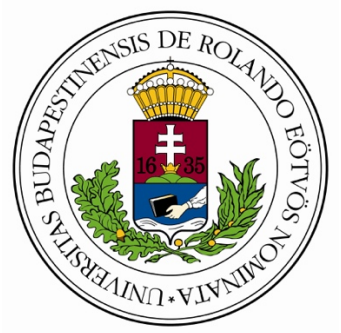
EÖTVÖS LORÁND UNIVERSITY
FACULTY OF PEDAGOGY AND PSYCHOLOGY
DOCTORAL SCHOOL OF EDUCATION

ENIKŐ ORSOLYA BERECZKI

NURTURING CREATIVITY IN TECHNOLOGY-ENHANCED LEARNING ENVIRONMENTS: A QUALITATIVE MULTIMETHOD STUDY OF TEACHERS' BELIEFS AND PRACTICES

Doctoral (Phd) thesis booklet

Advisor: Prof. Andrea Kárpáti, DSc



BUDAPEST
2019

Table of contents

1. INTRODUCTION AND BACKGROUND

In the past 25 years, creativity has increasingly been recognised as an important aspect of young people's education around the world (Craft, 2005). Evidence for the growing emphasis on creativity in education can be provided by its inclusion into various curricular documents around the globe (Heilman & Korte, 2010; Shaheen, 2010). At the EU level, creativity has been identified as a transversal aspect of all key competences for lifelong learning (European Parliament and the Council, 2006). Creativity represents an important goal of public education in Hungary too, and is included in the Hungarian National Core Curriculum (HNCC) as relevant for all domains and age groups (Bereczki, 2016; HNCC, 2012).

In addition to creativity, technology is also an important aspect of today's classrooms. To be effective in the knowledge society, students are required to create, evaluate and use information, media, and technology (Molnár & Kárpáti, 2012). Several researchers have highlighted that digital technology can make a distinctive contribution to the development of creativity in education by providing new tools, media, and environments for learning to be creative, and learning through being creative (Glăveanu, Ness, Wasson, & Lubart, 2019; Loveless 2003; 2007; Lubart, 2005; Nikolopoulu, 2015). The view that technology can promote creativity and learning is also shared by educators across many countries (Cachia & Ferrari, 2010).

Though a range of theoretical works have emphasised the potential of digital technologies for supporting creativity in the classroom, only few investigated the effects of technology-enhanced learning interventions on students' creativity (Lai, Yarbro, DiCerbo, & de Geest, 2018; Ma, 2006; Scott, Leritz, & Mumford, 2004a, 2004b). Research on technology-supported creativity-enhancement suggests that creativity can be developed using digital tools, findings of experimental and intervention studies, however, do not appear to have direct relevance for primary and secondary education (Lai et al., 2018). Thus, more research is needed with themes and questions grounded in the realities of classroom practice.

Creativity researchers generally agree that the beliefs teachers hold about creativity shape the ways in which they engage in the promotion of students' creative capacities in the classroom (Andiliou & Murphy, 2010; Beghetto, 2010; Skiba, Tan, Sternberg, & Grigorenko, 2017). Earlier findings on the topic were synthesized by Andiliou and Murphy (2010), indicating that teachers' beliefs have often been found at variance with research-based perspectives. Little is known, nevertheless, about what views teachers hold about creativity in recent years, and especially about its promotion through technology.

Also, literature on teachers' beliefs suggests that highly accomplished teachers conceptualize creativity consistent with the literature, and have a rich repertoire of teaching strategies to promote creativity in the classroom and therefore, might play an important role in promoting research grounded beliefs among educational stakeholders as well as inform future studies to pursue themes relevant for the classroom Henriksen & Mishra, 2015; Merriman, 2015; Scott, 2015), Their views on creativity, technology, and learning, however, have not been explored yet.

Finally, several studies examined Hungarian teachers' beliefs and pedagogical experience in diverse areas such teaching, learning, students, and school environment (e.g. Falus, Golnhofer, Kotschy, Nádasdi, & Szokolszky 1989; Golnhofer & Nahalka, 2011; Hercz, 2005; Vámos, 2001), standardized student assessment (Tóth, 2011), specific teaching practices (e.g. Tóth, 2008), integration and diversity (e.g. Bereczky & Fejes, 2010; Nagy, 2002), and technology integration (e.g. Buda, 2010; Kis-Tóth, Borbás, & Kárpáti, 2014), yet, to our knowledge, educators' views about creativity and its nurture, and specifically through the use of technology, have not been investigated in the Hungarian context.

2. PURPOSE AND RESEARCH QUESTIONS

The purpose of the study described in the dissertation was then to explore teachers' beliefs about and experience with nurturing student creativity in technology-integrated learning environments to generate themes and questions for future research on creativity, learning, and technology grounded in the realities of the classroom as well as to support policy, teacher education, and practice in the area of technology-enhanced creativity education. The overarching research questions guiding this study were the following:

What characterizes teachers' beliefs about and experience with nurturing creativity using educational technology?

How do teaches' beliefs and experience relate to the existing empirical evidence on creativity, learning, and technology?

3. RESEARCH PARADIGM AND DESIGN

The study was conducted in the pragmatic paradigm (Johnson & Onwuegbuzie, 2004) and applied a qualitatively-driven sequential multimethod approach (Morse & Niehaus, 2009) combining a systematic literature review (Study 1) and multiple case studies (Study 2).

4. STUDY 1: SYSTEMATIC LITERATURE REVIEW

4.1. Purpose and research questions

The purpose of Study 1 was to describe, appraise and synthesize the most rigorously available current empirical research base on in-service K-12 teachers' beliefs about creativity and its nurture with special focus to the perceived roles of technology in fostering creativity. Study 1 sought to answer the following research questions:

Q1: What is known about teachers' recent beliefs about creativity?

Q2: What is known about teachers' beliefs with regard to nurturing creativity with technology?

Q3: What is known about the relationship between teachers' creativity beliefs and classroom practices?

4.2. Systematic literature review methodology

In Study 1 a qualitative systematic literature review, more specifically a thematic synthesis, was chosen to describe, appraise and synthesize the current empirical research on in-service K-12 teachers' beliefs about creativity and its nurture, given its methodological strength as a means of establishing a comprehensive, and reliable evidence base (Gough, Oliver, & Thomas, 2012, p. 2). To ensure that the review was systematic, Study 1 was guided by the Preferred Items for Systematic Reviews and MetaAnalysis (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & ThePrismaGroup, 2009), and included the following steps: (1) defining relevant studies and establishing inclusion/exclusion criteria; (2) developing the search strategy; (3) identifying potential studies through searching and screening; (4) describing and appraising included studies; (5) analysing and synthesizing findings.

Electronic databases relevant to education, educational psychology and psychology (ProQuest ERIC, EBSCO PsychInfo, and ProQuest Dissertation and Theses Global) were searched for studies designed to describe and explore teachers' beliefs about creativity, which were presented in full primary reports of empirical research (qualitative, quantitative, and mixed method), published between January 2010 and December 2015, and written in English. Search terms developed included belief terms, creativity terms, and teacher terms, which were established upon a preliminary review of the literature. Further search strategies applied included the hand searching of key journals, forward reference list checking of key articles, reference list checking of studies included, Google searches, and asking personal, and professional contacts.

The articles identified through the search strategy were divided between the author and her advisor, and screened individually using the inclusion and exclusion criteria. A random sample of 10% percent of the articles were chosen and screened by both researchers involved. Interrater reliability was calculated for the sample showing almost perfect agreement (Kappa= 0.951).

Of the n=2628 studies identified through the search strategy n=71 met the inclusion criteria, which were then judged for their quality and relevance. The appraisal of studies was undertaken by the author while another researcher assessed a random selection of studies (n=16). The two judges reached full agreement on the quality and relevance ratings awarded to the sample. The appraisal strategy applied yielded a final sample of n=53 studies included in the review. For a graphic overview of the selection procedure see Figure 1.

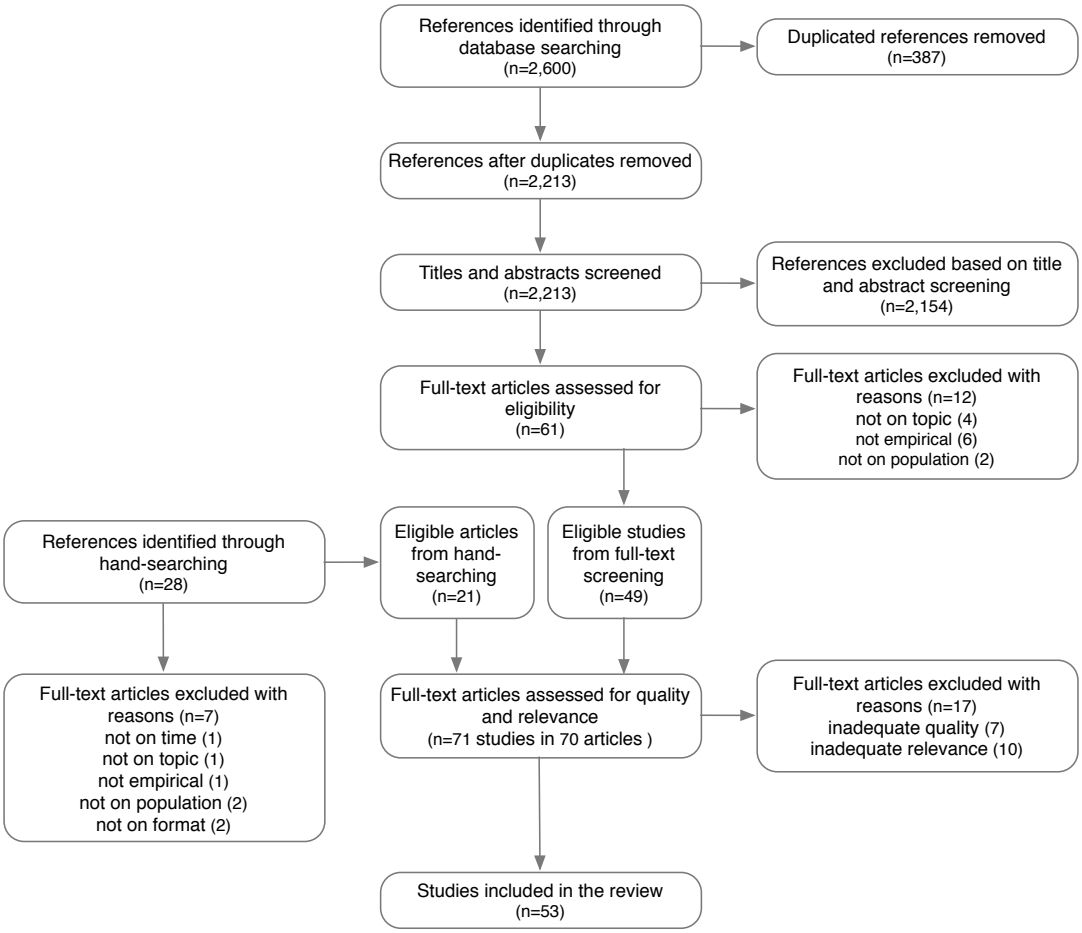


Figure 1. PRISMA Flow Diagram of study selection for the systematic review in Study 1

Surface characteristics of the reviewed studies were analysed using descriptive statistics. For the synthesis of findings in relation to the first research question, which focused on the characteristics of teachers' beliefs about creativity, a mixed-coding strategy with some pre-defined concepts was applied (Oliver & Sutcliffe, 2012) building on Andiliou and Murphy's

(2010) conceptual framework on the topic. For the questions concerning teachers' beliefs and perceptions in relation to classroom practice, as well as nurturing creativity with technology data was open-coded (Oliver & Sutcliffe, 2012). Coding in both cases was carried out in NVivo 11 for Mac, while themes as well as the decisions taken regarding these were discussed with the author's advisor.

4.3. Major findings

Studies included in the systematic literature review investigated teachers' creativity beliefs along three main themes: teachers' beliefs about the nature of creativity, creative individuals and classroom environment conducive to creativity. Teachers' beliefs about nurturing creativity with technology was addressed only in a limited number of studies.

Study 1 found that teachers hold several beliefs which could act as enablers to promoting creativity in the classroom, such as they generally value creativity, many believe that it can be nurtured in every student and across many subjects, and are aware of a number pedagogical strategies to promote it. Specific areas in which educators require more support include: the recognition of originality and appropriateness as joint requirements for creative outcomes; the conceptualization of creativity in different subject areas; the identification and appreciation of creativity in students; and the development of more awareness about the characteristics of pedagogical practices conducive to creativity across the curriculum and various education levels.

Study 1 found that teachers perceive few enablers and several barriers to nurturing creativity in the classroom. Most notable barriers are lack of time and training, inadequate resources, overloaded curriculum, standardized tests and difficulties in assessing creativity, which can easily outweigh teachers' positive beliefs and prevent the implementation of creativity in schools. The synthesis of the recent literature also highlighted that though common trends can be identified, teachers' views may vary considerably across teacher samples suggesting that beliefs about creativity are deeply rooted in the specific contexts of the educators. It has been also found that highly-accomplished expert teachers' views were in-line with current research.

Study 1 found that teachers may adopt various stances with regard to the role of technology in promoting creativity, which was viewed as an enabler or as a barrier, or both as an enabler and barrier of students' creative development by teachers across the studies. Few studies explored teachers' beliefs in-depth. In these studies, technology was argued to support idea development as well as to increase students' curiosity and interest necessary for creativity in the classroom. Negative effects of technology on creativity reported by teachers included

disruption and the suppression of thinking by access to ready-made answers. Such claims need empirical testing in K-12 settings.

Study 1 found various degrees of congruence and recurrent incongruence between teachers' espoused beliefs and enacted practices. It was found that even if teachers' hold positive or adequate beliefs about creativity and its nurture with or without technology, these rarely translate into creativity-fostering practices, suggesting that there are a number of internal and external factors that might prevent educators from nurturing creativity in the classroom.

4.4. Limitations

The review was subject to the usual limitations of systematic reviews. Despite the pilot searches, hand searching of important journals, forward referencing of past seminal studies and reference list checking of included studies for other relevant work, some research may have not been identified. Also, only English-language resources were searched for, thus an English-language bias is inevitable. The findings of the review are also inherently limited by the quality of available evidence. By designing and implementing a quality assessment protocol, low-quality studies were excluded to not adversely affect the review outcomes. For reasons of heterogeneity of the research on teachers' creativity beliefs, a narrative synthesis has been conducted, which is by nature a more subjective process. To ensure accuracy and reliability, data collected were checked, themes and interpretations were agreed on with the authors' advisor and when needed other experts were involved.

5. STUDY 2: QUALITATIVE MULTIPLE CASE STUDY

5.1. Purpose and research questions

The purpose of Study 2 was to investigate the relationships among creativity, technology, and learning by exploring educational technology expert teachers' beliefs about and experiences with nurturing creativity in technology-integrated learning environments across six areas of the secondary school curriculum: EFL, Hungarian language and literature, mathematics, science, social studies, and visual arts.

Study 2 sought to answer the following research questions:

Q1: What characterizes Hungarian digital pedagogy expert secondary school teachers' beliefs about creativity?

Q2: What characterizes Hungarian digital pedagogy expert secondary school teachers' beliefs about nurturing creativity with technology in their subject areas?

Q3: What enablers and barriers do Hungarian digital pedagogy expert secondary school teachers perceive to stimulating students' creativity with technology?

Q4: What characterizes Hungarian digital pedagogy expert secondary school teachers' enactment of their beliefs about nurturing creativity with technology in the classroom?

5.2. Qualitative multiple case study methodology

In Study 2 a qualitative exploratory multiple case study approach has been chosen to achieve the purpose of exploring educational technology expert teachers' beliefs about and experience with nurturing creativity (Yin, 2014, p. 16). A case study approach underpinned by qualitative methodology is particularly applicable to the present study since it can provide in-depth knowledge on teachers' beliefs not obtainable by other means, as suggested by the findings in Study 1 as well as the in other relevant literature (Andiliou & Murphy, 2010; Fives & Buehl, 2012).

Case selection and sample

Study 2 adopted purposeful sampling to select participant teachers able to provide expert opinion on the use of technology for nurturing student creativity across the secondary school curriculum. The sampling unit was represented by individual teachers and the data collected from them through interviews, classroom observation, document, and image analysis. Participant selection was guided by the combination of criterion, stratified, and maximum variance sampling (Mertens, 2010; Patton, 2002; Robson & McCartan, 2016). Sampling criteria to select potential participants included the following:

- Must have been teaching at secondary school grade levels.
- Must have been working as teachers for at least 5 years.
- Must have been teaching the following curricular areas: EFL, Hungarian language and literature, mathematics, science, social science, and visual arts.
- Must have been recognized by other educational technology stakeholders as digital pedagogy experts based on the following performance criteria: (a) have earned a local, regional, state, or national award for teaching with technology, (b) have presented at local, regional, state, or national conferences on the topic, and/or have mentored younger teachers or teacher candidates on the topic, (c) have earned grant funds related

to digital pedagogy, (d) have received praise and positive feedback from parents, students, and colleagues for their technology-integrated teaching practice.

The sampling strategy adopted yielded the identification of 12 Hungarian digital pedagogy expert teachers to participate in the study with two teachers from each curricular area in focus.

Data collection: instruments and procedures

Study 2 data have been derived from four different methods of data collection: semi-structured interviews (pre- and post-observation), classroom observation, document, and image analysis. A graphic representation of the data collection process from each teacher is provided in the following Figure 2.

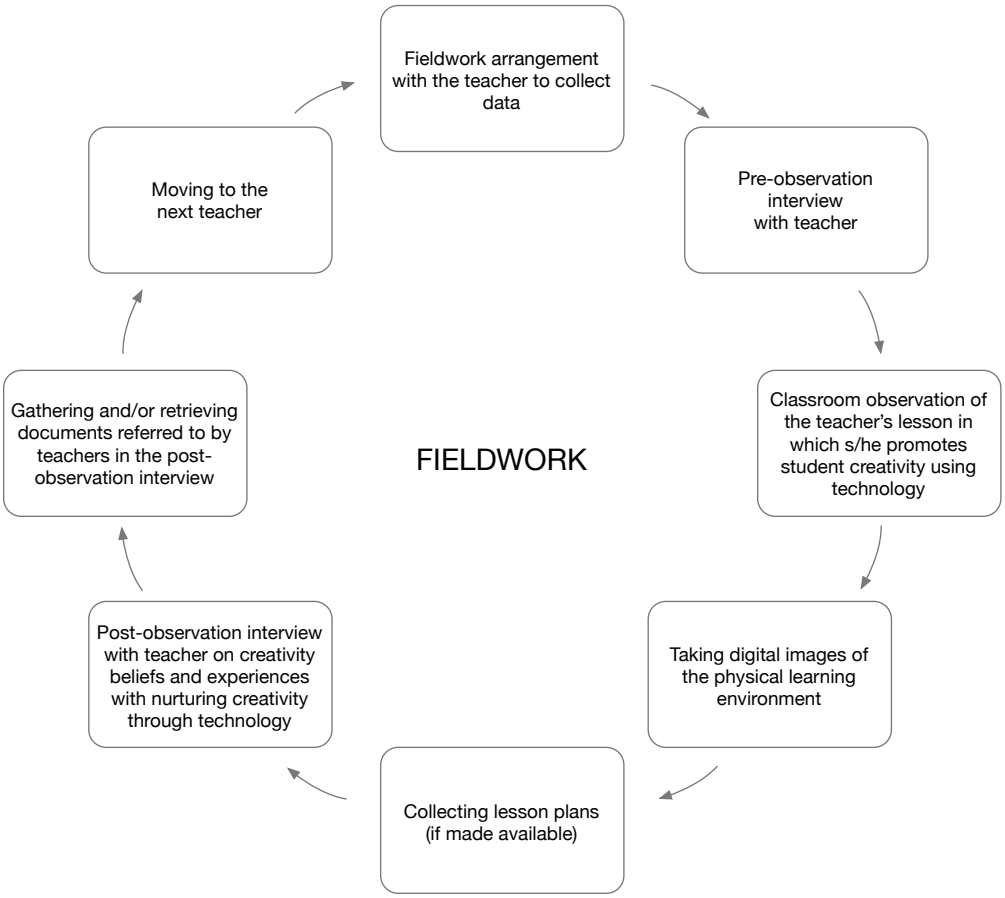


Figure 2. Data collection process in Study 2

Data collection instruments were developed based on previous research instruments identified in Study 1 and the review of the relevant literature, and piloted with one digital pedagogy exemplary teacher. Data for Study 2 were collected over a period of four months in the spring and summer of 2017 and autumn 2018.

Data analysis: preparation, coding, and data display

Individual interviews conducted with teacher participants were audio recorded and transcribed verbatim into word processing documents. Handwritten notes were turned into word processing documents, paper documents were scanned. All electronic data files prepared in this stage were stripped from identifiers, labelled by participant pseudonyms and data collection methods, and imported into Atlas.ti 8.3.1 for Mac for further analysis.

Coding in Study 2 was informed by the coding framework and procedures proposed by Miles, Huberman, and Saldaña (2014), and involved two major cycles, namely first-cycle (initial coding) and second-cycle (pattern coding).

Study 2 used two of the data display approaches proposed by Miles et al. (2014). Matrix displays in form of charts and tables allowed to organize the material into an at-a-glance format for reflection, verification, and conclusion drawing. Narrative descriptions in turn provided a prosaic representation and presentation of findings.

Data were also analysed and organized based on the techniques of within-case and cross-case analysis (Baxter & Jack, 2008; Stake, 2006; Yin, 2014).

Trustworthiness: credibility, transferability, dependability, conformability

In Study 2 credibility was achieved in several ways. First, methods triangulation (Denzin, 1978) was used to check the congruence of findings across data collected through individual interviews, observations, document, and image analysis. Source triangulation (Denzin, 1978) was also applied, since data was collected with the same method from different participants. Second, member checks (Lincoln & Guba, 1985) were incorporated at different points of the analysis process. Third, referential adequacy (Lincoln & Guba, 1985) was examined by archiving one interview and observation data and analysing it subsequently. Fourth, Study 2 used peer briefs during which the author consulted with other two researchers with regard to the analysis and interpretation.

To achieve transferability in Study 2, the author sought to provide a 'thick description' of the context of investigation (Geertz, 1973), thus allowing the reader to determine the degree of similarity between the present study's sites and the receiving one.

To ensure dependability, in Study 2 a detailed description of the research process was provided. In addition, an inquiry audit was carried by the author' advisor resulting in subsequent clarifications added to the report.

Conformability has been achieved through peer debriefing. The researcher asked another educational researcher with PhD to code and analyse the transcript of a teacher interview and

the notes of a classroom observation. The few discrepancies found were discussed helping the researcher confront her own values and guiding the next steps in the study, as it was indicated in the literature (Mertens, 2010).

Ethical concerns

Throughout the study great care has been taken to avoid any harm to participant teachers and students. The two most important ethical aspects considered for Study 2 were acquiring informed consent and securing confidentiality.

5.3. Major findings

First, digital pedagogy expert teachers in this study held several beliefs that could act as facilitators to promoting creativity in the classroom, such as they were aware of the various contexts in which creativity occurs in education, could differentiate between its different levels and domains, and endorsed a system perspective acknowledging that students' creativity arises from the interaction of certain personal characteristics and the environment (see Figure 3.).

In contrast with more traditional classroom teachers (Andiliou & Murphy, 2010), but in line with other highly accomplished ones (Henriksen & Mishra, 2015; Merriman 2015; Scott, 2015), educators in this study also recognized that creativity requires both originality and appropriateness, and could clearly establish its relationship with their own subjects. All this suggests that teaching for creativity is related to high quality teaching, and so expert teachers may play an important role in promoting research-grounded beliefs among educational stakeholders. An important area in which teachers in Study 2 needed further support was creativity assessment, an aspect of creativity education which may be problematic even for exemplary teachers, and, therefore, special emphasis should be placed on developing and promoting research-based creativity assessment and measures for K-12 education.

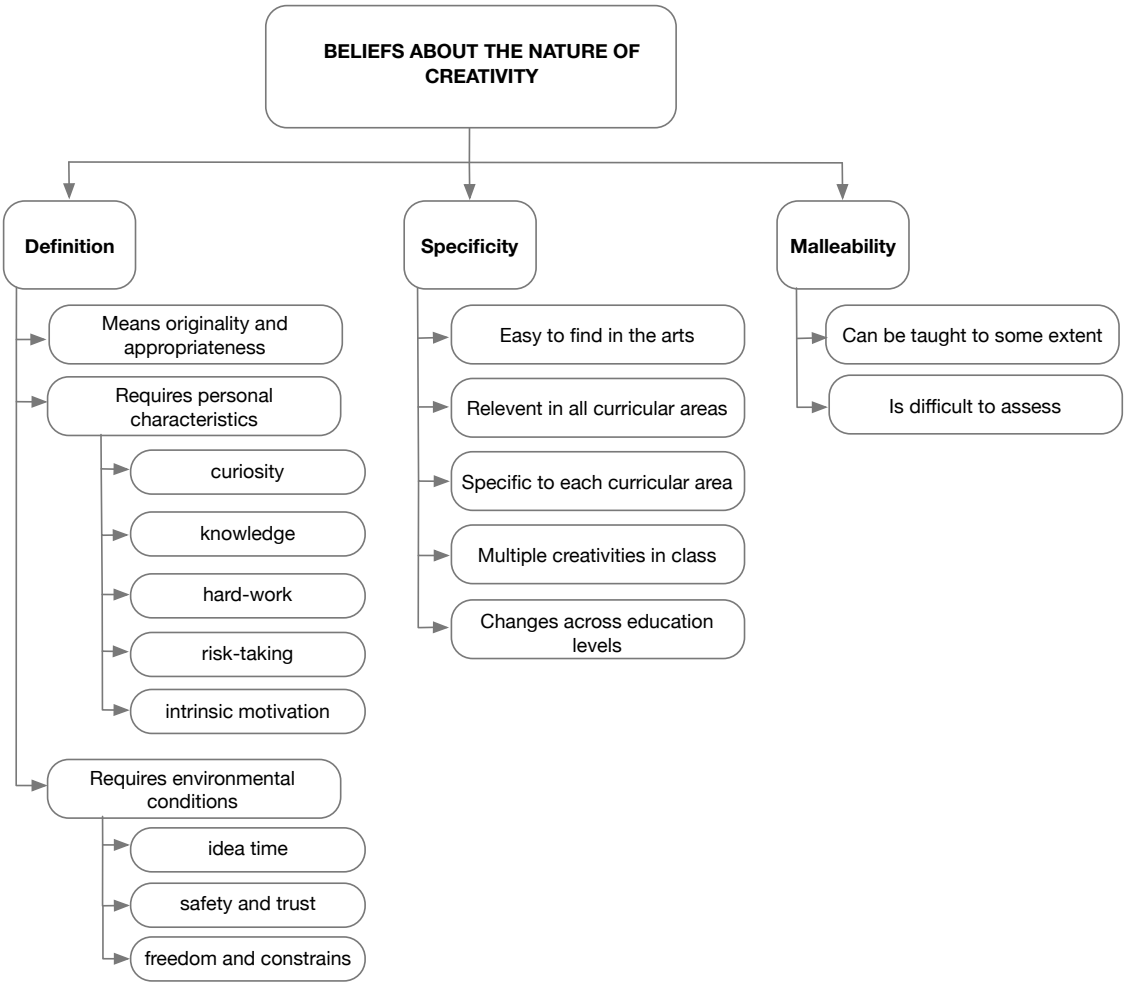


Figure 3. Thematic map of digital technology expert teachers' beliefs about the meaning of creativity in Study 2.

Second, Study 2 identified six types of technology-enhanced activities digital pedagogy expert teachers believed were valuable for fostering creativity across the secondary curriculum: (1) igniting students' creative thinking with technology, (2) developing and exploring ideas with technology, (3) creating with technology, (4) scaffolding student creativity with technology, (5) augmenting collaboration with technology, and (5) communicating and evaluating creative outcomes with technology (See Figure 4). The identified themes were in line with the theoretical work on creativity, technology, and learning (e.g. Glăveanu et al., 2019; Loveless 2003; 2007; Lubart, 2005), yet Study 2 could establish a new framework for technology-enhanced creativity fostering activities which reflects the realities of classroom practice. While teachers' beliefs about technology-enhanced creativity-fostering activities were in line with theory, a gap between practice and research has been highlighted. In addition, Study 2 identified several creative activities supported by digital tools, the effectiveness of which could be explored by future research.

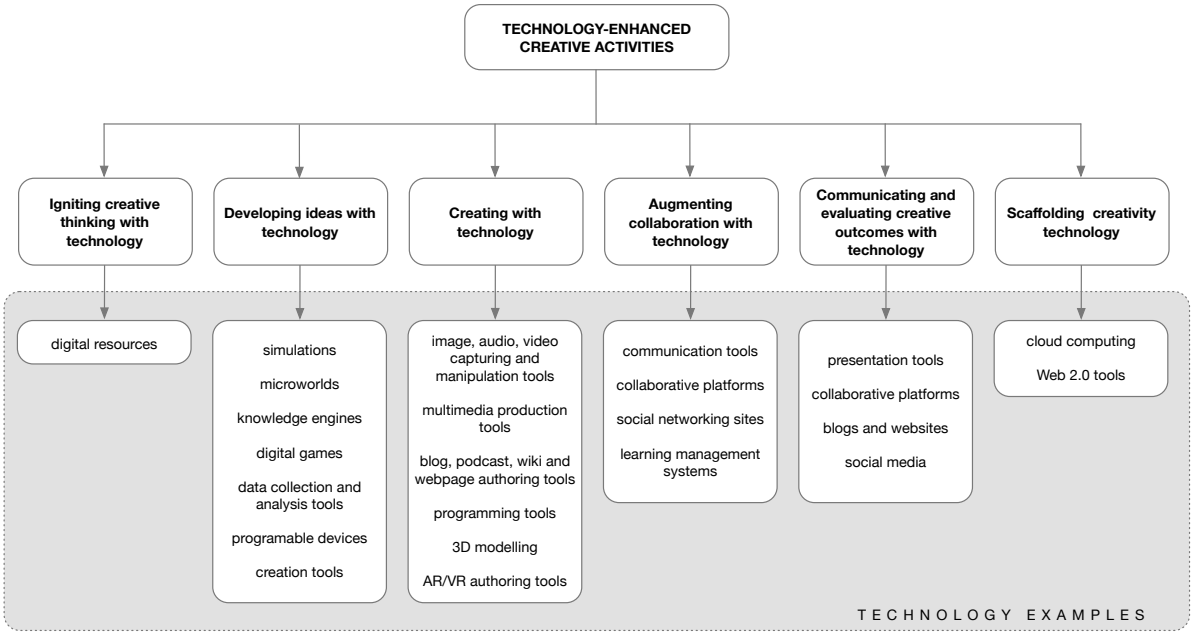


Figure 4. Digital pedagogy expert teachers' pedagogical beliefs of nurturing creativity with technology in Study 2

Third, digital pedagogy expert teachers in Study 2 perceived several barriers and few enablers to fostering creativity with technology at system, culture, interpersonal, and personal levels. Most cited barriers were those external to the teachers: packed restrictive curricula, often discussed together with lack of time and final exam pressure, lack of student access to appropriate technology in schools, a creativity-stifling pedagogical culture, and students' creativity-related attitudes, values, and beliefs. Most important enablers included students' use of their own devices in the classroom and at home, students' positive attitudes to technology and non-traditional professional development opportunities. Such supports and facilitators mediate how teachers translate their technology-enhanced creativity-fostering belief into classroom practices.

Finally, findings on teachers' beliefs-in-action showed that beliefs about creativity and its nurture with technology is reflected in classroom practice while their enactment is dependent on factors both internal and external to the teachers. Based on Study 2 it can be concluded that a barrier threshold (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012) exists in the enactment of teachers' beliefs, and technology-enhanced creativity-fostering practices can be limited despite beliefs.

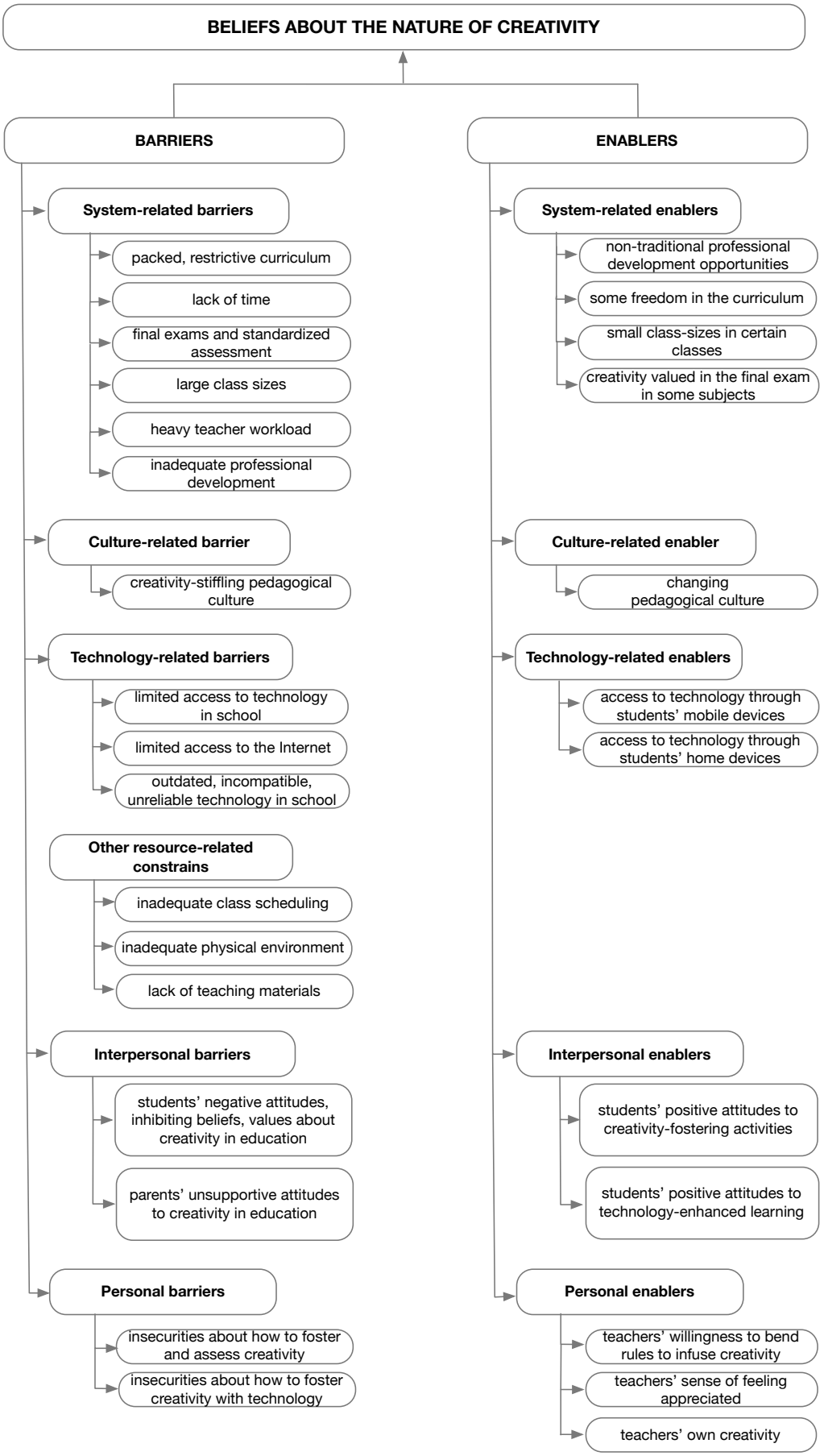


Figure 5. Perceived barriers and enablers to fostering creativity with technology in Study 2

5.4. Limitations and future directions

There are several limitations associated with this study. First, limitations include those commonly associated with case studies. Thus, findings of the current research are not appropriate for generalization. Instead of generalizability this study supports transferability. By providing a detailed description of the participating digital pedagogy expert secondary school teachers' beliefs and experiences of nurturing creativity with technology and their contexts others can evaluate the extent to which conclusions drawn are transferable to other situation, times, and settings. Second, given that teachers in this study were selected based on their expertise in digital pedagogy, implications may apply only specifically to this population. Hence, Study 2 may provide little insight into beliefs and practice for teachers who are at lower level of technology integration. In addition, teachers involved in the study taught specific subjects in secondary schools, which may also limit the range of implications. Subsequent research on teachers' belief and experience of nurturing creativity with technology would benefit from involving primary school teachers, too.

Third, Study 2 is subject to several methodological limitations. The descriptions of Hungarian digital pedagogy expert teachers' beliefs and experiences with regard to fostering creativity with technology were supplemented with classroom observations, image, and document analysis to reveal the relationship between teachers espoused and enacted beliefs. Nevertheless, due to limited funds, time, and participant access, only one site visit was coordinated for each teacher, which may not allow for an accurate portrayal of the teachers' technology-enhanced creativity-fostering beliefs in action. Future studies may include longitudinal investigations to better document teachers' beliefs and experiences. Through using different data sources the study could yet provide an in-depth description of the phenomena. Also, data for the present study was drawn from teachers' self-reports and observation of practice. Future studies would benefit from incorporating students' perspectives on the role of technology to foster creativity as well as their perceptions of teachers' technology-enhanced creativity-fostering practices.

Finally, it is important to note that Study 2 makes no claims about the effectiveness of the technology-enhanced creativity-fostering practices reported or observed, rather it hopes to generate a range of technology-integrated instructional approaches and activities the effectiveness of which for creativity and learning could be explored and empirically tested.

6. CONCLUSIONS AND IMPLICATIONS

The results of this qualitatively driven multimethod study have several implications which can help create opportunities to promote students' creativity across the curriculum in schools both in Hungary, and in other countries. These implications are assigned to different agents, namely policymakers, teacher educators, and teachers themselves.

6.1. Implications for policymakers

Beyond establishing creativity as an outcome for students, **policy documents should include research-based definitions and conceptualizations of creativity across curricular areas and education levels to increase teachers' understanding of the phenomena**. Both Study 1 and Study 2 revealed that despite several common elements, teachers define creativity in various ways. Study 1 also highlighted that though educators from various settings and cultures generally value creativity and believe it can be nurtured, many of them also hold beliefs that could as act as barriers to fostering creativity in the classroom. Study 2 found that highly accomplished teachers' creativity-beliefs may be more aligned with the literature, still there are certain aspects of creative pedagogy in the understanding of which they need support (e.g. assessment). Offering a research-based definition and conceptualizations in policy documents as well as framing creative pedagogy in the curriculum in more detail could increase the likelihood that teachers develop more coherent and research-aligned views, which in turn might lead to more effective creativity-fostering practices, either with or without the use of technology.

Policy documents should offer guidelines on how technology can promote creativity across the curriculum. Study 1 highlighted that teachers may adopt various stances in relation to the role of technology in creativity viewing technological tools as enablers or barriers to students' creative development. In addition, though few studies explored teachers' beliefs about technology-supported creativity-enhancement in-depth, these suggest that educators in certain contexts may have vague ideas on how to promote creativity with technology across the curriculum. Weaving technology-enhanced creativity into the curriculum based on the theoretical frameworks provided by the literature and Study 2 could support teachers to enrich their pedagogical repertoire, and promote students' creative capacities with digital tools in a more conscious way.

Education policy should address challenges and advance facilitators to promoting creativity in the classroom including those that are technology-related. Findings of both Study 1 and Study 2 revealed several barriers teachers perceive to promoting creativity which

prevent them from translating their positive beliefs into creativity-fostering classroom practices in various ways. Study 1 showed that most widely cited barriers to nurturing creativity across studies and cultures were lack of time and training, inadequate resources, overloaded curriculum, standardized tests, and difficulties in assessing creativity. For Hungarian digital pedagogy expert teachers, the most agreed on constrains to technology-supported creativity-enhancement were packed and restrictive curricula, often discussed together with lack of time and final exam pressure, lack of student access to appropriate technology in schools, a creativity-stifling pedagogical culture, and students' creativity-related attitudes, values, and beliefs. Constrains mediate how teachers translate their creativity-fostering beliefs into classroom practices, thus educational policymakers should take into account teachers' points of views, and examine these factors.

6.2. Implications for teacher educators

Creativity should be included in teacher education curricula. Findings in Study 1 suggest that teacher education should lay special emphasis on supporting teachers to conceptualize, recognize, explicitly teach for, and assess creativity across specific subject areas and grade levels, while Study 2 revealed that the assessment of creativity is a key area which should be specifically targeted in professional development. Training also needs to address teachers' creativity and technology beliefs by including opportunities for participants to make their beliefs explicit, and reflect on them in the light of new knowledge and experience gained.

Teacher education should address the role of technology in promoting students' creativity. Study 2 found that teachers had several ideas on how to promote creativity and implemented a range of technology-supported creativity-fostering activities, while other teachers in Study 1 had more limited views. These findings also suggest that teacher education should build on exemplary teachers' experience and involve them in the education of others.

Teacher education should prepare educators to address barriers to fostering creativity and using technology, and help them develop mechanism to cope with constrains. Infusing creativity into a packed curriculum, or addressing students' and parents' negative attitudes to creative education, as well as using mobile technologies to support creativity are some issues teacher educators might consider to tackle in professional development in the Hungarian context as suggested by Study. 2. Courses, training programmes, and workshops could also offer opportunities for participants to discuss constrains with each other and find creative strategies to confront these.

6.3. Implications for practice

Teachers need to monitor their own beliefs and cultivate self-responsibility to acquire knowledge about creativity and its nurture. Both Study 1 and Study 2 highlighted that educators might hold beliefs that act as barriers to fostering creativity in education, while Study 1 revealed that some have limited conceptions of creative pedagogies. Teachers could use current creativity research to inform their beliefs. In addition, self-directed learning from online resources and collaboration through digital tools enabled teachers in Study 2 to develop technology-supported creativity-fostering ideas for the classroom. Such forms of non-traditional professional development could play a key role in developing more effective classroom practices to promote creativity in education.

7. CONTRIBUTIONS OF THE STUDY TO CREATIVITY RESEARCH

In addition to practical implications, the present multimethod study also contributed to existing literature in the following ways:

The study **contributed to a better understanding of teachers' beliefs about creativity and its nurture through technology by synthesizing the most rigorously available recent empirical evidence bas**e. Though a systematic review of teachers' beliefs about creativity has been carried out before (Andiliou & Murphy, 2010), more recent beliefs and those about nurturing creativity with technology have not been yet synthetized.

The study **investigated highly accomplished teacher' beliefs and experience with nurturing creativity with technology for the first time in the literature**. Though highly accomplished teachers' beliefs about creativity (Henriksen & Mishra, 2015; Merriman 2015; Scott, 2015) and technology (Ertmer et al., 2012; Ottenbreit-Leftwich, Liao, Sadik, & Ertmer, 2018) have been explored separately before, the current study focused for the first time on exemplary teachers' beliefs and experience of nurturing creativity with technology. The study thus provides insights into what may work in the classroom in terms of fostering students' creativity with technology, informing research and practice about possible effective technology-enhanced creativity-fostering activities.

By identifying six types of technology-enhanced activities perceived as valuable digital pedagogy expert teachers for fostering creativity across the secondary curriculum, the study **established a new framework for technology-enhanced creativity fostering pedagogies grounded in the realities of the classroom**. In addition, the study identified several subject-specific creative activities with technology applied in the classroom, the effectiveness of which can be tested empirically by future research.

The study **provided a list of constraints and facilitating factors with respect to fostering students' creative capacities, and specifically to using technology in the process.** Study 1 first gathered facilitators and constrains to fostering creativity based on existing empirical evidence, while Study 2 provided a list of specific influencing factors associated with fostering creativity through technology in Hungary. Researchers can evaluate the transferability of the identified facilitators and constrains to other situation, times, and develop measures based on them.

The study **filled the gap in the Hungarian context by examining Hungarian teachers' beliefs about and experience with fostering creativity and using technology in the process for the first time**. Thus, the study contributed to the understanding of the relationship among creativity-related beliefs, practices, and influences within the Hungarian education system.

8. SUGGESTIONS FOR FUTURE RESEARCH

The multimethod study presented in this dissertation, being of an exploratory nature, raises a number of opportunities for future research at the intersections of creativity, technology, learning, and teachers' beliefs.

First, Study 1 showed that there are context-related variations in teachers' beliefs about creativity. Future studies could benefit from exploring the similarities and differences between teachers' beliefs in various settings, also other than cultural, through comparative studies and replications. Research in these areas would elucidate specific beliefs framed by the specific contexts in which teachers practice. Study 1 also found that various teacher groups hold different beliefs about the usefulness of technology to promote creativity. Findings showed that many teachers across the studies viewed technology as an important enabler or a serious barrier to creativity education in K-12 settings, while others had more balanced views. Future research could investigate teachers' value beliefs regarding the role of technology in creativity together with other potentially associated one's such as those about creativity, the role of technology in learning, and knowledge to explore underlying reasons. Such studies could inform interventions aimed at helping teachers develop more sophisticated beliefs about the relationships among creativity, technology, and learning.

Second, Study 1 revealed a concern for disruptive technologies impeding students' creativity in the classroom. The potential of technology to act as a barrier to creativity was also expressed by digital pedagogy exemplary teachers in Study 2. Educational research could investigate the effects of various levels of student access to technology in creative ideation or phases of creative production in K-12 settings to provide guidance for practice in this respect.

Third, Study 2 identified six types of technology-enhanced activities digital pedagogy expert teachers believed were valuable for fostering creativity across the secondary curriculum: igniting students' creative thinking with technology, developing and exploring ideas with technology, creating with technology, scaffolding student creativity with technology, augmenting collaboration with technology, communicating and evaluating creative outcomes with technology. In addition, Study 2 provided a numbers of domain specific creative activity examples based on digital-pedagogy expert teachers' view. These categories and examples could be used to develop scales to measure teachers' value beliefs about the role of technology in promoting creativity, and determine the relevance of the categories and activities identified for different grade levels and subject groups, and involving more traditional teacher populations.

Fourth, Study 2 offered a new framework for technology-enhanced creativity fostering pedagogies grounded in the realities of the classroom, and identified several subject-specific creative activities with technology for future empirical investigations. Thus, possible future research suggested by Study 2, include, for example, the examination of the role of different types of digital resources (video, audio, multimedia, teacher created, student created) to engage students in creative thinking; the effectiveness of using simulations, knowledge engines, and microworlds during inquiry-based learning in the STEM areas, as well as of commercial history-related games on students' learning and creativity in these domains. In addition, longitudinal studies could explore the effects of producing various digital products highlighted by Study 2 on students' learning as well as on their digital and domain-specific creativity. Future studies could also investigate the feasibility of promoting creativity through blended environments in K-12 settings, and the effects of diverse purposes and audiences enabled by technology on students' creative production and learning.

Fifth, Study 1 and Study 2 identified several barriers and enablers to nurturing creativity, and specifically to nurturing it with technology. Future studies could determine how the influences identified apply to other teachers' contexts and settings as well as explore the relationships between influencing factors.

Finally, it was evident that there was a serious lack of research on teachers' beliefs about and experience of nurturing creativity, either with or without the use of technology in the Hungarian context. Future studies could adopt both qualitative research and explore the rich data from it, and use statistical measurements and analyses to refine and further elaborate the novel findings in the present study.

9. REFERENCES

Andiliou, A., & Murphy, K. P. (2010). Examining variations among researchers' and teachers' conceptualizations of creativity: A review and synthesis of contemporary research. *Educational Research Review, 5*(3), 201–219. doi:10.1016/j.edurev.2010.07.003

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study Design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544–559.

Beghetto, R. A. (2010). Creativity in the classroom. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge Handbook of Creativity* (pp. 447–463). New York, NY: Cambridge University Press.

Bereczki, E. O. (2016). Mapping creativity in the Hungarian National Core Curriculum: a content analysis of the overall statements of intent, curricular areas and education levels. *The Curriculum Journal, 27*(3), 330–367.doi:10.1080/09585176.2015.1100546

Bereczki, E. O., & Kárpáti, A. (2018). Teachers' beliefs about creativity and its nurture: A systematic review of the recent research literature. *Educational Research Review, 23*, 25–56. doi:10.1016/j.edurev.2017.10.003

Bereczky, K., & Fejes, J. B. (2010). Pedagógusok nézeteinek és tapasztalatainak vizsgálata egy deszegregációs intézkedéssel összefüggésben. *Magyar Pedagógia*, *110* (4), 329–354.

Buda, A. (2010). Pedagógusok véleménye az IKT eszközök használatáról. *Pedagógusképzés, 2–3, 42–54*.

Cachia, R., & Ferrari, A. (2010). *Creativity in schools: a survey of teachers in Europe.* European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Seville, Spain. Retrieved from: http://ftp.jrc.es/EURdoc/JRC59232.pdf

Denzin, N. K. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods*. New York, NY: McGraw-Hill.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education, 59*(2), 423-435

Falus, I., Golnhofer, E., Kotschy, B., Nádasi, M., Szokolszki, Á. (1989). *A pedagógia és a pedagógusok*. Budapest: Akadémiai Kiadó.

Fives, H., & Buehl, M. (2012). Spring cleaning for the "messy" construct of teachers' beliefs: What are they? Which have been examined? What can they tell us? In K. R. Harris, S. Graham, & T. Urdan (Eds.), *APA Educational Psychology Handbook: Individual Differences and Cultural and Contextual Factors* (Vol. 2, pp. 471–499). Washington, DC: APA.

Geertz, C. (1973). *The Interpretation of Cultures: Selected Essays*. New York, NY: Basic Books.

Glăveanu, V. P., Ness, I. J., Wasson, B., & Lubart, T. (2019). Sociocultural Perspectives on Creativity, Learning, and Technology. In C. A. Mullen (Ed.), *Creativity Under Duress in Education?* (pp. 63–82). Cham, Switzerland: Springer.

Golnhofer, E., & Nahalka, I. (Eds.) (2001). *A pedagógusok pedagógiája*. Budapest: Nemzeti Tankönyvkiadó.

Gough, D., Oliver, S., & Thomas, J. (2012). Introducing systematic reviews. In D. Gough, S. Oliver, & J. Thomas (Eds.), *An Introduction to Systematic Reviews* (pp. 1–16). London, United Kingdom: Sage.

Heilmann, G., & Korte, W. B. (2010). *The role of creativity and innovation in school curricula in the EU27: A content analysis of curricula documents*. Seville: European Commission, Joint Research Centre,

Institute for Prospective Technological Studies. Retrieved from http://ftp.jrc.es/EURdoc/JRC61106_TN.pdf.

Henriksen, D., & Mishra, P. (2015). We teach who we are: Creativity in the lives and practices of accomplished teachers. *Teachers College Record, 117*(7), 1–46.

Hercz, M. (2005). Pedagógusok szakember-és gyermekképe (Gondolatok a kognitív fejlődésről vallott nézetek megismerése közben). *Magyar pedagógia*, *105*(2), 153–185.

Hungarian National Core Curriculum. (2012). Budapest: Ministry of Human Resources. Retrieved from http://www.ofi.hu/sites/default/files/WEBRA/2014/04/NAT_2012_EN_final_2014marc14.pdf

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14–26.

Kis-Tóth, L., Borbás, L., & Kárpáti, A. (2014). Táblagépek alkalmazása az oktatásban: tanári tapasztalatok. *Iskolakultúra*, *14*(9), 50–71.

Lai, E. R., Yarbro, J., DiCerbo, K. E., & deGeest, E. (2018). *Skills for today: What we know about teaching and assessing creativity*. Retrieved from: http://www.p21.org/storage/documents/Skills_For_Today_Series-Pearson/Creativity_White_Paper_FINAL.pdf

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills, CA: Sage.

Loveless, A. (2003). Creating spaces in the primary curriculum: ICT in creative subjects. *The Curriculum Journal*, *14*(1), 5-21.

Loveless, A. M. (2007). Retrieved from: *Creativity, technology and learning – A review of recent literature, (No. 4 update)*. http://www.nestafuturelab.org/download/pdfs/research/lit_reviews/Creativity_Review.pdf

Lubart, T. (2005). How can computers be partners in the creative process: Classification and commentary on the Special Issue. *International Journal of Human-Computer Studies, 63*(4-5), 365–369.

Luckin, R., Bligh, B., Manches, A., Ainsworth, S., Crook, C. & Noss, R. (2012). Decoding learning: The proof, promise and potential of digital education. London: Nesta Futurelab. Retreived from: http://www.nesta.org.uk/publications/decoding-learning.

Ma, H. H. (2006). A synthetic analysis of the effectiveness of single components and packages in creativity training programs. *Creativity Research Journal, 18*, 435–446.

Merriman, T. J. (2015). *A phenomenological approach to understanding Pro-C level teachers' perceptions of creativity (Doctoral dissertation)*. Available from ProQuest Dissertations and Theses database. (UMI No. 1771637095).

Mertens, D. M. (2010). *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed methods* (3rd ed.). Thousand Oaks, CA: Sage.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook*. Thousand Oaks, CA: Sage.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. ThePrismaGroup. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*(7), e1000097. http://dx.doi.org/10.1371/journal.pmed.1000097.

Molnár, G., & Kárpáti, A. (2012). Informatikai műveltség. In B. Csapó (Ed.), Mérlegen a magyar iskola. (pp. 441–476). Budapest: Nemzeti Tankönyvkiadó.

Morse, J. M., & Niehaus, L. (2009). *Mixed-method design: Principles and procedures.* Walnut Creek, CA: Left Coast Press.

Nikolopoulou K. (2018) Creativity and ICT: Theoretical approaches and perspectives in school education. In T. Mikropoulos (Eds.), *Research on e-Learning and ICT in Education* (pp. 87–100). Cham, Switzerland: Springer.

Oliver, S., & Sutcliffe, K. (2012). Describing and analysing studies. In D. Gough, S. Oliver, & J. Thomas (Eds.). *An Introduction to Systematic Reviews* (pp. 153–178). London, United Kingdom: Sage.

Ottenbreit-Leftwich, A., Liao, J. Y. C., Sadik, O., & Ertmer, P. (2018). Evolution of Teachers' Technology Integration Knowledge, Beliefs, and Practices: How Can We Support Beginning Teachers Use of Technology?. *Journal of Research on Technology in Education*, *50*(4), 282–304.

Patton, M. Q. (2002). *Qualitative Evaluation and Research Methods* (3rd ed.). London, UK: Sage.

Robson, C., & McCartan, K. (2016) *Real World Research (4th ed.)*. Chichester, UK: Wiley.

Scott, G., Leritz, L. E., & Mumford, M. D. (2004a). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal, 16,* 361–388.

Scott, G.M., Leritz, L.E. and Mumford, M.D. (2004b) Types of creativity training: Approaches and their effectiveness. *The Journal of Creative Behavior, 38*, 149–79.

Scott, K. A. (2015). *Creativity: Conceptions of a group of exemplary teachers (Doctoral dissertation)*. Available from ProQuest Dissertations and Theses database. (UMI No. 1696291085).

Shaheen, R. (2010). Creativity and education. *Creative Education, 1*(3), 166–169.

Stake, R. E. (2006). *Multiple Case Study Analysis*. New York, NY: Guilford.

Tóth, B. (2008). Tanítójelöltek olvasással kapcsolatos nézetei, *Pedagógusképzés, 4*, 35–49.

Tóth, E., (2011). Pedagógusok nézetei a tanulóiteljesítmény-mérésekről, *Magyar Pedagógia, 3*, 225–249.

Yin, R. K. (2014): *Case Study Research, Design and Methods (5th ed.)*. Los Angeles, CA: Sage.

10. PUBLICATIONS RELATED TO THE TOPIC OF THE DOCTORAL THESIS

JOURNAL ARTICLES

Bereczki, E. O. (2019). A kreativitás fejlesztése digitális eszközökkel támogatott tanulási környezetben, *Iskolakultúra, 29* (4-5), 50–70. DOI: 10.14232/ISKKULT.2019.4-5.50

Bereczki, E. O., & Kárpáti, A. (2018). Teachers' beliefs about creativity and its nurture: a systematic review of recent research literature, *Educational Research Review, 28*, 25-56. https://doi.org/10.1016/j.edurev.2017.10.003

Bereczki, E. O. (2016). Conceptualizations of creativity in the curriculum: the Hungarian case. *Neveléstudomány, 4*(3), 5-20.

Bereczki, E. O. (2015). Mapping creativity in the Hungarian National Core Curriculum: a content analysis of the overall statements of intent, curricular areas and education levels. *The Curriculum Journal, 27*(3), 330-367. doi:10.1080/09585176.2015.110054

CONFERENCE PROCEEDINGS AND PRESENTATIONS

Bereczki, E. O. (2018, November). Creativity in offline, blended, and online environments [Kreativitás offline, blended és online környezetben]. Conference of the Pedagogy Department of the Hungarian Academy of Sciences: Teaching and learning in the digital culture. Veszprém, Hungary.

Bereczki, E. O. (2018, November). Kreativitás digitális környezetben. Paper presented at the Digital Conference 2018 – Digital Space [Digitális konferencia 2018 – Digitális tér]. Budapest, ELTE PPK.

Bereczki, E. O. és Kárpáti, A. (2018, November). Nurturing students' creativity in technology-enhanced learning environmnets [A tanulói kreativitás fejlesztése IKT-ezközökkel támogatott tanulási környezetben]. 18th National Education Science Conference, Budapest, Hungary.

Bereczki, E. O., and Kárpáti, A. (2018, May). The relationship between teachers' beliefs about creativity and classroom practice: What we assume and what we know? UK Creativity Researchers' Conference, Christ Church University, Canterbury, UK.

Bereczki, E. O. & Kárpát, A. (2016, November). A systematic literature review of teachers' beliefs about creativity: How to synthetize and present results in an educational systematic review? [Tanárok kreativitásról vallott nézeteinek szisztematikus szakirodalmi áttekintése: Egy neveléstudományi áttekintés eredményeinek összegzése, bemutatása]. 15th National Education Science Conference: Interdisciplinary Approaches in Learning and Teaching, Szeged, Hungary.

Bereczki, E. O. (2014, November). Creativity and the Hungarian system of content regulation [A kreativitás megjelenése a hazai tartalmi szabályozás rendszerében]. 14th National Education Science Conference: Education - Practice and Science, Debrecen, Hungary.