing on the research of the NMT application and training of post-editing competences in Lithuania. Ever since 2013, when I began my academic path as a student of translation studies, I have aspired to explore translation training in the light of the liberal paradigm, covering related aspects such as lifelong learning, problem-based learning, etc., as opposed to the instructional paradigm. In other words, I was eventually overwhelmed by the idea that in the eye of the digital revolution any academic training of professionals, be it translators or representatives of any other field, demands a strong reconsideration with regard to the challenges posed by the AI-based technologies (including NMT).

Prior to that, I graduated from the Centre of Oriental Studies at Vilnius University in 2010, and received my BA and MA degrees in ethnology (indology and contemporary Asian studies).

Supervisors (indicate your 'daily supervisor' with an *)

*Nijolė Burkšaitienė, Prof. Dr.
Vilnius University
Institute for Literary, Cultural and Translation Studies
Thesis advisor

Title of your research project

Development of the NMT Post-editing Competences in Translator Training in Lithuania

Description of your research project (max 2000 words total)

Problem statement

We happen to live in the time of a significant historical turning point witnessing the digital revolution, and it has fundamental impact on pedagogy just as any other area of our everyday life. The post-industrial society is particularly affected by the uncertainty of how today's rapidly evolving technologies will affect the unpredictable and increasingly complex postmodern world. According to Lyotard, postmodern science focuses on the unsolvable and changes the meaning of "knowledge" as it generates not what is known but rather what is unknown (Lyotard 1993). So what is knowledge and how can it be acquired under the conditions of this uncertain reality, which

is, among other things, so complex? The question is in particular relevant to Lithuanian educology, which has been moving from the instructional to the liberal paradigm for over two decades now, implementing notions such as lifelong learning, problem-based learning, self-regulation and "changing the role of the teacher from causal to transformative" (Doll 1993). Thus, the theoretical problem of this research, or the research problem in the broader sense, is enabling specialists to endure and act in a complex, constantly changing reality.

The topic of automated translation, or machine translation (MT), has been of interest to researchers in various fields since the middle of the last century, but it has received significant attention with the emergence and widespread use of the AI-based translation technologies. The latter are changing the day-to-day work of a translator so drastically that all translators may have to work as post-editors in the near future (Pym 2012). There are also major challenges for the translation profession and its future (Austermuehl 2013), and the issue of post-editing automatically translated texts is becoming increasingly more relevant (O'Brien 2002). Thus, the research problem in the narrow sense, is the imperative to improve translator training in Lithuania with regard to the prospects to be brought about by AI-based automated translation. In other words, the practical problem adressed in this research lies in the necessity for translation students to develop new attitudes as well as competences directly and indirectly related to NMT and post-editing tasks.

Although increasingly more research is being conducted abroad on MT and post-editing, the issue of post-editing competence development is relatively new and has only recently been explored in more detail (Rico and Torrejón (2012), Doherty and Kenny (2014), Koponen (2018), Moorkens (2017)). In addition, studies by Garcia (2012), Lommel and DePalma (2016), and Yamada (2014) show that a large proportion of translators are unfavourable and distrustful of MT technologies because they do not fully understand how using them would help them work more productively. In Lithuania, research related to post-editing competences has been carried out by Kasperė et al. (2020). In addition, a study of the Lithuanian translation market (Levanaitė 2021), granted by the Research Council of Lithuania, was conducted in 2020-2021 to collect the fundamental information on the application of NMT among language service providers and the issue of post-editing competences among translators in Lithuania. What is currently missing in translator training in Lithuania is a training concept or model as well as appropriate methodology for its practical implementation to equip translation students with the necessary attitudes and competences that could further serve them in the new complex ever changing reality.

Aims and objectives (research questions):

The overall purpose of my research is to determine the impact of post-editing competence development on translation students' attitudes towards MT technologies and the quality of their work. In order to measure this impact, I intend to create a training model and implement it practically in a one-semester pedagogical intervention.

Hence, in pursuit of achieving the above mentioned aim, I am planning to take the following steps: (1) analyse relevant literature and latest research in the field of translator training as well as acquisition of AI, digital and other related competences, (2) carry out semi-structured in-depth interviews with a group of experts and single out the essential aspects of post-editing competence

development, (3) create a theoretical model of post-editing competence development, which will include knowledge (i.e. post-editing theory, history), skills and abilities necessary for post-editing, practical application of the model (sample description of the post-editing course), (4) test the developed model in order to determine the impact of post-editing competences on translation students' work quality (i.e. perform a one-semester experimental pedagogical intervention with university translation students and compare the results of the experimental group with the results of the control group), (5) conduct a survey of students who participated in the pedagogical intervention in order to assess students' attitudes towards MT technologies, (6) organise and compare the results of the pedagogical intervention with the results of the survey to find any causal links and verify whether the assumption of the link has been confirmed, (7) evaluate further perspectives for the application of the developed training model.

During the process of establishing the training model I aim at answering the following questions. Firstly, is there a link between the development of post-editing competences, translation students' attitude towards MT technologies and the quality of their work? Another important problematic question is which of the competences have the greatest impact on the strengthening of students' favourable attitude towards MT technologies and the quality of their work?

Relevance and importance of the research:

On the one hand, attempts are being made to tackle the issue of translation training with regard to NMT application and post-editing competences by developing national and international standards for their activities (ISO 17100, ISO / TS 11669, ISO 18587, etc.), university study programmes are being supplemented with courses such as Machine Translation Technologies, Introduction to Post-Editing, etc. On the other hand, translation as a discipline is often lagging behind industry developments and is subject to an "institutional belatedness" (Pym 2011), because NMT technologies develop outside universities and there is not enough research on these tools, their impact on translation processes (Austermuehl 2013). Given the expeditious progress of the NMT technologies since 2016, and bearing in mind that the data collected and analysed in the aforementioned study of the Lithuanian translation market (Levanaitė 2021) does not correspond to the global NMT expansion, the present situation regarding translator training in Lithuania remains obscure and new methodologies need to be imported to train specialist in accordance to the worldy trends. From the theoretical point of view, research into new training methodologies regarding new digital competences is crucial for a variety of specialist training programmes, hence, the relevance of this research is of much wider scope than only translator training or only Lithuania. It is of vital importance to solve this problem and tackle the issue of competence training that would shield future professionals from the aforementioned "institutional belatedness". In other words, the training model developed for the planned research will contribute to reducing the current gap between the global change with regard to translation technologies and improving translator training in Lithuanian, meanwhile, the application of the training model will help collect particularly valuable data how it could possibly affect the quality of translators' work.

Theoretical framework

There are several theories relevant to this research. The initial idea was the theory of education

based on social constructivism, on which a variety of currently popular competence acquisition models are currently being based. Vygotsky's theory of "motivational scaffolding" is often used to substantiate these models: knowledge is acquired by individuals interacting with each other and learning from each other, and the learner must participate in the learning process. However, even more relevant to my research is the complexity theory, which might be viewed as a possible reinterpretation of postmodernist thought (Cilliers 1998). Complexivism perceives knowledge as a complex entity emerging through experience, constantly in flux and developing through fractal, self-similar and multifaceted experiences, rather than a body of static truths which could merely be objectivised and transmitted (Marczak 2018). This corelates well with the concept of the complex reality and its future that burdains the overall specialist training and demands for new methodologies to train “transversal” (Pym 2012) or “emergent” competences (Kiraly 2013), that are situated and impossible to predict (Risku 2014) and that can be developed through interaction with others. As Kiraly suggests, emergentist epistemology could be promoted as a solution for translator education, hence, this research attempts to draw a training model based on the aforementioned epistemological notions.

Research design and methods (planned or used):

The design of my research relies on both qualitative and quantitative methodology, and the following research methods are to be taken: analysis of scientific literature (semester 1-2), pilot interviews with experts (semester 2), semi-structured in-depth interviews with experts (semester 3-4), experimental pedagogical intervention (semester 5), survey (of the participants who took part in the pedagogical intervention) (semester 6). The choice of these methods was determined by the aforementioned problematic research question aimed at determing the link between the development of post-editing competences, translation students’ attitude towards MT technologies and the quality of their work.

Potential problems may involve experts’ lack of openess to take part in the in-depth interviews (therefore, I am planning to start with a pilot interview with experts I already have contacts with and continue from there on), finding a fitting group of translation students who could take part in the pedagogical intervention (I am already looking for support at the Department of Translation Studies for this matter), finding proper methodology for the analysis of the research results (that is why I intend to use mix-method research and triangulation).

Achieved results (so far):

Currently I am carrying out a research into the ontological and epistemological theories relevant to my thesis and as a result of this analysis I have come across new insights for the training model to be build for this research (in particular, complexivism, emergentism, process theory, etc).

Anticipated project duration

4 years
Start date: October 1, 2021
End date: September 30, 2025

Research Schedule		
Outline Research Plan for the Remaining Years of the Project		
Research phase	Objectives	Deadline
Theoretical framework (1)	Analysis of the theoretical scientific literature and documents regarding educational policy relevant to the research, definition of key terms and concepts	January 2022
Theoretical framework (2)	Review and analysis of the latest Lithuanian and foreign relevant research, formulation of tasks	June 2022
Theoretical framework (3)	Compilation of research methods, formulation of the hypotheses	January 2023
Empirical part (1)	Scheduling empirical research, preparation of its instruments	June 2023
Empirical part (2)	Data collection, organisation and analysis	January 2024
Empirical part (3)	Summary of research results, preliminary conclusions	June 2024
Final conclusions	Preparation of final research conclusions and the thesis	January 2025
Defence	Preparation of the thesis summary, defence of the thesis	September 2025

Reference framework for Smart Learning infrastructure in Computer Science Education

Maia Lust

PhD-candidate	
Name, titles	Maia Lust, junior researcher
University	Tallinn University
Institute	School of Digital Technologies

Motivation, any relevant background (max 200 words)

I would like to attend Doctoral Consortium in order to get to know practices from other students, supervisors, to get research related information and insights. To make contact to field research community. To get knoweledge about PhD studies and some thoughts about how to write dissertation. I'd like to finish my PhD studies during nominal time of studies, so i'm very motivated to get to know more about field of research in general.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles,	Mart Laanpere, professor of mathematics and computing education
University	Tallinn University
Institute	School of Digital Technologies
Role in project	consultant

Title of your research project

Reference framework for Smart Learning infrastructure in Computer Science Education

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

How to model Pedagogy-driven design of smart learning infrastructure to

support learner modelling and learning analytics in CSE

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

1.What are the existing frameworks, platforms and tools used in CSE

2. How to design and validate an effective Smart Learning Infrastructure in CSE context to support Learner Modeling and Learning Analytics?

3. What are the design requirements/patterns, components and implementation procedures for reference framework for Smart Learning Infrastructure for CSE?

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

Learner's computing knowledges is uneven in different parts of the country: there are pupils who have great potential in becoming IT specialists in the future, but in other hand there are pupils who doesn't feel interested enough in informatics specific knowledge and they are satisfied with average level of digital literacy that will help them to be active citizen of information society. Another side of the situation is that informatics is not a compulsory subject in our schools, due this fact at the moment Estonia lacks qualified informatics teachers at schools. In Estonia we have many successful software development enterprises and start-ups who raise their potential on the market by using at fullest employees potential, also societal expectancy shows that pupils show get a hands on experience from school where they need to gain competences of collaboration, critical thinking, creativity etc.

Organising collaborative work of students, where each have their own responsibility and input in common results is not a new thing for school, but how to organise collaborative work of pupils in computer mediated environments of informatics in order to obtain subject specific learning outcomes; how can teacher who lacks informatics subject specific knowledge provide a guiding for pupils through the process of collaborative work in computer mediated learning of informatics. Is there a way to help such teachers by designing a smart learning environment that provides support for pupils as well as for the teacher? What are the such environment design criterias and design decisions that need to be made in order to provide the mentioned above approach?

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

This section starts with a brief overview and introduction to the concept of learning environment and learners scaffolding, followed by presentation of learner scaffolding approaches that can be used in computer supported collaborative learning environments.

A variety of interpretations of the concept of learning environment can be found in the literature. In some of these, the focus is on the role of information and communication technology (ICT), as in the "innovative learning environment" (Kirschner, 2005), which should have the necessary technological, social and educational affordances to provide opportunities to learn. Similar is the

"collaborative learning environment" which responds to societal trends by increasing the focus on open-ended problem-solving tasks via heterogeneous, distributed teams using Computer Supported Collaborative Learning (CSCL) technology (Beers et al, 2005). Computer Science Education (CSEd) heavily uses online educational tools like Integrated Development Environments (IDEs), Learning Management Systems (LMS), eTextbooks, interactive programming environments, and other smart content. Learning technologies themselves offer promise in remediating these difficulties (Järvelä & Hadwin, 2013; Morris et al., 2010). During past few years several online learning environments and platforms were developed in order to enhance online and blended learning for CSE, such as for example ProTus (the programming tutoring system), which initially was developed to provide various interactive courses in learning complex problem-solving skills (Ivanović et al., 2012) ProTuS is an adaptive and learning platform that provides personalization and adaptation to support the learning process (Klašnja-Milicević et al., 2018) Teaching students to write code with good style is important but difficult: detailed feedback currently requires a teacher. To resolve this issue AutoStyle program was developed, a style tutor that scales, offers adaptive, real-time holistic style feedback and hints as students improve their code. (Wiese, 2017)

CS Education (CSEd) researchers increasingly make use of learning analytics (Hundhausen etal., 2017; Fernandez-Delgado et al., 2014;) However, students, instructors and researchers all face barriers that slow progress: Educational tools do not integrate well. Information about the computer science learning process and outcome data generated by one system is not compatible with that from other systems. Computer science problem solving and learning (e.g., open-ended coding solutions to complex problems) is quite different from the type of data (e.g., discrete answers to questions or verbal responses) that current educational data mining focuses on. CSEd infrastructure should support broader re-use of innovative learning content that is instrumented for rich data collection, formats and tools for analysis of learner data, and development of best practices to make collections of learner data available to researchers. (SPLICE, 2018)

A starting point for defining pupils need for support in the learning environment is a zone of proximal development (ZPD), which is defined as: "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Vygotsky (1978) believed that when a student is in the ZPD for a concrete task, providing the needed support and guidance will give the pupils enough of a motivation to achieve the task. To assist a pupil to move through the zone of proximal development, teachers are encouraged to focus on three important components which help the learning process:

The presence of someone with knowledge and skills deeper that of the pupil (a more knowledgeable other). Social interactions with a skillful teacher or peer that allow the pupils to observe and practice their skills. Supportive activities provided by the teacher, or more competent peer, to support the pupil as he or she is led through the ZPD.

The ZPD has become synonymous in the literature with the term scaffolding. However, it is important to note that Vygotsky never used this term in his writing, and it was introduced by (Wood, Bruner and Ross 1976). Wood et al. (1976) define scaffolding as a process "that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts." As

they note, scaffolds require the adult's "controlling those elements of the task that are initially beyond the learner's capability, thus permitting him to concentrate upon and complete only those elements that are within his range of competence"(Wood at al, ibid.) Researchers have identified various scaffolding strategies for helping learners overcome conceptual and procedural hurdles (Hmelo-Silver and Barrows 2006; Lajoie et al. 2001; Quintana et al. 2004; Reiser 2004).

Cazden (1983) supported Bruner's use on term scaffolding, but divided scaffolding to vertical and sequential scaffolding, where vertical scaffolding involves adult extending child's knowledge by asking further questions and sequential scaffolding could be found in games played with children at daily basis, for example during the meal or bathing. Applebee and Langer (1983) mentioned the term of instructional scaffolding as a way to describe essential aspects of formal instruction. In their view, learning is a process of gradual internalization of routines and procedures available to the learner from the social and cultural context in which the learning takes place.

Based on meta-analyses of scaffolding in online learning environment completed by Juumat&Tasir (2014) there are four types of online scaffolding, such as: procedural scaffolding, conceptual scaffolding, strategic scaffolding and metacognitive scaffolding. According to Hannafin, Land and Oliver (1999) these variations of scaffolding appropriately supports students learning. *Conceptual scaffolding* helps students to decide what to consider in learning (Hill&Hannafin, 2001). It particularly guides them to prioritize fundamental concepts. *Procedural scaffolding*, in addition, assists students in using available tools and resources while *strategic scaffolding* suggests alternative ways to tackle problems in learning. Finally, *metacognitive scaffolding* guides students on what to think during learning (Hannafin, et al.,1999). Other types of scaffolding addressed by researchers in the beginning of 21 centuries, include technical support, content support, argumentation template, questioning and modeling. However, these terms were rarely used, probably because they were inadequately justified.

Rapid development of technologies that provide wide possibilities for online learning has changed the types of the scaffolding that could be provided through online learning environments. In regards to computer supported learning environments for computing several tools can be used to scaffold learners through their journey in the learning environment.

For example, different types of Code-check or Auto-style tools, Intelligent tutor system (ITS) open learner models (OLM) can serve as scaffolds, providing learners with support they need. Kirsher&Erkens (2013) specifies that computer supported collaborative learning (CSCL) are three main components: pedagogical, social and technological. And scaffolding happens mainly in pedagogical components where tools, scripts, and teacher (or computer) scaffolding focus on supporting the cognitive and metacognitive aspects of task fulfillment. Cognitive support focuses on executing the task itself, whereas metacognitive support focuses on the task strategy and regulation (i.e., the planning, monitoring, and evaluation of task execution). In other words, the pedagogical component refers to the learning goals of the task. However, in collaborative learning the learning goals may be aimed at the individual student, at the collaborating group as a whole (learning team), or even to the community (class or school) to which the collaborating groups belong. Depending on the unit that the learning goals are aimed at, the support that is offered can be different. In a review of a range of scaffolding designs for ICT, Quintana et al. (2004) developed a scaffolding design framework for enquiry learning for science. where it's recommended that

tasks should be structured to a level and complexity in which learners can focus on the most relevant parts of the task.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Research design will follow the design-based approach (McKenney and Reeves, 2004), a genre of research in which the iterative and rigorous development of solutions to complex educational problems provide the setting for scientific inquiry. The solutions that results from educational Design research can be an educational product, process, program or policy (ibid.). In my PhD research, the solution that will result from iterative design-based research is a reference framework for SLICE. According to van den Akker et al., (2006) design based research incorporates a cyclic (or iterative) approach of design, evaluation and revision of a solution. Then, the research typically consists of a constructive part that builds an artefact and a part that evaluates the designed artefact (March, Smith, 1995). My PhD research will start with the definition of basic design requirements for SLICE informed by literature review and participatory design that will engage both typical users and experts. Based on this assessment and the reviewed literature, a reference framework will be constructed and, eventually, validated empirically. During the first iteration, the primary data collection will be conducted through 2-3 participatory design sessions engaging a sample of 6-8 persons. The purposive sampling is informed by personas the stereotypical user profiles of the platform. The design sessions focus on usage scenarios and various aspects of existing prototypes for Smart Learning Infrastructure for Computing Education (SLICE), resulting with a conceptual model of SLICE in a form of concept map and ontology. Additional (quantitative and qualitative) data will be collected from platform in form of learning outcomes, learning analytics data from exercises, feedback questionnaire at the end of each course. The second iteration will focus on defining the design requirements reference framework for SLICE and implementing these requirements to improve the platform. The learner modeling and learning analytics support will be added to the platform, to support the primary data collection. The secondary data will be collected through an online survey (the sample includes all students and teachers who participated in that year) and also through interviews with teachers and experts. The third iteration will be dedicated to the improvement and validation of the reference model. The primary data will be collected through focus group interviews using Nominal Group Technique (Gallagher et al, 1993). According to Delbecq & van de Ven (1971) NGT is a structured brainstorm procedure to facilitate effective group decision-making in research and evaluation. NGT protocol consists of five phases (Potter et al, 2004):

1. Introduction and explanation of the purpose and procedure of the meeting

2. Silent generation of ideas about SLICE framework

3. Sharing ideas about the requirements for and potential improvement of SLICE framework

4. Moderated group discussion: synthesizing collected ideas about SLICE framework

5. Voting and ranking: prioritizing collected thoughts and ideas about the requirements and improvement recommendations for SLICE framework trough voting and ranking processes NGT session will result with the validation requirements for SLICE and recommendations for improvement. The purposive sample for the NGT will be based on the same personas as in the first iteration. The final validation will be conducted in a from of heuristic evaluation by the panel of experts.

Achieved results (so far):

At the moment, literature review is complete approximately for 50%, scenarios and personas for design sessions is developed, sample size is clear, first design session was held

Anticipated project duration

Duration (years)4 years
Start date:23.08.2019
End date:2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
I iteration	to develop conceptual model and prototype of the Smart Learning Infrastructure for CSE	February 2022
II iteration	to define the design requirements reference framework for SLICE and implementing these requirements to improve the platform	June 2022
III iteration	to the improve and validate of the reference model	February 2023
Theoretical background	To finish systematic literature review	March 2023

Teachers' tactics when programming and mathematics converge

Ana Fuentes-Martinez

PhD-candidate	
Name, titles	Ana Fuentes-Martinez, Accredited Proficient Practitioner teacher (mathematics and programming). Licentiate research degree
University	University West
Institute	School of Business, Economics, and IT

Motivation, any relevant background (max 200 words)

My work as a supervisor within the programming conferences offered by the Swedish National Agency for Education's gave me valuable experience and insights into the purpose of the revision of the curriculum that was implemented in 2018 and where digitalization runs as a common thread throughout the school system. It is a comprehensive endeavor that affects all forms of schooling from preschool to high school and adult education and that is having direct consequences for everyone involved, from young children to prospective teachers and teacher educators, in-service teachers and school principals. The reform aligns with the international trends which ultimately aim to increase computational thinking and computer science skills among citizens. For mathematics teachers in upper secondary school, the revision of the curriculum implies that they now need to include computer programming as yet another tool in their subject. Since for most of them, computer programming was not part of their own teacher education, comprehensive teaching training initiatives will be necessary to successfully implement the reform.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Professor Lars Svensson *
University	University West
Institute	School of Business, Economics, and IT
Role in project	Main supervisor
Name, titles	Thomas Winman, PhD
University	University West
Institute	School of Business, Economics, and IT
Role in project	Professor Lars Svensson *

Title of your research project

Teachers' tactics when programming and mathematics converge

(This is as a working title, but isn't overall title for my investigations, because my research is not part of an external project.)

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The purpose of my investigations is to analyze the digitization process as a result of the revisions in the syllabi and curricula of the upper secondary school, with special focus on the integration of programming within the subject of mathematics. The teachers' perceptions, knowledge and opportunities are set in relation to the governing documents' requirements for digitization in the school in order to shed light on different ways of bridging the gap between practice and policy.

Research about policy implementation has showed the different layers involved in curriculum implementation, from its design at the governmental level to the pragmatic decision in the classroom. This knowledge, together with insights in technology acceptance and teacher professional development will be the pillars of the investigation.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

My contribution will be an explorative study into a new phenomenon which purpose is to inform further curricular reforms as well as to serve as a guide for realization of the current one, particularly with regard to the integration of programming in mathematics.

The questions I would like to answer are:

- How do teachers relate to the governing documents' requirements for general teaching in programming? Interview study and unit plan analysis with mathematics teachers proficient in computer programming
- In what way can teacher education learn from the different teaching approaches? Intervention study in several programming courses for in-service teachers.

Modeling system for computational thinking automatic assessment

Vaida Masiulionytė-Dagienė

PhD-candidate	
Name, titles	Vaida Masiulionytė-Dagienė
University	Vilnius University
Institute	Institute of Data Science and Digital Technologies

Motivation, any relevant background (max 200 words)

One of the goals of computer science teaching is to develop computational thinking (CT). CT skills nowadays are essential for everybody, not only computer science specialists. The problem still appears within the proper assessment of CT skills. This problem is stated in various articles, (e.g., Zhang et al. (2020) mention that some computational thinking skills, still remain a challenge in how to properly assess them) and observed in teaching practice. My research will focus on the CT assessment problem.

References:

1. Zhang, L. C., Nouri, J., & Rolandsson, L. (2020). Progression of Computational Thinking Skills in Swedish Compulsory Schools with Block-based Programming. ACE - Proc. Australas. Comput. Educ. Conf., Held Conjunction Australas. Comput. Sci. Week, 66–75. Scopus. https://doi.org/10.1145/3373165.3373173

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Assoc. Prof. Dr. Tatjana Jevsikova
University	Vilnius University
Institute	Institute of Data Science and Digital Technologies

Title of your research project

Modeling system for computational thinking automatic assessment

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The main problem is how to assess CT skills properly. There are some tests created and tools developed (e.g. based on Scratch) for CT assessment, but all of them focus on one or two concepts of CT. There is still no unified system that could address all the main aspects of CT in CT assessment, especially when talking about automated CT assessment. My PhD studies have just started and research plan has been just approved – the first step is to make analysis of the current situation in this research field.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The main objective of this research is to model automated computational thinking assessment system. We are going to study how Artificial Intelligence methods could be used for the system of CT automatic assessment.

Planned objectives:

1. To analyse relevant literature on the CT conceptualisation and assessment.
2. To analyse relevant models of assessment in e-learning systems.
3. To make a model of automatic CT assessment system based on AI.
4. To validate the modelled CT assessment system and improve it.
5. To approve experimentally the modelled CT assessment system.

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

The system of CT assessment will focus on the high school students, also it could be later on used in higher education or in IT sector to test computational thinking level of the employees. Because now in IT sector there is quite a problem to find skilful employees, and some companies are using IQ test or some other tests to test the logical thinking skills of future employees.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

The analysis of the literature is planned to be conducted untill September 2022. The PhD studies have just started and research plan has been just approved.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The plan is to validate the model with experts in the field of CT and e-learning and to test the system empirically with at least two classes of high school students.

Achieved results (so far):

As the studies began on the first of October, 2021, the first result is the poster presentation (https://issep2021.science.ru.nl/wp-content/uploads/2021/11/Gamification-for-developing-computational-thinking-in-1.pdf) at the international conference ISSEP 2021 (November 3 – 5, 2021; https://issep2021.science.ru.nl/)directing the research problem.

Anticipated project duration

Duration (years)	4
Start date:	2021 10 01
End date:	2025 09 30

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Analysis of the current situation on CT assessment and automatic assessment systems	To find out what automatic systems are used so far for CT assessment	2022 September
To concrete the aim of the study and to define the methods for the research	According to the analysis results to define the best methods for the further research	2022 September
Theoretical research	To improve the theoretical methodologies of CT assessment and to model the automated CT assessment system	2024 March
Empirical research	To test the modelled CT assessment system and to improve according to the test results	2025 January
Conclusions	To summarize the results of theoretical and empirical research and establish conclusions	2025 May
Prepared Thesis	To prepare final thesis of the research model for the defence	2025 May
Defence	To defence the prepared thesis	2025 September

Enhance teaching of robotics in early secondary school

Alexandra Maximova

PhD-candidate	
Name, titles	Alexandra Maximova, MS Computer Science
University	ETH Zurich
Motivation, any relevant background (max 200 words)	
Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Dennis Komm, Prof. Dr. *
University	PH Graubünden
Role in project	Supervisor
Name, titles	Elizabeta Cavar, Dr.
University	ETH Zurich
Role in project	Supervisor
Name, titles	Juraj Hromkovič, Prof. Dr.
University	ETH Zurich
Role in project	Supervisor
Title of your research project	
Enhance teaching of robotics in early secondary school	
Description of your research project (max 2000 words total)	
Problem statement: *Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?*	
Presently, there are a lot of efforts in Switzerland and worldwide to introduce robotics into classrooms, for example, the First Lego League, the World Robot Olympiad, or the Roberta, Robbo, or Robofest initiatives and platforms. The corresponding hardware varies from moving robots like Lego models, Edison, or Thymio to programmable boards such as Calliope, Microbit, or the Oxocard. Most educational IDEs use block-based programming languages, some of which are specifically designed for this purpose. We believe that students in grades 7-9 can profit from using a text-based programming language that makes programming and CS concepts very explicit, yet keeps the syntax as simple as possible. We further believe that teaching concepts is more important than teaching one concrete technology stack, which will probably become obsolete in 5-10 years. We will use Python as the programming language, because of its simple syntax and the possibility not to use or even mention advanced features (for example, object-oriented code) until the students feel confident with basic concepts. Moreover, using Python at this stage nicely integrates	

into a K-12 spiral curriculum, which has been developed in our group over the last 15 years. For the IDE, we chose to use TigerJython (https://tigerjython.ch) and WebTigerJython (https://webtigeerjython.ethz.ch), because they have a sleek design without any features that could confuse novice programmers rather than help them, because of its improved error messages compared to standard Python, and the presence of the 'repeat' loop construct. For the robot, we chose the relatively cheap yet extensible Calli:bot as a first step, which uses the Calliope as programmable brick.

We want to connect to and develop further the aforementioned spiral curriculum that starts with the Bluebot in Kindergarten and continues with Logo and Turtle Graphics at primary school. In secondary school, the students should first learn to move the robot like the turtle on the screen and then control motors, actors, and sensors in a state-based manner.

Concretely, as a first step we want to implement the possibility to control the Calli:bot from the WebTigerJython IDE. Web-based IDEs are simpler to use for the students since they do not need to install any further programs.

In the future, we may enhance the IDE with an easy-to-access documentation and example programs, and improve the grobot library, currently used in TigerJython to control robots.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e., studies) you will take to achieve this aim?

The overall research question is whether and how robotics can be used to foster computational thinking skills and competences. To this end, we will design a framework, which allows us to integrate robots in a spiral curriculum in a K-12 context. This will be realized as a specific Python module specialized to abstract away the object-oriented code needed to instantiate and control a robot. In particular, our goal is to allow for a smooth transition from turtle graphics to robot movements. Still, our approach will be powerful enough to utilize object-oriented code and other advanced concepts for more advanced tasks (for example, for additional sensors or communication between robots).

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

Most educational robotics initiatives exist in the form of extracurricular activities (for instance, the First Lego League or the World Robot Olympiad). This way, only a specific share of students can be reached, maintaining, or even worsening the gender and socioeconomical gap. We believe that every student should have the possibility to try out robotics and programming and foster computational thinking abilities, independently of their prejudices.
Educational robotics programs commonly use block-based programming languages. We believe that in our spiral curriculum, where students learn text-based turtle graphics in grades 5 and 6, it makes little sense to return to blocks in grade 8 just to use robots.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

A literature review is ongoing. From our current knowledge, it seems that there are initiatives that support robotics in schools but mostly in an extracurricular context. Moreover, our approach is unique in that we use a text-based programming language that allows to master complex concepts in small steps.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

We plan to conduct a quantitative study in the context of school projects. We will subdivide the students into experimental groups (some using our set-up with Calli:bot and WebTigerJython and tasks that require the usage of modularity, loops, and sensors; and maybe some other following another existing educational robotics initiative) and a control group (no computer science at all or only unplugged computer science). At the end, we will test all groups for computational thinking competencies, for example, using Beaver Cards or other tests, and see whether there is any difference.

It is also interesting to see whether our approach increases motivation in the students to engage in computer science.

Achieved results (so far):

We will officially start in February, so no results so far.

Anticipated project duration

Duration (years)	4
Start date:	01.02.2022
End date:	01.02.2026

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
We are too early in the process to give a detailed roadmap.		

Knowledge extraction from students' essays and their usage in student's final evaluation prediction

Kitti Nagy

PhD-candidate	
Name, titles	Ing. Kitti Nagy
University	Constantine the Philosopher University in Nitra
Institute	Department of Computer Science

Motivation, any relevant background (max 200 words)

Studying translation is a very popular field in Slovakia. Among different translation language combinations, the studying of the Slovak language – English language translation is the most popular. As part of students' studies, they have several different subjects with an output of some written work as papers, essays, articles, or another type of unstructured text. All listed types of work are manually evaluated by the teachers. Currently, there is not any tool that would automatically evaluate the translations from English to Slovak, or at least help the teacher evaluate the student's text output from the stated languages.

As part of my dissertation, I am engaged in research in the field of natural language processing, especially focusing on syntactic and morphological analysis of unstructured text and word depth in sentences, which is also referred to as dependency grammar. Natural language methods are widely used in various fields. The research challenge is to verify whether and with what accuracy can natural language techniques be used in translation teaching.

My work focuses on the automatic translations' evaluation using natural language processing techniques and machine learning methods. The output is a prediction of the student's translation evaluation.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	*doc. PaedDr. Jozef Kapusta, PhD.
University	Constantine the Philosopher University in Nitra
Institute	Department of Computer Science
Role in project	Supervisor

Title of your research project

Knowledge extraction from students' essays and their usage in student's final evaluation prediction

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Human correction of machine translation is currently a used technique that leads to an increase in machine translation accuracy. However, the constant improvement of natural language processing leads also to the possibility of the opposite – to automatically evaluate or correct the human translation. Nowadays, few research works are dealing with the automatic evaluation of translation from the English language to the Slovak language. Students who study translation have several tasks of translating different texts during their studies. Those with the feedback from teachers are stored in electronic format, so they can be very easily used for further analysis. An existing limiting factor of the analysis is the amount of the same text. Every year students translate various texts with current topics of the period and therefore the amount of the available dataset is limited to the number of students each year.

According to current research work, we know that we can applicably analyse text, create vectors from texts and use them in classification tasks that can classify with high accuracy. Syntactic and morphological analysis can be widely used in different unstructured texts for knowledge extraction. Text's syntactic analysis is defined as analysis that tells us the logical meaning of certainly given sentences or parts of those sentences. The morphological analysis is a process of classifying the words into grammatical-semantic classes and assigning grammatical categories to these words. Research in the education area is aimed to verify students' translation and their evaluation using natural language processing methods, thus helping teachers to consequentially evaluate their students' translation.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The contribution of the research is in the field of translation studies, either in the evaluation of students or as a basis for new teaching methods.

The main question of this research is to verify whether it is possible to improve the classification for predicting the evaluation of students' essays using syntactic and morphological analysis.

The research aims to find out with which accuracy we can automatically classify translations from students using machine learning methods and natural language processing techniques. Research can also be beneficial in the field of machine translation evaluation.

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

There is a lot of research on improving machine translation using human translation, but there is

little research on Slavic types of languages that automatically evaluate a human translation. Therefore, we see a high potential in this area. If this problem is solved, we will be able to evaluate student's translation work faster and this will reduce the burden on teachers. A successful solution of the problem can lead to benefits in other areas, whether in teaching other than English-Slovak translation or through further research in the evaluation of students in other areas where the study includes outputs in the form of unstructured text.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

As we have mentioned above, few research works are dealing with translation evaluation, especially from the English language to the Slovak language. In our approach, we were using natural language processing techniques for creating input vectors suitable for classifiers. Using machine learning we are classifying translation texts and trying to evaluate them.

For the knowledge extraction from texts, we are using two techniques and then combining them. The first method is TfIdf (Term frequency – inverse document frequency) which is a traditional technique that is leveraged to assess the importance of tokens to one of the documents in a corpus. The TfIdf weight is composed of two terms: the first computes the normalized Term Frequency (Tf), the second term is the Inverse Document Frequency (Idf). We combine TfIdf weights with dependency grammar which assigns weights to each word based on the depth of the word in the sentence. This combined weight we call MultipleDgw. As results of the knowledge extraction are weights for each word in the corpus and they are represented by vectors. These can be easily used in classifiers. Based on recent research and the high accuracy of machine learning classifications we are modelling several machine learning classifiers for our work.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The research data is collected by the Department of Translation Studies which prepares future English-Slovak translators for their professional lives. As part of the course, students translate various current topics into a second language and their translations are electronically recorded for example in learning management systems. There are currently available 4 different originally English texts, which 32 students have translated into the Slovak language and more datasets are expected in the future. In the system is recorded also the translation rating on a scale of 0 to 5. My work is focused on the analysis of received data, modelling of classifications, implementation of classifications and evaluation. The implementation is in python scripting language and we are using various libraries, whether for analytical work or machine learning, such as scikit-learn, keras, tensorflow, pandas and numpy. The aim of the research is to find out whether and with which accuracy we can automatically classify translations using machine learning methods. We are

planning to verify also other approaches in the future.

The current workflow is as follows:

1. Identification of word dependencies in the sentences of the analysed dataset.
2. Determination of the importance of the words based on word dependencies.
3. Calculation of the TfIdf weights of words.
4. Combination of TfIdf weights and depths from dependency grammar.
5. Creation of input vectors for the classifiers.
6. Design and creation of classification models.
7. Identification of the results and their analysis and evaluation.

Achieved results (so far):

The translation text analysis and proposed methods were implemented. Currently, we are modelling the classifiers. On a similar approach (*Improving fake news classification using dependency grammar*) where the knowledge was extracted from fake news data using TfIdf and dependency grammar and then classifications were performed showed accuracy between 78 % - 93 % depending on the data used. We are expecting similar accuracy from automatic translation text evaluation.

Anticipated project duration

Duration (years)	3
Start date:	September 2020
End date:	June 2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Completion of the classification and evaluation of the translation texts	Automatic translation text evaluation with acceptable accuracy	End of the year 2021
Improvement the accuracy of the text classifications using TfIdf, dependency grammar and POS tags	Improving the classification accuracy	February 2022
Different knowledge extractions based on dependency grammar and their usage in classification tasks	New knowledge extraction methods ready for use in unstructured text classification	End of May 2023
Finalization of the dissertation thesis	Thesis defence	June 2023

Tangible AI Introducing AI Literacy in Schools and Teacher Trainingt

Viktoriya Olari

PhD-candidate	
Name, titles	Viktoriya Olari
University	Free University of Berlin
Institute	Department of Mathematics and Computer Science Computing Education Research Group

Motivation, any relevant background (max 200 words)

Nowadays, we encounter phenomena that cannot be easily explained in computer science classes by means of rule-driven computing (Tedre et al. 2021): search engines that return results relevant to the question posed in milliseconds, machine translations that perform better than human ones, or apps that recognize places and people on pictures or in videos. The approaches underlying these phenomena are based on a wide range of data-driven AI technologies that work differently than what has been taught in computer science classes to date. This raises several questions: Do we need to integrate AI and data literacy into schools, and consequently into teacher education, to equip students with the necessary skills and expertise required to thrive in the digital world? If so, what are the concepts that everyone needs to know about AI and data science, and how can a novice, such as a child with no prior knowledge of linear algebra and statistics, be introduced to them?

In my dissertation, I aim to explore the fundamental concepts that every student and teacher should know about AI and to identify pathways to teach them to students of different ages and backgrounds. My motivation in doing so stems from my extensive work educating young people in computer science and exploring how to make technology tangible to everyone from university students to primary school children.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Prof. Dr. Ralf Romeike *
University	Free University of Berlin
Institute	Department of Mathematics and Computer Science; Computing Education Research Group
Role in project	Daily supervisor

Title of your research project

Tangible AI

Introducing AI Literacy in Schools and Teacher Training

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

More and more researchers around the globe are devoting their attention to AI and data literacy as topics for school education. Touretzky et al. (2019); Long and Magerko (2020); Blakeley and Breazeal (2019); Farrell and Watts (2020); Clarke (2019) to name a few have made attempts to define school curricula and competence models for AI and data literacy. Several primary studies have been published that provide practical accounts of incorporating selected AI topics into school education (Wong et al. 2020; Michaeli, Seegerer, and Romeike 2020; Williams et al. 2019) and there is variety of research-oriented initiatives such as TrainDL (German Informatics Society 2021), Data Education in Schools (University of Edingburgh 2021), MIT Raise (MIT raise 2021) and others, that produce hands-on teaching materials to be used by teachers directly in schools to introduce AI and data science.

Despite this extensive research activity, there are several gaps in knowledge about AI education.

G1. First, attempts to define a competence framework for AI literacy are not systematic and there is still a lack of a comprehensive and holistic AI model that reflects both the approaches of classical AI and the topics such as data-driven systems that are shaping the field of AI (Tedre et al. 2021). Differentiation of competences by age group or school type is largely absent. None of the frameworks provide information on how to measure students' learning progress in AI. There is also no systematic analysis of the fundamental concepts relevant to teaching AI to school students.

G2. Second, despite the increasing availability of materials and approaches for AI education in schools, it is unclear where exactly AI can be anchored in schools. Nor it is evident how can AI be best taught. Many existing approaches for teaching AI to students resemble restrictive playpen environments rather than playgrounds[1] and mostly address artificially created problems (Olari, Cvejoski, and Eide 2021; Opel et al. 2019).

G3. Third, few research-based educational programs on AI have been piloted with K-12 teachers (Williams, Kaputsos, and Breazeal 2021; Vazhayil et al. 2019) and there are no studies that assess the integration of AI into teacher education. There is also no evidence on which factors related to teaching and teacher personality are relevant for AI and data literacy to reach school students.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The overall aim of the research is to provide a comprehensive study of AI education, focusing

[1] Resnick and Robinson (2017) made a crucial distinction between two types of playful environment: playpen and playground. The first is a restrictive environment in which the children have limited space to experiment, whereas the second is designed to allow them to move, explore, and collaborate. If the aim of play is to educate creative thinkers, the instructional playpen environments should remain a steppingstone, not a final destination. Instead, the learning environment should be more oriented towards a playground style, with metaphorically low floors and wide walls, so that the children can make decisions about what to make and how to make it (Resnick et al. 1996; Resnick and Silverman 2005).

mainly on G2 but also touching on G1 and G3, in order to provide a holistic and more systematic approach to the field of AI education that can guide the integration of AI in schools and international teacher education.

Specifically, following questions should be addressed at two levels:

Conceptual level

Q1. What are the fundamental concepts relevant to teaching AI to learners with and without a computer science background? What should computer science and non-computer science teachers know about AI?
Q2. What is the relationship between AI and data literacy? Can data literacy be a stepping stone to AI literacy when educating students about AI? Can data literacy facilitate entry into AI literacy?
Q3. How can we measure and assess progress in learning AI and data literacy? What are the skill progression schemes (e.g. focusing on age group and subject)?

Teaching approaches

Q4. How do existing research-based interventions, materials, tools and approaches introduce AI literacy? What are the weaknesses of existing approaches?
Q5. How can AI be made tangible for novices (e.g., using tangible user interfaces, educational robotic, physical computing, unplugged activities, block-based-programming languages)? How can young people get creative with AI and use it to solve problems they care about? How should teaching materials be designed to support AI education?
Q6. Can the subjectively perceived relevance of an AI project and thus the motivation to learn about AI be increased by using subjectively meaningful data in comparison to less meaningful data? / How can working with subjectively meaningful data increase motivation to learn about AI? What kind of data are educators and students interested in? What data is relevant for both teachers and students? What kind of data is relevant for educators / students from different domains? Can subject-related data build a bridge to the interdisciplinary AI education?
Q7. How does hands-on exposure to AI concepts impact learners' knowledge on AI, their study skills and motivation to engage with AI?
Q8. What is the difference between using plugged and unplugged approaches in teaching AI in terms of the quality of the knowledge transfer?
Q9. How deep should the student delve into AI to create a proper mental model? How can data literacy support the building of proper mental models of AI?
Q10. What factors related to teaching and teacher personality are relevant for AI and data literacy to reach school students through teacher education? Can data literacy be a stepping stone for the integration of AI literacy in teacher and school education in different domains?

Concrete steps at the conceptual level:

S1. Systematic literature review for papers on AI literacy (Q1). Investigation of the relation between AI and data literacy (Q2)

S2. Development and validation of an AI and data literacy competence model and a progress test for teachers and school students as a potential skill progression schema (Q3)
S3. Expert interviews for the validation of AI and data literacy competence model and progress test (Q1, Q2)

Concrete steps at the level of teaching approaches:

S4. Review of exiting materials and approaches for teaching AI (Q4)
S5. Investigation and development of approaches to make AI tangible (Q5)
S6. User studies (interventions) with students of different age groups and backgrounds to answer questions Q5 – Q9.
S7. User studies (interventions) with teachers of different backgrounds to answer questions Q5 – Q10.
S8. Interviews with pedagogical experts from STEAM subjects on integration of AI literacy in different domains through data literacy (Q2, Q10)
S9. Qualitative analysis of user studies and expert interviews on integration of AI literacy in different domains through data literacy (Q2, Q10)

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

Overall, the insights from S1–S3 will contribute to a systematic, and comprehensive overview of AI education. S2 will provide a first international framework for measuring AI and data literacy competences. S5, S5, and S7 will contribute to in-depth guidance of how AI literacy can be promoted through constructivist and constructionistic approaches. S7 and S7 will provide insights into whether it is beneficial to use concrete data when teaching abstract AI concepts and how best to do it. S8 and S9 will contribute a deeper insight into the structures available for integrating AI and data literacy in school and teacher education, and the factors relevant to AI and data literacy reaching students through teacher education.

The insights from S1, S2, S3, S4, S8, and S9 are particularly relevant for academics working on AI and data literacy in education. The findings from S5, S7, and S7 will be relevant for academics, school students and teachers as they will directly involve students and teachers from different levels and subjects.

The research is worth doing and has wide relevance as it will provide a comprehensive and holistic approach to introducing AI literacy in education. The results can be used to form a basis for introducing AI literacy into computer science and other subjects. Without such research, there is a risk that the integration of AI literacy into the education will be undertaken by non-experts, resulting in the inclusion of cursory and irrelevant topics being included in the curricula and the long-term formation of misconceptions about AI among the younger generation of students.

Furthermore, the research will contribute to identifying approaches that enable students to become AI and data literate while developing AI systems that are meaningful to them. Otherwise, there is a hazard that students will encounter AI in restrictive environments or through artificially

created problems and will not be able to transfer the knowledge to other kinds of issues and thus actively shape the direction of AI in the future.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in

Several theoretical frameworks are considered to frame the project.

For answering Q1 and Q2, the possible approach that can be used is a model of didactic reconstruction utilized by computer science education researches when preparing new topics for teaching (e.g. Grillenberger 2019). For Q3, the author aims to invoke constructive alignment framework developed by Biggs (2003); Biggs and Tang (2011) which helps to orient teaching decisions towards helping students achieve the intended learning outcomes and to assess how well they do so.

Although there is not much research on how to design activities and environments that enable students to acquire AI literacy, the author will draw on the learning theories of constructivism and constructionism to address Q5–Q9, as these theories are widely used to frame learning activities in computer science education. Constructivism sees children as active builders of their knowledge (Piaget, Fatke, and Kober 2016; Margulieux, Dorn, and Searle 2019): Instead of receiving information passively, children learn about the world by actively interacting with it. Papert (1993a, 1993b) expanded Piaget's cognitive theory and developed a constructionist approach based on the theory of constructivism. The main idea of constructionism is that children construct their knowledge most effectively when they are actively involved constructing things in the world (Papert and Harel 1991). Specifically, the author will build on the framework of Four P's of Creative Learning, which is based on constructivist ideas and focuses on the intersection of emerging technologies, activities and strategies (Sakulkueakulsuk et al. 2018). The core values of the framework and its guiding principles are the four P's: projects, passion, peers, and play (Resnick and Robinson 2017).

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

This PhD project is an experimental research project combining qualitative and quantitative methods.

For S1 and S4, the author will utilize statistical topic modelling and thematic analysis combined with the qualitative content analysis of selected literature and teaching approaches. In-depth interviews with experts in the field of AI and data literacy (S3, S8) will help to ensure the relevance of the identified topics.

For S2, S5, S7, and S7 the author draws on the experimental methods of design-based research that is well suited for computing education research (Margulieux, Dorn, and Searle 2019). Specifically, the author will design teaching approaches and activities to make AI tangible, test them in interventions with students of different ages and teachers from different backgrounds, collect data on the effectiveness of the interventions through questionaries and participatory observations, and evaluate them. After the evaluation, the procedure and activities will be adjusted, and iterated as needed. The author is aware that ethical issues may arise due to the collection of participant data and will address these issues in accordance with the ACM guidelines on Ethics and Professional Conduct (Association for Computing Machinery 2021). It is not yet determined which instrument the author will use to measure the effectiveness of the interventions.

A potential obstacle lies in the multi-level nature of the PhD project. For example, the inclusion of students from different age groups and teachers from different backgrounds may exceed the time frame of the project. To manage this, the author will prioritise which research questions need to be addressed first and plan possible cut-offs.

Achieved results (so far):

So far, the author has worked on S1 and S4. First findings related to S1 were published at the WiPSCE 2021 conference (Olari and Romeike 2021).

The author also conducted the first test intervention related to S5 and S7. A total of 14 computer science teachers participated. Thematically, the intervention included topics on classical AI, supervised, unsupervised and reinforced learning. Participants engaged with the topics through unplugged approaches and activities using computer applications such as the data mining tool Orange3. Although the test intervention was not evaluated, the author noted that the focus was heavily on AI and the role of data was underrepresented. This will be improved at the next event in February 2022.

Anticipated project duration

Duration (years)	4
Start date:	August 2021
End date:	August 2025

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline

Literature Review and research summary (S1, S2, S4)	Provide a state of the art related to studies that address AI and data literacy in order to understand how these researches are being conducted, what results are being obtained and provide some insights that can be used for future research in this field (related to Q1, Q2, Q4)	March 2022
Summarize research summary results	Report findings	March 2022
Develop activities and investigate datasets that can be used while introducing novices to AI	Design first drafts of activities (related to Q5, Q6)	January – March 2022
First round of interventions with CS teachers (weekend workshop, Part 1)	Conduct the intervention; evaluate intervention (related to Q5, Q6)	March 2022
Development of the AI competence model with the focus on DL and the progress test	Develop first drafts, investigate the relation between AI and data literacy (Q1–Q3)	March – June/July 2022
First round of interventions with CS pre-service teaches	Prepare, conduct, and evaluate the intervention (related to Q5, Q6)	April/May 2022
First round of interventions with school students of CS	Prepare and conduct the intervention; evaluate intervention (related to Q5, Q6)	May 2022
First round of interventions with CS teachers (weekend workshop, Part 2)	Evaluate whether computer science teachers have succeeded in integrating AI&DL in schools (Q10)	June/July 2022
First round of expert interviews related to S2 and the AI competence model	Improve the quality of the assessment test and AI and data literacy competence model (Q1–Q3)	June/July 2022

Evaluation of the first round of interventions with CS pre- and in-service teachers and school students	Report findings	July/August 2022
Second round of interventions with pre- and in-service teachers and students from different subjects teachers	Evaluate to what extent the approaches used meet the criteria for constructivist acquisition of AI and data literacy.	August / September 2022 – August / September 2023
Third round of interventions with pre- and in-service primary school teachers and students	Evaluate to what extent the approaches used meet the criteria for constructivist acquisition of AI and data literacy.	August / September 2023 – August / September 2024
Finalizing the thesis	Overall reflection on all research questions	October 2024 – March 2025
Buffer Time		March – August 2025

Computational Thinking in Mathematics Education

Kristin Parve

PhD-candidate

Kristin Parve, MA
Tallinn University
School of Digital Technologies

Motivation, any relevant background (max 200 words)

I got my masters degree on the field of mathematics and informatics teacher. Integrating computational ideas, computational thinking (CT) ideas to be precise, into mathematics curriculum, gives me an opportunity to bring those two fields of interest together.

Supervisors (indicate your 'daily supervisor' with an *)

Name, titles: Mart Laanpere, PhD*
Tallinn University
School of Digital Technologies
Supervisor

Title of your research project

Computational Thinking in Mathematics Education

Description of your research project (max 2000 words total)

Problem statement:
Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Computational thinking (CT) is a fast-expanding area of educational research since 2006. Although it is described as a mandatory part of future school curriculum, there is a list of challenges to overcome when implementing CT in schools. Presently more than 20 countries in Europe integrate programming or computational thinking in their curricula (Balanskat, Engelhardt & Ferrari, 2017). The Open Book of Educational Innovations (Licht, Tasiopoulou & Wastiau, 2017) has a list of several examples describing computational thinking initiatives in schools, like Scratch in France, primary school coding in Portugal, Italy and Belgium, and coding and creativity in Spain. It has been stated that the introduction of computational thinking and programming is a key priority for compulsory education in several countries, including England, France, Finland, Ireland, Malta and Poland (Bocconi et al., 2016).

The main motive to include CT into mathematics and other science classrooms is the growth of computational counterparts in those disciplines over the last years. Including CT ideas to those subjects in schools brings education more in line with current professional practices in those fields. (Weintrop et al., 2016) CT and mathematical thinking are closely related, sharing similar traits like problem solving, modeling, analysing and interpreting data (Sneider et al., 2014). On the other hand, linking CT and mathematics could also have a more practical reason. Praxis study concentrating on ICT education in Estonia (Leppik et al., 2017) asserted that teaching digital skills is inconsistent all over the country depending too much on the will of teachers. It is alarming that only about half of the schools have informatics or other similar courses held as a separate course to teach digital skills. For example, Bocconi, Chioccariello and Earp (2018) stated that CT and programming have to be a compulsory part of the curriculum because teaching them as elective courses can result in limited local uptake and actual student participation. Finland and Sweden

have already implemented teaching and learning programming and other CT related skills in their school curricula, mostly integrating it into mathematics courses, but also have integrated it in crafts, technology, science and other subjects. Therefore, implementing teaching CT skills in mathematics is on the one hand a logical solution based on the similarities of these two fields, on the other hand, it is driven by practical causes.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The goal of this research is to understand better the possibilities of integrating CT ideas into mathematics education, then design and validate a prototype of a pedagogical design model that can be used to integrate teaching and learning of CT in mathematics curricula and lessons in lower and upper secondary education. To achieve this goal, the following research questions were formulated:

- What are the main barriers for integrating computational thinking into mathematics education and how to reduce them?
- What are the effective pedagogical design principles and techniques for integrating computational thinking with mathematics education and how to prove the effectiveness of such intervention?
- How to model the pedagogical design and implementation of embedded and evidence-centered assessment of CT in integrated STEAM learning projects?

The whole study will be divided into three consecutive cycles:

First cycle (2021-2022) of the study is set up to understand the environment and context of the study. Thorough theoretical research will be conducted to map the present practices in the field of implementing CT into mathematics teaching, gather together the ideas for the best practices and note the main challenges that have appeared during similar projects.

Second cycle (2022-2023) of the study will focus on the initial research-based design of the pedagogical design model and accompanying teaching and learning resources, as well as an Computer-Supported Collaborative Learning platform (potentially consisting of integration of Wekan, NetLogo and CODAP). In that part of the study the first solution for integrating CT ideas into mathematics teaching will be introduced and used for planning an educational intervention (pilot).

Third cycle (2023-2024) of the study will focus on improvement and validation of the pedagogical design model and accompanying CSCL platform so that it is supported by a didactical approach, assessment framework and needs of the target groups while addressing the key challenges in the classroom level. Large-scale pilot of the pedagogical design model (along with accompanying resources and online CSCL platform) involving 80 schools will be conducted in this cycle of the study that is followed by the assessment of CT skills.

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

As it was clarified before, CT will play an important role in K-12 education in the following years, bringing closer together the school curriculums and current professional practices in different

fields. CT is seen as an essential skill like writing and reading, therefore it deserves a worthy place in the K-12 education, preferredly in the context of subjects' students are already familiar with. This thesis will propose a pedagogical design model that can be used to integrate teaching and learning of CT in mathematics curricula and lessons in lower and upper secondary education.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

CT is seen as a fundamental skill that should be added to everyone's analytical ability in addition to reading, writing and arithmetic (Wing, 2006). It helps to understand the fast-developing world around us and increase awareness of how the everyday digital tools work (Denning & Tedre, 2019). As students learn more about what computers can do and get to know their limitations, they will have an increased understanding of scientific issues and engineering projects (Sneider et al., 2014). CT can also be a way to foster students' creativity by guiding them from being merely consumers of technology to citizens with ability to build tools that can have a larger impact on society (Mishra, Yadav & Deep-Play Research Group, 2013). Also, deeper CT skills will help us not only to model more and more complex systems, but also to analyse the massive amounts of data we can collect and generate in this process (Wing, 2008).

On the other hand, CT is still a blurry construct with no clear definition. Starting from 2006 when Wing wrote her game-changing article (Wing, 2006), several authors have proposed different angles to decompose CT. Selby and Woollard (2013) proposed that CT is a thought process that reflects the ability to think in abstractions, in terms of decomposition, algorithmically, in terms of evaluations and in generalizations. Angeli et al. (2016) proposed their own set of elements of CT that is based mostly on the frame Selby and Woollard (2013) proposed some years earlier and Selby (2014) explained in detail. It consists of five elements, every one of them defined separately: abstraction; generalization; decomposition; algorithms (sequencing and flow of control); debugging. Some examples of authors who have proposed their own definition of CT are Barr and Stephenson (2011), Lee et al. (2011) and Wing (2006, 2008, 2011). This diversity in definitions not only raises a problem of clear understanding of the concepts of CT, but the assessment of CT remains an unresolved issue as well (Román-González, Moreno-León & Robles, 2019). The lack of assessments is also a main factor that limits the uptake of CT into K-12 classrooms (Werner et al., 2012).

Research design and methods (planned or used):
Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The study will follow the generative research approach as a new model has to be designed in the upcoming process. In detail, design-based research that is mostly being used in educational purposes and design science research methods that are more in use in the field of information technology will be used.

Design-based research was introduced as a way of extending existing methods and linking theory and practice in educational research (Reimann, 2011). Design-based research "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in

real-world settings, and leading to contextually-sensitive design principles and theories." (Wang & Hannafin, 2005) The aim of use of design-based research methods is to make learning research more relevant for classroom practices (Reimann, 2011).

Design science is aimed to understand, explain and improve information systems (Hevner & Chatterjee, 2010). It can be defined that design-science research "is a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing new knowledge to the body of scientific evidence. The designed artifacts are both useful and fundamental in understanding that problem." (Hevner & Chatterjee, 2010)

As stated before, the whole study will be divided into three consecutive cycles. The first cycle will concentrate on building up a thorough knowledge-base of the field. In addition to that, the main data will be collected through the process of expert group interview to evaluate the concept of the pedagogical design model. In the second cycle the design requirements have to be defined and implemented to create the first example of the pedagogical design model. In this cycle, the main data is collected through the process of piloting the pedagogical design model, resources and platform in at least 10 schools. The third cycle will include a large-scale pilot of the pedagogical design model involving 80 schools.

Achieved results (so far):

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Anticipated project duration

Duration: 4 years
Start date: Autumn 2021
End date: Summer 2024

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Literature review	Building up knowledge-base	Spring 2022
Conceptual model	Designing the conceptual model, validating it with experts	Spring 2022
Conference paper	Conference paper for ITICSE 2022	Spring 2022

*since I am on my first year of studies, the research plan is not too detailed yet

Application of Selected Knowledge Discovery Methods in Learning Analytics

Janka Pecuchová

PhD-candidate	
Name, titles	Mgr. Janka Pecuchová
University	Constantine the Philosopher University in Nitra
Institute	Faculty of Natural Sciences, Department of Informatics

Motivation, any relevant background (max 200 words)

Student success predictions are useful for a wide variety of tasks. Despite the fact that the learning process is closely linked and supported by different technologies, there are still many students who have a learning problem and who fail to successfully complete the subject or study program for which they have applied. As each such technology is able to keep records of student interaction, the natural question arises as to what extent this data can be used effectively to improve the learning process and at least partially reduce the number of students who fail to complete the course. If we want to predict the student's outcome in time, there are still numerous open-ended questions at the level of understanding, data processing, as well as the appropriate form of intervention.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	*doc. Mgr. Martin Drlík, PhD.
University	Constantine the Philosopher University in Nitra
Institute	Faculty of Natural Sciences, Department of Informatics
Role in project	

Title of your research project

Application of Selected Knowledge Discovery Methods in Learning Analytics

Description of your research project (max 2000 words total)

Problem statement:
Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The development of diverse learning environments, such as learning management systems (LMSs), personal learning environments (PLEs), online learning communities, and adaptive learning systems, produces a massive amount of data. Numerous types of data about learners' learning processes can be tracked and stored, allowing for identifying students' preferences, the refinement of teaching methods to meet students' needs better, and the provision of empirical evidence for educational decision-making. It is known that data analysis can help understand students' behaviour and predict their results. The real question is why these methods are not as successful as in other areas, such as marketing.
Nonetheless, effective utilization of such educational data remains uncommon. A critical issue to address in educational settings is effectively using massive and complex data to optimize teaching and learning. Even though various researches produced acceptable results, it is a considerable challenge to optimize the learning process based on the results obtained by predictions. This is caused by different methods presenting a large variance in performance rates that depend on the combination of many intrinsic and external factors, which influence the character of input variables, like balance among classes, amount of data, input variables, and others. There is a lot of research at the level of the course, which provides promising results. Unfortunately, there are still many unresolved problems in terms of the research at a higher level, represented by academic

year, study program, and concerning longer period, periodic cycles of the course over several years, which should be examined.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The aim of the dissertation is to design and verify the contribution of selected methods of discovering knowledge in the domain of Learning analytics for understanding and improving the learning process and the virtual learning environment in which learning takes place. One of the main objectives of the dissertation is to verify the possibilities of deploying the developed methodology for predicting the behaviour of students of VLEs, with an emphasis on a longer period of time. Consequently, the results will be applied to identify and verify appropriate forms of intervention in the selected virtual environment.

The research design will take into account the individual phases of the CRISP-DM methodology, which consists of obtaining a course logfile from LMS Moodle and its subsequent pre-processing through data pre-processing techniques. The pre-processed data will represent a suitable input for further analysis by selected machine learning models. The outputs and performance metrics of these models will be compared with the results obtained from the LA module integrated within the LMS, which will be launched simultaneously from the beginning of the course in the researched period.
The findings will serve to design a suitable way to predict the unsuccessful completion of the course/student's final assessment, along with the proposal of the beneficial intervention mechanisms. Their overall contribution will be evaluated using selected statistical methods.

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

The early dropout rate is one of the key indicators of study performance. It is also key to the effective management of the virtual learning environment at the university. It represents one of the most frequent research issues in the field of learning analytics.
Reliable prediction of possible dropout can encourage students to study more when they know they are at risk of early dropout and plan their semester work more carefully. Predicting students at risk also sends teachers a signal to intervene in a timely manner to improve student engagement in interactive activities. University management may take this information into account when deciding whether to confirm or reject requests from students who request repeating a failed course.
We will explore a longer period of time, data from periodically opened courses, to achieve prediction not only at the level of a specific course. It is important to reveal what the courses have in common and how this set of characteristics can affect students' behaviour and performance.
Moreover, we will evaluate the model performance compared to the model already implemented in LMS Moodle, which is not still widely used. Simultaneously, we will try to answer what can be the reasons for its limited deployment worldwide.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

Our research identifies a research gap that represents the adoption of temporal modelling techniques.

Prediction in VLE's is clearly temporal: many courses are offered using a cohort-based model. Course activity and learning occur over time, with the majority of courses lasting several weeks; data is collected incrementally, with little usage data available during the early phases of a course and increasing data as the course progresses; and learner behaviour evolves over the course's duration. This shows that models that explicitly account for and model the complex, time-dependent patterns found in VLE's learner data are more likely to provide a full picture of this behaviour than models that ignore time. However, research on temporal modelling tools has been restricted to date.

The majority of prior research that takes temporality into account falls into two basic categories. One group uses "weekly" feature sets to capture distinct collections of features across time periods, generally one for each week of a course. While this sort of modelling captures distinct aspects throughout time, it does not explicitly represent them as sequential. It treats predictors as otherwise independent when they are, in fact, coupled over time. A second large kind of work is that which makes use of survival models. Many of the methods used for survival analysis are forced to make the statistical assumption that student dropout probability at different time steps is independent. Further research within a dissertation that delves deeper into these approaches, for example, by examining other survival modelling approaches or that applies other time series approaches, would be beneficial and is likely to uncover both informative patterns in data and improvements in predictive modelling performance, thereby improving both the accuracy and theory-building components of future models. We will investigate a longer time period, using data from periodically recurring courses, to achieve prediction beyond a single course level and validate the model deployed in the LMS Moodle.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The research is organised into several steps described below:
During the teaching process, teachers collect both qualitatively and quantitatively variables about their students to keep track of their progress using advanced selected metrics. Before data analysis, it is important to distinguish between them.
At first, the goal is to extract and transform the data into an understandable structure for further use. Data mining is a part of this process, which involves integrating statistics, machine learning, pattern recognition, data visualization, or data analysis techniques. The process is often iterative and focused on discovering valuable relationships and information by analysing many variables. Extracting and transforming data is the purpose of the knowledge discovery process, which has been continually improved and transformed into several practical variations. One of the most widely used is the Cross-Industry Standard Process for Data Mining, known as CRISP-DM. The creation of predictive models in this research is a typical task of a knowledge discovery problem. Therefore, the CRISP-DM methodology will also drive it.
Secondly, the modelling phase will consist of applying different machine learning techniques to the dataset. The goal of the prediction is to create a model based on the students' current activities and accomplishments that attempts to predict learner failure and future performance. It is a typical classification problem that a binary classification model or a binary classifier can solve. Classifiers as Logistic regression, Decision tree, Naïve Bayes classifier, Support Vector Machine, Random Forest and a Neural network will be applied to find the most suitable prediction model.

Hyperparameters will be tuned using the grid search technique. Python programming language will be used.
Finally, models produced in the previous phase should be evaluated. The evaluation used in this case study will be numerical, based on model performance metrics, in contrast to empirical evaluation, in which the creator of the model and the domain knowledge expert assess if the model fits the purpose. Moreover, the performance of the machine learning classifiers will be compared using McNemar's test.
One constraint to consider is that access to some user/student information may be prohibited owing to privacy concerns, necessitating the adoption of special procedures and permits. Additionally, it is necessary to maintain the anonymity/privacy of student data while allowing for the linking of disparate pieces of information about the same person without explicitly identifying him or her or to ensure that users can be disconnected from their sessions as required by local, state, or federal laws.
It is important to note that recognizing students at risk of dropping out is only the first step in addressing school dropouts. The next step is to recognize each student's unique needs and problems dropping out and then introduce adjustments to include effective dropout prevention strategies, which could point to real reasons for students' dropout and develop strategies that may encourage students to complete their courses on time successfully. Therefore, the research should focus on applying proposed models to predict students at risk of dropping out based on similar students' previous achievements. The knowledge obtained from this research may serve as the basis for designing a course recommendation.

Achieved results (so far):
The partial results of this research published in the article Towards Predicting Student's Dropout in University Courses Using Different Machine Learning Techniques showed that the classification models could be considered trustworthy enough to properly predict completing or early dropout the course before the end of a semester. In fact, good results of prediction were obtained, regardless of the employed model. The features selected in this study proved to be influential in the prediction of completer and non-completers. The prediction accuracy varied between 77 and 93%.
Similarly, in line with the published article, it was shown that suitably selected indicators, which do not require access to the system logs, may be beneficial despite a small dataset if different performance metrics are evaluated. Simultaneously, a proposed methodology has been shown to be reliable for predicting course completion when there is enough time to encourage educators to make timely interventions.

Anticipated project duration

Duration (years)	3
Start date:	01.09.2020
End date:	30.06.2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
1st year	Data preprocessing	31.01.2022
2nd year	Classification	30.06.2022
3rd year	Segmentation	31.12.2022

The development of teachers' professional identity through the reflection of early experiences

Lina Pečiulienė

PhD-candidate	
Name, titles	Lina Pečiulienė
University	Vilnius University Šiauliai Academy
Institute	

Motivation, any relevant background (max 200 words)

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Remigijus Bubnys, Professor
University	Vilnius University Šiauliai Academy
Institute	
Role in project	*PhD thesis supervisor

Title of your research project
The development of teachers' professional identity through the reflection of early experiences

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

The quality of education and with it the quality of teacher education are high on the policy agenda in many countries. As the teaching profession, at its essence, is a lifelong learning, it is important to give a lot of attention to teacher education and the professional development of teachers. In other words – it is an urgent need to articulate a clear understanding who is a teacher, whom we need, and to support such identity formation in teachers, because the identity of a teacher has been recognized as crucial to the practice and development of teachers as well as their retention. It is a challenge because of constant changes in the field, qualification requirements and even expectations towards the role of the teacher.

Aims and objectives (research questions):

Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The definition of the teachers' professional identity and content isn't clear and varies, there are questions still lacking the answers:

- What are the factors affecting beginning teachers' identity development? How are they related to their experience?
- How the reflection is related to identity and how it enhances the development of professional identity?
- What is the direction of the development of the story/narrative about me as a teacher?

The aim of the project is to explore the process of professional teacher identity development.

Objectives:

Theoretical:

1. To define the relation of professional identity and personal identity.
2. To substantiate the assumptions and factors of teacher professional identity formation.
3. To describe the role of reflection in teacher identity formation.
4. To describe the relations between early experiences and professional identity.

Empirical:

1. To identify the factors/critical events what lead to the profession choice.
2. To reveal the possibilities of reflection as empowering identity factor application in teacher training
3. To unfold the latent shift of professional identity during different stages of professional development (profession choice, studies, and the beginning of career).

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

Although the identity itself is one of the most extensively studied constructs in the social sciences, especially psychology (e.g., narrative, social identity theory), there are still many questions to be answered by research. Particularly teacher identity research can be considered as relatively new, as it began in the eighth decade of the last century. Quite often the identity is seen not as a fixed attribute of a person, but a relational phenomenon which develops as a continuum, what makes it more difficult to investigate, but it is important to better understand the process for the reasons mentioned in the problem statement.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

The theoretical framework is planned to develop after empirical research, as the knowledge of researcher might affect the interpretations (following IPA methodology).

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The research will be qualitative, employ epistemological attitude. It is planned to apply content analysis and interpretative phenomenology (IPA) for analysis of experiences expressed in reflective diaries, tasks (including drawings), and interviews of teacher education students at the very beginning of their studies, during studies and at the end of the studies. Students won't necessarily will be interested to participate, but just other (in-service) teachers might be willing to share their memories about profession choice etc. The knowledge of researcher is an obstacle in IPA, it is planned to use researcher diary before and after interviews in order to evaluate how researcher could have influenced the participant.

Achieved results (so far):

Analysis of literature, experimental IPA research in order to understand the methodology.

Anticipated project duration

Duration (years)4
Start date: 2019
End date: 2023

Research Schedule		
Outline Research Plan for the Remaining Years of the Project		
Research phase	Objectives	Deadline
Methodology	justification and corrections	2022
Empirical research, finalizing the theory	Interviews, reflective diaries and their analysis, finalization of the theory part	2022
Finalizing thesis	Defence of the thesis and participation in conferences	2023

Teachers contextualisation of computational thinking in teaching and learning practice

Helena Isaksson Persson

PhD-candidate	
Name, titles	Helena Isaksson Persson
University	KTH Royal Institute of Technology, Stockholm, Sweden
Institute	Learning
Motivation, any relevant background (max 200 words)	
The graduate school is a chance to get feedback and input from fellow students and researchers on my research design, which is still in the development stage.	
Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Arnold Pears, professor
University	KTH Royal Institute of Technology, Stockholm, Sweden
Institute	Learning
Role in project	Supervisor
Title of your research project	
Teachers contextualisation of computational thinking in teaching and learning practice	
Description of your research project (max 2000 words total)	

Problem statement:
Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

Computational thinking in terms of controlling and instruct digital artefacts are new in education for children and youngster (K-9). There are several frameworks defining Computational thinking and I will not report on these in this text. Instead, I will argue for computational thinking content as a phenomenon emerging within a school subject, linked to the subject's regulations as curriculum and syllabus.

In the early eighties, Seymour Papert saw opportunities to use computers as a tool for children's learning. Papert's programming language LOGO gave children a tool to instruct and control computers. Based on Papert's arguments, the term computational thinking defines approaches and concepts needed when interacting with computers and other digital artefacts. Based on Papert's ideas, Jeannette Wing claim that computational thinking need to be taught as a fundamental skill comparable to the ability to read and write.

Sweden, one of many countries, have implemented programming in the curriculum. Besides programming, new emphasizes is on digital skills and awareness of how the digitalized society affects us. The curriculum does not mention computational thinking at all. Is computational thinking not relevant in a Swedish educational perspective?

A research overview aiming to map research on computational thinking in Swedish schools (compulsory K-9 and upper secondary school). After reading, twenty-four selected articles are analysed with thematic analysis. The oldest from 2015 and the latest from 2021. Findings shows that programming, as an activity in school is the most common theme in the research. The programming tool Scratch is commonly used. Research published before the revision of the Swedish curriculum (2018) focus on changes in the curriculum and on programming training for teachers. The school subject mathematics is more in focus than other school subjects are.

We can learn from this research that concepts and approaches defined as computational thinking

are taught in Swedish schools. Research after 2018 confirm this when describing needs for assessment frameworks of computational thinking skills.

The research also describes a variety of digital artefacts used in the classroom, different software, robots, Micro:bits. The aim of the interplay with the digital artefacts can differ from school subject to school subject, in physics the students work with simulations, in art with visual interfaces and in technology with automatic control. It seems like computational thinking content, for example learning how to manipulate a simulation, control automation or design interfaces is dependent on the context.

Leaving the background research from Sweden, there is other research indicating that (Barendsen, unpublished ?, Tedre) computational thinking content is context-dependent. The content must be transformed (re- and decontextualized) for use in a specific context. In practice, I see this as an opportunity to investigate how teachers work to adapt and transform the computational content into activities that are suitable for teaching and assessment in a particular context.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?
The aim is to reveal how computational thinking content contextualizes in teaching and learning.

Specific questions to reach the aim (but not defined research questions)

-What counts as computational thinking content in school subjects and by whom?
-How do teachers design teaching and learning with computational thinking content regarding alignment of content-activity-assessment?

Steps to deepen the aim and formulating research questions.
-Further literature studies on computational thinking content in different school subjects.
-Pilot study to try out methodology.

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

The study can contribute to an understanding of how computational thinking content contextualize in a school subject. Results from the study can provide insights useful in teacher education for active and prospective teachers.

The analysis of previous research from Sweden show that computational thinking content is part of teaching and learning activities in different subjects with different learning goals. The analysis also shows that teaching and learning of computational thinking content is concentrated to programming activities. This research study provides a new perspective on computational thinking content as a phenomenon that emerge within a school subject, linked to the subject's regulations as curriculum and syllabus.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from

literature and how your project will fit in.

This research can provide in-depth knowledge of how computational content is contextualized in specific school subjects. Examining computational thinking content linked to a school subject can be seen as the opposite of Papert's and Wings' view of computational thinning as a general skill. Further literature studies are necessary to place this research in position to Papert and Wing.

Research design and methods (planned or used):
Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

1. Background. Mixed methods is used. A content analysis to get an overview of computational thinking's position in the Swedish curriculum. Systematic database search for research concerning computational thinking in Swedish compulsory and upper secondary school, analysed with tematic analysis.

2. Planning stage. A pilot study with purpose to highlight teachers and prospective teachers' understanding of computational thinking.

3. The research study. Phenomenographic analysis and variation theory to examine computational thinking content as a subject-specific phenomenon. Needed is studies in Phenomenographic analysis and variation. The hypothesis; there is variation in how computational thinking content is perceived and contextualised within a school subject.

Achieved results (so far):

- Content analysis of the Swedish curriculum for compulsory school. Search for the words computational thinking, programming and digital. The results show that the word digital appears in all parts of the syllabus and in all syllabi except two. Programming is presented in three syllabi and computational thinking is not represented at all.

- Mapping and thematic analysis. Systematic database search for research concerning computational thinking in Swedish compulsory and upper secondary school. The results show that computational thinking content is primarily found in programming activities. It is not clear whether the learning of computational thinking is based on prior knowledge of programming or whether the learning of programming is based on understandings of computational thinking.

Anticipated project duration

Duration (years)	Two years on full time
Start date:	February 1st 2021. 60% of full time.
End date:	September 2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
2021	Content analysis curriculum	September 2021
	Thematic analysis previous research	January 2021
2022	Pilot studies	February
	Research study	April-October
	Conferences	June, October
	Courses	December
2023	Publications	Hole year
	Dissertation	September

Developing of computational thinking in study groups and camps

Dóra Solymos

PhD-candidate	
Name, titles	Dóra Solymos
University	Eötvös Loránd University
Institute	Faculty of Informatics, Department of Media & Educational Informatics

Motivation, any relevant background (max 200 words)

As an undergraduate student, I got to know the LEGO MINDSTORMS EV3 robot and its educational applications. In several camps and study groups, I was able to help pupils explore the possibilities of this tool and learn the basics of programming. However, in the sessions, I did not receive feedback on what the pupils learned from what was said, what was not clear, which part of the session they enjoyed the most, so I asked them using an anonymous questionnaire. The responses to the questionnaire were intriguing and instructive, which also helped my professional development.

I think that as a teacher, I need to help not only children develop but also my colleagues and share (good) methodological experiences. Therefore, after graduating as a teacher of informatics and mathematics, I decided to apply for a doctorate course and study the potential of robots and the possibilities of the development of computational thinking.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Andor Abonyi-Tóth Dr.
University	Eötvös Loránd University
Institute	Faculty of Informatics, Department of Media & Educational Informatics
Role in project	Supervisor

Title of your research project

Developing of computational thinking in study groups and camps

Description of your research project (max 2000 words total)

Problem statement:

Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?

A common phenomenon in developed countries is that interest in STEM areas is declining among pupils. This can be a cause for concern, as there is a great need for professionals with STEM skills in the knowledge economy. This aspect can also be observed in Hungary.

Pupils in computer science classes generally (mostly) acquire user knowledge, while less emphasis is placed on tasks that promote programming and CT. However, informatics and computational thinking interweave our lives and our daily lives, so it is worth developing such skills in pupils and drawing their attention to these areas of information technology.

While they learn how to use robots, they develop their ability to design and solve problems, their knowledge of mathematical and scientific abstraction, their communication, their critical thinking,

and their ability to facilitate teamwork. Furthermore, these tools make real (engineering) problems tangible for them while connecting many disciplines, helping to stimulate children's interest in science and improving their computational thinking.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

With my research, I would like to encourage the interest of children in the fields of STEM and the development of their computational thinking. For this, it would be necessary to assess the improvement of groups and individuals in programming and computational thinking along with the theoretical knowledge and practical use of each definition in different activities. (The effectiveness of learning processes could be assessed by a questionnaire and an evaluation of practical tasks according to a points system.) Furthermore, it is necessary to assess the potential of each tool, to study different learning methods, and to examine their success. Following this, the aim is to develop a methodology in which experiential learning and problem-based education are given priority, thus helping children prepare for the challenges of the future.

I am currently doing two questionnaire research. In the first one, I examine the development of computational thinking of pupils participating in informatics classes and study groups. I have the following hypotheses for this research.

1. Pupils who learn the basics of programming in robot-supported sessions will gain more thorough programming knowledge and are more experienced in using programming structures than those who do not use robots.
2. Students who participate in robot-supported classes show a greater interest in the programming profession than those who do not use robots to learn to program.
3. Students who have not yet had programming knowledge and participated in programming lessons with robots achieved similar (or better) results in solving programming tasks than those who had some programming knowledge.
4. Students who do not learn English also have no problem using English terms.

In my other questionnaire research, I evaluate the experiences, programming knowledge, and teaching habits of teachers. I began my research by setting up the following hypotheses.

1. A higher percentage of IT teachers who have mastered the basics of programming during their training teach in study groups than those who have not learned to program at that time.
2. In most IT study groups, programming is not the main topic.
3. A higher percentage of IT teachers in the county headquarters teach programming than in other cities.

4. The first programming language learned by students is a programming language not intended mainly for children (eg. C#, C++, C, Java, JavaScript, Python).
5. A significant part of the IT teachers does not teach programming.
6. Most schools have lower-priced robot kits. (Fewer schools have robot stocks with a value of 135-275 euro per each.)

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?
In Hungary, the teaching of programming and computational thinking in IT classes has not been typical in primary and secondary education so far, but there has been a great deal of interest in programming study groups and camps organized by private companies. From September 2020, education experts made it compulsory to teach algorithmic thinking in computer science classes while at the same time reducing the curriculum of previously taught user knowledge, increasing the time and number of hours of studying the subject.

My research also includes an examination of the study groups and camps organized by the schools, which would be given even more emphasis in terms of change. Earlier, the teaching of programming with robots has been a popular topic in the courses; however, by allowing children to come across such a tool at school (in the lessons), they participate with a higher expectation to an extra session. For this reason, my goal is to look for unplugged tools that can improve computational thinking but are not necessarily related to programming, such as board games.

Furthermore, I would like to develop a methodology that can be applied not only in study groups and camps, but even in lessons, which would help IT colleagues who are get acquainted with algorithmic thinking again.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.
The literature is still being processed, I am currently studying the literature on teaching methods, and I have already reviewed some of the literature on computational thinking.

I think there is little literature on the role of board games in the development of computational thinking, so I would like to study this area and examine their success and usability in the study groups and camps.

Research design and methods (planned or used):
Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

So far, I have conducted three questionnaire surveys, all of which included short- and long-answer questions, Likert-scale evaluation, and multiple-choice options. The questions were answered online by those who completed the questionnaire using a google form.

The three questionnaires were designed for two different studies. In the first research, I surveyed the development of the computational thinking of the participants in the study groups and camps I held. The first data collection had already been evaluated which the participating children filled in the questionnaires anonymously. I examined the data based on statistical and content aspects. I gained enough information about the knowledge and development of the participating groups, but I was not able to track the individual development of the participants, so I designed another research in which I made it possible. The second data collection was no longer done anonymously but with full name and date of birth, for which I asked written consent from the parents of the participants. During the processing of the data, the personal data of the participants will be treated confidentially under the relevant legislation, and I will not disclose them to third parties. Data is still being processed.

In the second research, I surveyed the professional experience, education, foreign language skills, and programming skills of teachers who are teaching computer science in Hungary with the help of a non-anonymous questionnaire. In addition, the questionnaire surveyed whether participants run any extracurricular IT program in their school and whether their institution has any robotic kit. Data is still being processed.

The non-anonymous questionnaires were needed to allow me to interview one participant or possibly ask to participate in another research after the data had been processed.

One of my plans is to broaden my research methods, and I would like to do an interview for my doctoral work.

Achieved results (so far):

Published (sort by latest):

- Developing of computational thinking in study groups and camps
  In: Zsakó, László; Szlávi, Péter (szerk.) INFODIDACT 2020
  Budapest, Hungary: Webdidaktika Alapítvány (2020) pp. 185-199., Paper: 15, 15 p., ISBN 978-615-80608-4-4
- Lego Mindstorms EV3 robot programming II. – Teaching materials (hun)
  Solymos, Dóra; Solymosné, Barbalics Dóra Krisztina (authors)
  Budapest, Hungary: ELTE Informatikai Kar (2020), 105 p, ISBN 978-963-489-280-9,
  http://tehetseg.inf.elte.hu/jegyzetek/Lego%20Mindstorms%20EV3%20robotok_INF_SZE3.pdf
- Possibilities of using LEGO robots in education (hun)
  In: Szlávi, Péter; Zsakó, László (szerk.) InfoDidact2019
  Zamárdi, Hungary: Webdidaktika Alapítvány (2019) pp. 265-275., 11 p., ISBN 978-615-80608-3-7
- Lego Mindstorms EV3 robot programming I. – Teaching materials (hun)
  Barbalics, Dóra Krisztina; Solymos, Dóra (authors)
  Budapest, Hungary: ELTE Informatikai Kar (2018), 101 p, ISBN 978-963-489-040-9,
  http://tet.inf.elte.hu/tetkucko/wp-

content/uploads/2018/12/legomindstorms_szakkorianyag.pdf

Not yet published:

- Presentation of programming elements using modern board games (hun)

Anticipated project duration

Duration (years)	4
Start date:	2020
End date:	2024

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
3-4. semesters	• Analysis and processing of data collected during the camps. • Making a publication of the results. • Study of learning methods. • Examine the usage of the board games' success.	2022 spring
5-6. semesters	• Searching for and studying the tools that can be used to develop computational thinking, examining their success • Examination of the success of learning methods • Making a publication of the results.	2023 spring
7-8. semesters	• Writing the dissertation	2024 spring

Portrayals of Technology in Upper Secondary Education

Louise Björlin Svozil

PhD-candidate
Louise Björlin Svozil KTH Royal Institute of Technology Department of Learning in Engineering Sciences
Motivation, any relevant background (max 200 words)
Degree of Master of Science in Engineering Degree of Master of Science in Upper Secondary Education
Supervisors (indicate your 'daily supervisor' with an *)
Arnold Pears, Prof. KTH Royal Institute of Technology Department of Learning in Engineering Sciences Main supervisor
Lena Gumelius, Doc. KTH Royal Institute of Technology Department of Learning in Engineering Sciences Supervisor
Title of your research project
Portrayals of Technology in Upper Secondary Education
Description of your research project (max 2000 words total)
Problem statement: *Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?*

The gender gap in technology education is much researched and findings suggest a number of aspects to handle in order to make the field more inclusive for girls and women (i.e. Wang & Degol, 2017). In this project I will focus on how cultures of technology education are portrayed and percieved in the context of Upper secondary education. Like many fields, the field of technology is fronted by stereotypes representing how people engaged in the field like, behave, dress, and so on. Cheryan et al., (2011) showed how women who encountered a stereotyped representant of computer science believed they would have less success in the field than women who encountered a non-stereotyped representant. This was not evident for the male study participants. Similarly, women who read a (fabricated) news article about computer scientists no longer fitting the stereotype expressed more interest in computer science than those women who read that computer scientists fit the stereotype (Cheryan et al., 2013). Gender domination has also been shown to matter for women's interest in a field (Murphy et al., 2007; Smith et al., 2013).

How the work is conducted also matter for women's interest in a field. College women who read about scientists working independently showed less positive attitudes toward these careers than the respondents who read about scientists performing collaborative tasks (Diekman et al., 2011).

A successful invention was presented by Margolis and Fisher in 2002. After studying the experiences of women and men in higher education institution in computer science, changes involving expansion of the possible way to be a computer scientist (beyond the traditional hacker), contextualizing computer science, paying attention to variations in experience with computing,

enhancing the teaching experience and building students' awareness of confidence issues. These changes resulted in a great increase of female applicants (Fisher & Margolis, 2002).

Thus, to make gender skewed STEM fields more inclusive for non-traditional students and attract a varied population of students, the cultures need to adjust to be relevant to those outside the in-group. An early encounter with the technology field is in Sweden when lower secondary school pupils select their upper secondary school programme. How this culture is perceived could be an important negotiation whether they belong and would like to pursue or not.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The aim of my research is to explore how features in Upper secondary technology education in Sweden could be organized to include and engage girls and other non-traditional students.
How are educational programmes communicated to presumptive students? What features are special for the technology programme?
These questions are answered by qualitatively analyzing images from upper secondary schools' websites. The scope for the study is the four largest (in number of students) higher education preparatory programmes in Sweden. These results are integrated with an analysis of images from the Finnish upper secondary context.
The next study will explore how these images are considered by pupils in making their Upper Secondary educational choice. How do pupils perceive the programmes' images in terms of accessibility, relevance, interests and engagement?
What need to be done in order to achieve a sustainable culture and education in technology education to be inclusive and relevant for more people?
What do we wish for future technology education?

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

I hope to contribute to the creating of cultures in technology education that is inclusive and relevant to more people and avoid reproducing stereotypes attracting more of the same.
There is a need for more people with diverse backgrounds to technology professions. The field will benefit when more perspectives within technology education are included at the same time as there is a democratic argument that the representation in the creation of technology should be wide. To make technological solutions relevant to people of diverse backgrounds, the creators of technological solutions should have a wide representation (and knowledge to not just assimilate and reproduce unequal structures).

The possibilities when contextualizing learning in technology education are the considerations of issues on sustainable development. To raise awareness in technology education can enhance the contribution to a sustainable future at the same time as making the field relevant for more.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project. Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

How gendered media images of STEM professionals play an important role in STEM identity formation (Steinke, 2017). Although much is known about how stereotypes play affect gendered study paths, not much research is conducted focusing on communication to presumptive students. A study of Swedish universities' websites revealed how pictures and text made certain engineering identities as possible (Berge et al., 2019). In Sweden, the first important educational choice happens before entering Upper secondary school. This is why I attempt to investigate the structures and cultures informing this choice.

Research design and methods (planned or used):
Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

The first study (Study 1) is a discourse analysis of images from Upper secondary schools' websites in Sweden. The reason for including several university preparatory programmes in the analysis was that pupils select, deselect and contrast the programmes to other programmes. The technology programme doesn't exist in a vacuum but is compared to other programmes leading up to admission to higher education. An observational protocol was used in first stage of analysis and features were discovered that formed themes describing the setting, the activities and the objects for the image.
Another body of images from the Finnish context was introduced to get a wider perspective on how STEM fields were communicated to presumptive pupils. New themes evolved in the analysis of the Finnish images.
The second study (Study 2) will gather perspectives from pupils at the stage of selecting their Upper secondary education in Sweden. In focus groups, pupils will discuss how they perceive selected images in order to explore if website images can be relevant to presumptive pupils, what they see in the images and if they carry stereotypical images of the selected programmes.

Achieved results (so far):

The analysis resulted in three themes: Learning space, Learning experience and Focal point and agency. The technology programme stands out in several ways. Specific for technology education, contrasted to especially social science education, showed minimal settings in collegial and community areas. Instead learning took place in classrooms (Formal spaces). The learning experience showed in technology education was focusing on experiential learning, mostly conducted alone or in pairs, whereas in social science collaborative learning in a variety of group sizes was more common. Another aspect of human involvement was that images in social science showed more people looking into the camera while the images from technology education showed less human presence and more artefacts.
Relating the findings to previous research on the nature of technology, this aligns with the technology professions to work alone (Cheryan et al., 2015), with things (Su & Rounds, 2015) and not endorsing communal goals (Diekman et al., 2011). Reproducing these stereotypes of technology education/profession will make technology education more appealing to male than female pupils.

Anticipated project duration

Duration (years) (PhD Feb 2019-Dec 2024)
Start date: January 2020 (leave Oct 2020-Aug 2021)
End date: Sept 2022

Research Schedule		
Outline Research Plan for the Remaining Years of the Project		
Research phase	Objectives	Deadline
Analysis of Study 1		December 2021
Writing up results Finalizing article		Dec-Jan 2021/22 Jan-Feb 2022
Data collection Study 2		Feb-March 2022
Analysis of Study 2		April 2022
Literature review		Dec 2021-June 2022
Writing up results/article		June 2022
Completion of article		Aug-Sept 2022

Interdisciplinarity in Modern Higher Education: from University's Strategy to Students Competences

Evelina Vilčinskaitė

PhD-candidate
Evelina Vilčinskaitė Vilnius University Institute of Educational Sciences
Motivation, any relevant background (max 200 words)
As an interdisciplinary (humanities/social sciences) field professional, with 10+ years of active academic life and 8+ years of experience in educational leadership and management through direct work with students, schools, universities and educational organisations in 50+ countries, I have a strong sense of what diversity really means and how to deal with its challenging nature in formal and non-formal education nowadays. From 2017 to 2020 I was a National Director in the biggest youth exchange network „Youth For Understanding" where I have organised and attended different learning, training and counselling sessions in Europe and USA, monitored personalised educational processes for 200+ students and gathered many valuable experience while integrating research and internationalisation strategies in the field. Since 2020 I'm working as a CEO in Lithuanian EdTech startup "CodeAcademy Kids" - an innovative education academy focused on STEM, programming and creativity for students aged 5-18. I'm responsible for academy's strategy and c-level management. This year I started my PhD research on Higher Education (HE) policy focusing on interdisciplinarity and HE strategy, so I would like to share my research vision and receive valuable feedback from the participants in this Doctoral School.
Supervisors (indicate your 'daily supervisor' with an *)
Prof. habil. dr. Rimantas Želvys* Vilnius University Institute of Educational Sciences PhD supervisor
Title of your research project
Interdisciplinarity in Modern Higher Education: from University's Strategy to Students Competences
Description of your research project (max 2000 words total)
Problem statement: *Describe the theoretical or practical research problem that you want to address. What is already known about the problem? What attempts have been made to solve the problem? What is the gap in current knowledge?* A growing number of studies of the strategic change process in the Higher Education Institutions (HEI) focus on the issue of making the University a more significant player in shaping the knowledge economy. Lithuania is not an exception. However very little is researched on the HEI's strategy itself and how certain strategic aspects (as interdisciplinarity) affects competences of the University's community and students in particular.

With the passage of time, academic disciplines have developed, generally with increasing specialization in sub-disciplines. At the same time, it is evident that many problems in modern society, such as those associated with sustainability (climate change, energy shortage and population growth) require expertise from many different fields for their solution. Modern problems even shift the purpose of Higher Education (HE) and University itself. It has also been noted that scientific discoveries tend to be made at the borderlines of traditional disciplines. These circumstances have stimulated interdisciplinary research as well as research on interdisciplinarity.[2]

However, interdisciplinarity tends to be more a strategic decoration than a practise in HE management and execution in Lithuania. Analysis of how strategic change and resistance to it unfolds in relation to policy (Siegel and Wright, 2015)[3], as well as how the tension at the heart of the strategic challenges facing universities is resolved, is lacking. This is a notable gap in the literature given the need to conceptualize how HEI can better sustain and enhance new theoretical (strategy) and practical (curriculum/competences) models faced with tension about the purpose of the university. I aim to fill this gap by examining interdisciplinary activity in higher education as a form of transformative change to strategy and competences. My target for this research is Lithuania, aiming to lead a comparative analysis with Central Eastern European (CEE) countries.

Aims and objectives (research questions):
Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?

The overall purpose of this research is to clarify the current state of the debate with regard to strategy and competencies for interdisciplinarity in HEI in Lithuania; to provide further comparative analysis with CEE countries; to make suggestions for next steps on national and international basis.

Thus, myriad questions surfaced, questions already present within the long history of *interdisciplinarity*, but also new points are being brought up and ways forward are identified, such as:

- What is the conceptualisation of the *interdisciplinarity* in Lithuania and Central and Eastern Europe (CEE)?
- How Higher Education Institutions (HEI) in the region perceive this conceptualisation and/or integrate it into practice?
- How to bridge gaps between disciplines and research domains?
- What are the implications for resetting research agendas? What are the implications for the global dimension?

In addition, in relation to higher education, a further fundamental question is - how to “reform” modern university through it’s strategy which (with a few exceptions) have not implemented systematic reforms of the traditional institutionalized boundaries between disciplines?

[2] Among earlier works on interdisciplinarity, see for example J.T. Klein (1990) Interdisciplinarity: History, Theory, and Practice (Detroit: Wayne State University Press); J.T. Klein (2005) Humanities, Culture, and Interdisciplinarity: The Changing American Academy (Albany, NY: State University of New York Press); and J.H. Aldrich (2014) Interdisciplinarity (Oxford: Oxford University Press).

[3] Siegel DS and Wright M (2015). *Academic entrepreneurship, time for a rethink?* British Journal of Management 26: 582–595.

Relevance and importance of the research:
Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

The originality of my research is very high as very little (in Lithuania practically none) research and literature to date specifically analyses HEI strategy with a link to interdisciplinary competencies and supporting knowledge for interdisciplinarity itself in an accessible manner. Having in mind that University is seen as a mirror of society, even the slightest change has a strong impact on the mechanisms of HE's practice, didactics, governance, legal framework and budget (Cook 2019, 2).

There is a need for a concerted research effort in order to:

- Show how sustainable Higher Education Institutions strategy works in modern world and why there is a need for it.
- Develop coherent sets of competencies to equip students for interdisciplinarity for sustainable development and other related fields.

This research has not only national importance in Lithuania but suggests broader perspective for Central European Countries and has global impact on evolution of HE.

Theoretical framework:
Compare and contrast the theories and concepts that are most important for your project.
Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

This research is expected to propose epistemological considerations by means of a transdisciplinary dialogue between Critical Realism as a philosophical approach to the functioning of society proposed by Roy Bhaskar, and Critical Discourse Analysis – a theoretical approach to the social functioning of language and methodological tool to the situated analysis of texts. More specifically, the research explores the relation between social structures, practices and events, taking the position-practice system as an epistemological argument.

Research design and methods (planned or used):
Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

Design research is still under construction. The current plan has two broad steps which will be divided into smaller research steps:

1. To employ a critical literature, review to identify key themes and gaps in the debate and consider how the strategy and competencies for interdisciplinarity might be further supported.
2. Use case analysis for selected Lithuanian HEI and employ comparative analysis with Central Eastern European (CEE) countries.

Achieved results (so far):

Only literature review (80+ books / book chapters / articles).

Anticipated project duration	
Duration: 4 years Start date: September, 2021. End date: September, 2025.	
Research Schedule	
Outline Research Plan for the Remaining Years of the Project	
Research phase Objectives	**Deadline**
Review and analysis of the scientific literature in Lithuania and abroad	January, 2022
Development of research methodology	July, 2022
Execution and analysis of the theoretical research of the dissertation	January, 2023
Execution of empirical research, preparation of research instrument	July, 2023
Execution of empirical research, data collection, systematization, analysis	January, 2024
Summary of theoretical and empirical research results and preparation of preliminary conclusions	July, 2024
Preparation of the final version of the dissertation	January, 2025
Dissertation defense	September, 2025

The Web – A Toolbox for Learning Programming

Márton Visnovitz

PhD-candidate	
Name, titles	Márton Visnovitz
University	Eötvös Loránd University, Budapest
Institute	Faculty of Informatics

Motivation, any relevant background (max 200 words)

2021-	Software developer
2017-2021	Assistant lecturer at Eötvös Loránd University, Faculty of Informatics
2014-2017	MA degree in Teacher Education (informatics, environmental science) Eötvös Loránd University, Budapest, Hungary
2011-2014	BSc degree in Computer Science Eötvös Loránd University, Budapest, Hungary

I used to work as an assistant lecturer at Eötvös Loránd University for about 4 years. My main focuses were teaching web programming and teacher education. My passion always was web development and web programming. I am currently employed as a software developer, working with mostly web technologies.

The goal of my research is to find a way to use web technologies to support various programming learning activities and to provide a framework that would allow teachers to use this very powerful platform to help students to learn about the various aspects of programming.

Supervisors (indicate your 'daily supervisor' with an *)	
Name, titles	Dr. Győző Horváth*
University	Eötvös Loránd University, Budapest
Institute	Faculty of Informatics
Role in project	Main supervisor

Title of your research project

The Web – A Toolbox for Learning Programming

Description of your research project (max 2000 words total)

Problem statement:

In the current practice of Hungarian programming education in schools, many different technologies and methods are used to teach programming. The National Curriculum identifies various topics to be taught, and many of these topics require various tools to address them. There are clear trends in the choice of tools (i.e., technologies) that teachers in Hungary use to teach programming, and one emerging trend is the usage of web technologies (e.g., the JavaScript programming language) to teach. I believe that this "toolbox" (i.e., programming platform, languages, and associated tools) can be used to improve the quality of the learning experience.

Aims and objectives (research questions):

I would like to provide a comprehensive learning/teaching framework based on web-programming and web technologies, that provides a motivating and effective learning experience for students. I would like to build this framework in a way so that it can cover all the programming topics and subjects of the Hungarian National Curriculum to provide teachers a new, innovative, and modern method for teaching programming. Although the focus is Hungarian schools, I believe that this

framework could be used everywhere to provide alternative means for programming education.

To achieve this, research must be conducted on the current situation of the Hungarian programming education space, for example requirements, topics, subjects, concepts that must be covered, also the methods and technologies that are currently being used. With the findings of such research, it is possible to evaluate the usage of web-programming as an educational tool, and to create a teaching methodology that utilizes this toolset. It is also very important not to limit our investigation to the technology level, but the usage of the accompanying pedagogical methods and methodological approaches must also be examined.

Research Questions

1. What programming languages, programming environments and teaching methods are currently being used in Hungarian public education and why?
2. In which ways could web programming improve the efficiency of introductory, code-based programming?
3. Is it possible to use the web-programming and related technologies to teach the various programming topics and subjects of the Hungarian National Curriculum?
4. Which teaching strategies could be effectively used with web-based programming education, and in which ways should they be applied?

Relevance and importance of the research:

Hypotheses

The basic idea behind my hypotheses is that web programming could be an effective tool to teach programming in public education, and it could solve many problems that we currently face in programming education. I believe that the web browser as a programming platform and the JavaScript programming language provide many opportunities that would enable us to introduce various programming paradigms and technologies to the pupils to broaden their view of the technological world. These technologies include computer graphics, event-driven programming, mobile technology, robotics, sensor system and smart devices. In order to learn about all these technologies, we need to introduce only one programming language (JavaScript). This means that this approach could be an answer to the age-old problem of having insufficient time to teach programming in schools.

Based on these ideas I formulated the following hypotheses:

1. Web programming and its associated technologies are suitable to teach about all the programming-related topics and concepts that are present in the current Hungarian National Curriculum.
2. By using web programming and its associated technologies, it is possible to create an educational framework that facilitates the effective learning of different programming concepts and paradigms.
3. The usage of a *higher-order-first* approach to teaching programming is beneficial as it emphasises problem-solving on a higher level, which is closer to our natural way of thinking.

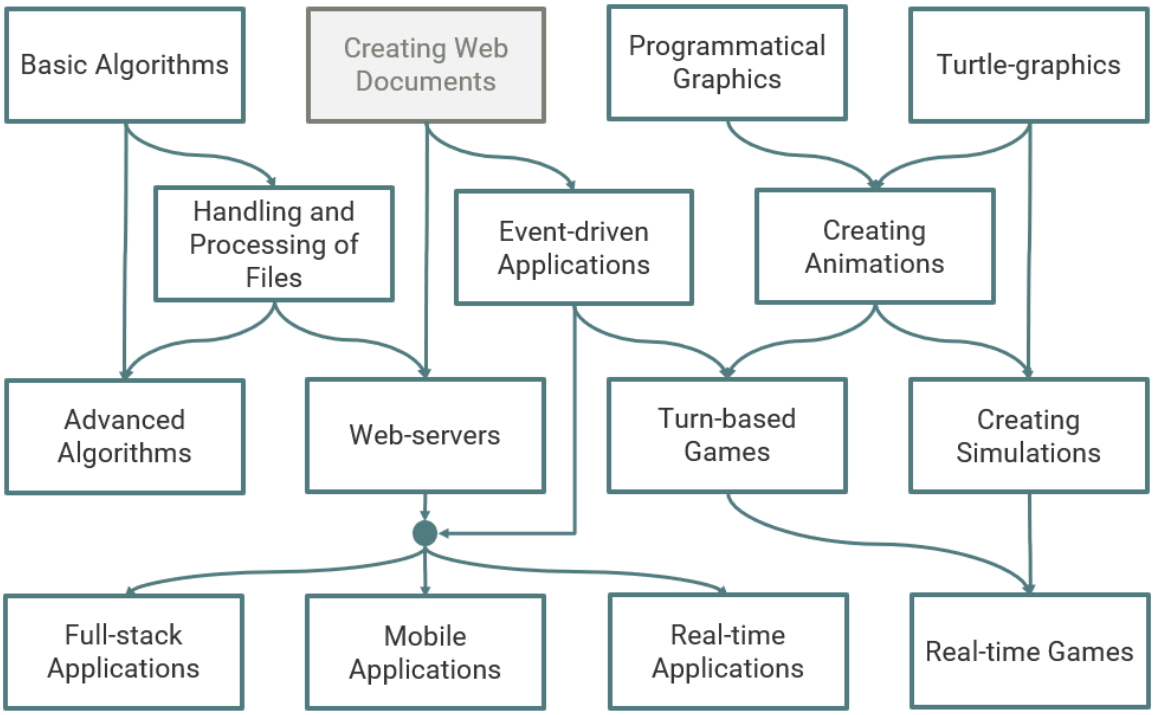
If the aforementioned hypotheses were to be proved true, that would mean that using this technological and methodological toolbox, we could provide educators with new and effective

educational options to use in their classes, to have students engage with technology and to learn about the various concepts of programming.

Theoretical framework:

Many theories and strategies exist for teaching programming. While some of these strategies focus only on a small subset of programming topics (e.g., algorithms) many of them try to cover a wide range of the domain of programming (and sometimes software development). Student groups (and individual students) are receptive to various approaches to learning. That means that it is very important for teachers to have access to a wide range of strategies, so that they can choose the best method based on the needs of their students.

Lots of such strategies are well described in literature. My goal is to provide a new way of teaching programming based on web-programming and related web technologies, that is suitable for covering a wide range of topics that are only partially covered by other strategies.



Map of the various topics that can be covered with web-programming

While the usage of web technologies in education is on the rise, there is very little in scientific publishing about their usage in public education. The aim of my research is to fill this gap, and to provide the necessary resources for teachers to help them to effectively use this strategy for teaching programming.

Research design and methods (planned or used):

Method: *design-based research*

Research focus: The curriculum (technologies and methods), the student, the learning process

Design goals:

- To create a methodology based on web-programming and web technologies that covers

the requirements of the Hungarian National Curriculum, and that supports teaching various programming concepts and paradigms for students aged 13-18.
- To develop tools and learning materials that provide insight on how to use the web as a programming platform and web technologies for learning programming.

Quantitative measurements

- Surveys with IT/CS teachers about the programming languages they use in education. (RQ 1)
- Evaluation of data about the usage of programming languages in the high school final exams. (RQ 1)

Qualitative measurements

- Interviews and surveys with IT/CS teachers about the methods they use to teach programming. (RQ 1, 2)
- Analysis and evaluation the new Hungarian National Curriculum, syllabi, and final exam requirements to see how the proposed methodology can cover the required topics and subjects. (RQ 1, 3)

Experimental measurements

- Testing and evaluating the proposed methodology in various environments (summer camps, extracurricular activities, school classes, coding schools) (RQ 2, 4)

Achieved results (so far):

- Gathered data about the currently used methods and technologies in Hungarian schools
- Created a map of various topics and teaching strategies of the public education programming space – investigated how these topics can be covered with web programming
- Compiled a list of methods, strategies and best practices that can be applied to a web-programming based environment to achieve highly successful learning outcomes
- Preliminary tests in summer camps about the effectiveness of using web programming in programming education

Publications

1. Visnovitz, M. (2020). Classical Programming Topics with Functional Programming. Central-European Journal of New Technologies in Research, Education and Practice, Volume 2 Number 2, Budapest, Hungary
2. Visnovitz, M. (2020). A Constructionist Approach to Learn Coding with Programming Canvases in the Web Browser. In Proceedings: CONSTRUCTIONISM 2020.
3. Visnovitz, M. (2020). JavaScript könyvtárak programozott rajzolás alapú tanulás támogatásához [JavaScript Libraries for Learning with Graphics-based Programming]
4. Horváth, Gy., Visnovitz, M. (2018). Dinamikus weboldalak előállítása szerveroldali technológiákkal [Creating Dynamic Webpages with Server-side Technologies], Handbook, ELTE Faculty of Informatics.
5. Horváth, Gy., Visnovitz, M. (2018). A böngésző mint alkalmazásfejlesztési platform [The Browser as an Application Development Platform], Handbook, ELTE Faculty of Informatics.
6. Visnovitz, M., Horváth, Gy. (2018). Nevezetes felsorolók funkcionálisan [Notable Enumerators with Functional Programming]. In Proceedings: INFODIDACT 2018, Zamárdi, Hungary
7. Horváth, Gy., Visnovitz, M. (2018). Tesztelési módszerek webes tárgyak tanításában [Testing Methods in Teaching Web Technologies]. In Proceedings: INFODIDACT 2018, Zamárdi, Hungary
8. Visnovitz, M. (2017). Programozási tételek funkcionálisan [Fundamental Algorithms with

Functional Programming]. In Proceedings: INFODIDACT 2017, Zamárdi, Hungary
9. Horváth, Gy., Visnovitz, M. (2017). Egy bevezető webfejlesztési kurzus módszertani megfontolásai [Methodological Considerations of an Introductory Web Development Course]. In Proceedings: Informatika a felsőoktatásban 2017 [Informatics in Higher Education 2017], Debrecen, Hungary, University of Debrecen, Faculty of Informatics. p. 265- 274.

Relevant Conferences

10. INFODIDACT 2021, Online. Presentation: Programozási alapfogalmak sorrendje a módszeres és funkcionális programozásban [Order of Programming Concepts in Algorithmic and Functional Programming]
11. INFODIDACT 2020, Online. Presentation: JavaScript könyvtárak programozott rajzolás alapú tanulás támogatásához [JavaScript Libraries for Learning with Graphics-based Programming]
12. INFOÉRA 2019, Zamárdi, Hungary. Presentation: Élményalapú tanulás webes techológiákkal [Experience-based Learning with Web Technologies]
13. INFODIDACT 2018, Zamárdi, Hungary. Presentation: Nevezetes felsorolók funkcionálisan [Notable Enumerators with Functional Programming]
14. CONSTRUCTIONISM 2018, Vilnius, Lithuania. Poster: The Web – A Platform for Creation
15. INFODIDACT 2017, Zamárdi, Hungary. Presentation: Programozási tételek funkcionálisan [Fundamental Algorithms with Functional Programming]
16. DAMSS 2016, Druskininkai, Lithuania. Presentation: Aspects for Choosing Textual Programming Languages for High School Education

Anticipated project duration

Duration (years)	4-5 (1-2 remaining)
Start date:	09. 2018
End date:	05. 2023

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
Framework development	Develop the necessary tools and learning materials for the web-based learning framework.	End of 2022
Framework testing	Testing the framework in various learning environments	End of 2022
Summary of results, preparation of the thesis	Summarise the results of the tests, iterate on the framework as necessary, write thesis	Mid 2023

The phenomena of disability in the group (school class)

Viktorija Voidogaitė

PhD-candidate
Viktorija Voidogaitė, PhD student Vilius University Institute of Educationals Sciences
Motivation, any relevant background (max 200 words)
This is my very first doctoral school. I'm keen to come and to learn.
Supervisors (indicate your 'daily supervisor' with an *)
Prof. Roma Kriaučiūnienė Vilnius university Institute of Forenge Languages The supervisor
Title of your research project
The phenomena of disability in the group (school class)
Description of your research project (max 2000 words total)
Problem statement: In a phenomenological approach the researchers do not create (or make a statement of) any kind of problem to solve. They do form the phenomenological questions. So, the main question that seem to me important to form is: **What does it mean to learn and act in the inclusive school class?** By the year of 2024 all the schools of Lithuanian will have had an obligation to accept all kinds of students to every class. The phenomenological research of students experiences in the inclusive class can give a practical answer to difficult question: how Lithuanian schools should prepper to this extreme everyday life changes?
Aims and objectives (research questions): *Frame how you will address the problem. What is the overall purpose of your research? What are the specific questions that you aim to answer? What are the concrete steps (i.e. studies) you will take to achieve this aim?*
In the theoretical part of the work the research question is going to be investigating while taking into consideration three aspects: the circumstances under which the students meet each other in the inclusive class, the existing dynamics of the class (group) that the student (with special needs)

enters and the preparation of the classmate to welcome a child with special needs. The literature review will show if there is an increase in number of children with special needs in Lithuanian school.

In the empirical part of this thesis, we will find the description and interpretation of the

phenomenological question, which includes the experiences of the individual student.

Relevance and importance of the research:

Make clear what new (theoretical and practical) insights you will contribute, who they are relevant to, and why the research is worth doing. Why is it important that the problem is solved? What will happen if the problem is not solved? Does the problem have wider relevance?

This is the first phenomenological research of a disability in class. Every time when the voice is given to a person with disability it is worthy researching it. It is important to research and to understand if it is meaningful to do the inclusion in a planned way. Other vice the inclusion is an expensive, forced to reach illusion.

Theoretical framework:

Compare and contrast the theories and concepts that are most important for your project.

Identify points of conflict and situate your own position. Show clearly what is missing from literature and how your project will fit in.

Persons with disabilities are now recognised under international law as right-holders, with a claim to the right to education without discrimination and on the basis of equal opportunities. The United Nations Convention on the Rights of the Child (CRC, 1989), the World Declaration on Education for All (1990), the United Nations Standard Rules on Equalization of Opportunities for Persons with Disabilities (1993), and the Salamanca Declaration and Framework for Action (1994) all embody measures testifying to the growing awareness and understanding of the right of persons with disabilities to education (General comment No. 4, 2016).

Still Lithuania is struggling with a lack of political will, technical knowledge, and insufficient education of all teaching staff. That is why some researchers are doubting: “do we need an inclusion and if so, what kind of inclusion do we need?” (Gervytė, 2014). My project will fit in with a description and interpretation of the phenomena of a disability in the class.

Research design and methods (planned or used):

Explain how you will design the research. Qualitative or quantitative? Descriptive, correlational, experimental, ..? Describe the participants, instruments, procedures and tools of the research. When, where and how will you collect, select and analyse data? Address any potential obstacles, limitations and ethical or practical issues. How will you plan for, and deal with problems?

I’m planning hermeneutical phenomenological research (Merleau-Ponty, 2018 and Ricoeur, 2001). The main task of the hermeneutic phenomenological research is an interpretive description of the primordial meaning structures of pre-reflective lived experiences. The current research orients to

the possible meanings of the phenomenon of learning in an inclusive class and will reveal the essence of this phenomenon.

The research will feature ten or twelve interviews conducted with grownup people (aged 20-35 years) who had studied in diffrent inclusive schools of Lithuania.

The main obstacle: it is possible that during the research I will find out that experience of inclusion is so disappointing that it is not worthy even to begin the transformation of all primary and secondary education in Lithuania. And this is hard to bracket. I am still working on it.

Achieved results (so far):

I've chosen the methodology and have made my first interviews.

Anticipated project duration

Duration (years) 4
Start date: 2020
End date: 2024

Research Schedule

Outline Research Plan for the Remaining Years of the Project

Research phase	Objectives	Deadline
The theoretical part of the work.	To investigate all three aspects: the circumstances under which the students meet each other in the inclusive class, the existing dynamics of the class (group) that the student (with special needs) enters and the preparation of the classmate to welcome a child with special needs. The literature review will show if there is an increase in number of children with special needs in Lithuanian school.	2023
The empirical part of the work.	To make the description and interpretation of the phenomenological question, which includes the experiences of the individual student.	2024