

Supporting children's creative writing skills with the help of generative artificial intelligence

Untertitel des Artikels

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Abstract

This study aims to enhance creative writing skills in 6–8-year-old children using generative artificial intelligence (GAI). While research on writing skills has primarily focused on spelling and linguistic features, there is a gap in understanding the creative aspects of writing. The study collaborates with GAI experts, teachers, and pupils to develop safe ways for GAI to support creative writing. Three objectives guide the study: understanding teachers' knowledge and expectations of GAI, creating a safe GAI application, and developing pedagogically sound ways to use GAI in classrooms. The study employs both qualitative and quantitative research methods, including interviews, observations, and questionnaires. The findings will contribute to research on the development of literacy skill research in early childhood education and advance the field of educational GAI.

Keywords: e-learning; generative artificial intelligence; creative writing; early childhood education; children.

The Future of Literacy: Integrating Generative Artificial Intelligence into Children's Writing Education

Recently, there has been widespread national and international concern and debate about children's and young people's declining literacy skills. Finnish 15- and 10-year-olds have performed earlier well in large international studies on reading (OECD 2010; 2014; Kupari et al. 2012; Leino et al. 2017), but in recent PISA- and PIRLS -tests the results of Finnish students' reading have diminished. These declining results in reading are also a global trend (OECD 2019; Hiltunen et al. 2023; Leino et al. 2023). Paralleling these reading developments, national Finnish assessments of young students' competencies in producing texts have shown weakening and the differences between students have become bigger (Lappalainen 2008; Harjunen & Rautopuro 2015; Ukkola & Metsämuuronen 2021). Apart from this, the studies of early literacy skill (6–8-year-olds) in Finland have found differences in skill and motivation development (Lerkkanen et al. 2011).

Especially in the digital age, early writing skills are argued to be an essential prerequisite for further academic achievement (e.g., Burnett and Merchant 2015; Merchant 2007). Early writing skills can be divided into three large components: writing concepts (knowledge of purposes of print and how print works), transcription skills (handwriting and spelling) and composition skills (creative sides of writing) (Rohloff et al. 2023). However, research on writing skills in early elementary level is stressed on spelling skills and linguistic features of produced text. There is a lack of studies on creative sides and process of writing (Graham et al. 2012; Kulju et al. 2017). Creative writing could be defined in various ways. Definitions involve the notions of children's imagination, choice, and originality as well as creativity through the process of writing (Barton et al. 2023). The importance of creative writing in children's development lies in its capacity to nurture imagination, broaden problem-solving skills, and encourage deep thinking (Grainger et al. 2005; Sahin & Polatcan 2019). Therefore, we are concentrating in this study on possibilities to develop early elementary pupils' creative writing skills.

It must take into account that the balance in teaching literacy skills in early elementary level needs to be on the components of early writing. However, attention should also be focused on text design skills (Cope & Kalantzis 2015) and above all on how and why texts are used and how they serve individuals and communities in their purposes. According to the sociocultural understanding of writing (Hamilton & Barton 2001; Bazerman 2016), text genres are communal, so pupils should learn to write them together. The literacy skills needed in today's world are increasingly participatory, collaborative, and sharing, and require also productive literacy skills including writing skills (Voogt & Roblin 2010). These new requirements for reading, writing and language literacy have been considered in the national core curriculum for basic education (Finnish National Agency for Education 2021), where the central concept of multiliteracies emphasises both text production and critical evaluation skills, and texts are intended to be produced collaboratively as well as alone, already on early elementary grades.

Digital technologies are seen as a way to increase social interaction and peer collaboration, composing processes and skills as well as a way for pupils to engage in writing instruction (Williams & Beam 2019). Over the last couple of years, the rapid emergence of easy access generative artificial intelligence (GAI) tools such as ChatGPT and Midjourney has challenged

the idea of literacy skills needed. GAI refers to machine learning models that use patterns learned from data to simulate creative processes and generate

new and coherent outputs, such as text or images. These models leverage neural networks to produce content that goes beyond what was explicitly in their training data. This enables learners to concentrate on developing and expressing their ideas rather than the mechanics of writing. Additionally, GAI tools hold the promise of improving accessibility for a wide range of students, fostering novel avenues for creative self-expression, and enabling the development of immersive and interactive educational environments (Baidoo-Anu & Ansah 2023; Chheang et al. 2023; Kadaruddin 2023). Since publicly available GAI applications are still relatively new, research on them in education is still emerging during the past couple of years. Furthermore, owing to the swift and dynamic evolution of technology, the practicality of GAI tools and their integration within pedagogical frameworks remain insufficiently investigated. Research has also primarily focused on higher education, and GAI is often viewed more as a tool for teachers than for learners (Bahroun et al. 2023). In addition, GAI language models are scarcely available for smaller language groups and are not particularly tailored for children.

In public debate about GAI in education, the predominant emphasis has been on student misapplication of this technology, while the prospective benefits offered by GAI tools have frequently been disregarded (Pack & Maloney 2023). Several critical issues are associated with the safety, bias, and dissemination of misinformation within the GAI system. These challenges encompass ensuring equitable access, safeguarding student privacy, and effectively countering AI-generated misinformation (Han & Cai 2023). In cases where young children are using these applications, as in this study, it is especially important to identify these challenges. Hence, within the realm of education, it holds significance to actively involve students in shaping their interactions with GAI by investigating strategies for incorporating GAI to enhance student cognition and foster creativity (Kasneci et al. 2023).

Even though GAI has its unique strengths and weaknesses, it holds significance for educators to comprehend emerging technologies and discern the types of comprehension and knowledge that are optimally facilitated by these innovations (Mishra et al. 2023). Teachers' specialized form of professional knowledge to support technology integration into teaching is called Technological Pedagogical Content Knowledge (TPACK). TPACK framework, first introduced by Koehler and Mishra (2005), divides teachers' knowledge into three foundational knowledge areas, technological, pedagogical and content knowledge. In the framework, teachers' professional knowledge builds on combination and interplay of these knowledge areas. From the perspective of teacher education and ICT integration, the TPACK framework has been extensively utilized at different school levels and in different phases of teacher careers (e.g. Voogt & Roblin 2010; Zhang & Tang 2021; Kontkanen et al. 2024). Therefore, it is chosen as a one central framework of this study of studying teachers' knowledge and expectations of GAI in education.

Consequently, the goal of this study is to develop in co-operation with GAI experts, teachers, and pupils pedagogically sound and safe ways to use GAI in supporting children's creative writing skills. The study is structured under three objectives, aligning with the design-based research (DBR) outlined by Edelson (2002). The first objective is to discover teachers' knowledge and expectations of GAI. The second objective is to create safe GAI application for supporting children's creative writing in co-operation with GAI experts, researchers, and

teachers. The third objective is to develop pedagogically sound ways to use GAI application to support creative writing skills in classroom. This study employs a mixed-methods approach, utilizing both qualitative and quantitative research methods.

The Design-Based Research to Tackle Gai Use in Creative Writing with Young Children

This study is DBR, which applies a co-design approach aligning Edelson's (2002) model. DBR endeavours to propel research, design, and practice by fostering collaboration among participants (such as teachers) during the initial stages of crafting technology-enhanced learning environments. This collaborative effort aims to achieve optimal alignment with the local context. The subsequent process of actual implementation across diverse settings constitutes a pivotal aspect of the research endeavour. For instance, in the domain of creative writing, these varied settings encompass the dynamic interplay between the GAI system, instructional materials, educators, and learners (as exemplified by the Design-Based Research Collective in 2003). Importantly, DBR also anchors its designs in prior research while concurrently striving to yield broader advancements in both theoretical understanding and practical design (Wang & Hannafin 2005; Tinoca et al. 2022).

The co-design process consists of six cycles. The first builds on TPACK-GAI questionnaire, a modified version of the TPACK-21 questionnaire by Valtonen et al. (2018) (n=200) and teachers' interviews (n=30). The ideas, challenges, opportunities and risks of using GAI in education presented by the teachers in the questionnaire and the interviews are mapped and will serve as a basis for the technical design of the first version of the GAI application. In order to catch the versatile process of pupils' creative writing, possibilities of learning analytics (LA) attached to GAI application are also mapped. The second cycle consists of workshops of teacher groups (three groups of 20 in- or pre-service teachers), where the teachers test the first version of the GAI application and give feedback and suggestions for improvement. The workshops will be recorded and written material will also be collected. At the same time, a few early elementary pupils (two to three) will test the app. These sessions will be recorded and the pupils will be interviewed. Experiences and feedback from the second cycle are mapped and used as a basis for the second version of the GAI application. The third cycle of co-design is similar to the second cycle; teachers will test applications and give feedback and suggestions. For this version of the GAI application, a larger group of pupils (n=20) will use it. The data collected in this cycle will consist of recorded workshops, written materials from workshops, video-recorded observations of GAI use with pupils and video-stimulated recall interviews of participating pupils (n=10). Experiences and feedback from the third cycle are mapped and used as a basis for the final version of the GAI application.

In the fourth cycle, different groups of teachers in workshops (three groups of 20 in- or pre-service teachers) will develop a range of practical class-room activities using the GAI application to teach productive writing to early elementary pupils. The workshops will be recorded and the written material of developed activities will also be collected. The fifth cycle will be carried out in two elementary level classes, in close collaboration with researchers,

class teachers and pupils. The practical activities developed in the fourth cycle will serve as the basis for the co-design of pedagogical testing in classrooms. The idea in this cycle is to learn to use the GAI application technically and in creative writing pedagogically in various ways. Depending on the timetable of the participating classes, the testing will last around 10 lessons each during the fall semester. The planning sessions will be recorded and written material such as diaries, lesson plans and emails of the codesign process will be collected. During the testing lessons, observation data and video recordings will be collected and after the testing some pupils (n=20) are interviewed with the video-stimulated recall method (Lyle, 2003). Artifacts (texts, pictures, movies) produced by pupils using the GAI application and possible LA data during the process are also collected. The process of creative writing can be examined through LA attached to the GAI application. Pupils' artifacts can be assessed from the perspective of language (for example, word choice, imagery, clarity) and their development throughout the process. The sixth cycle will draw on the experiences of the fifth cycle and be implemented in the same two classes. The purpose of this cycle is to integrate the testing of the GAI application and creative writing to the wider phenomenon being addressed and studied in the classroom. Data collection is similar to the fifth cycle.

Expected Benefits and Results of the Study

Currently, we have primarily encountered rather general-level studies and descriptions regarding the potential and challenges of using GAI to support learning. Furthermore, the focus of these studies has predominantly centered on the higher education context, with elementary-level considerations receiving limited attention. This research aims to elevate the discourse by delving into this uncharted territory, focusing on the convergence of GAI technology research with literacy skill development research. This approach holds promise for opening new avenues within the field of literacy skills and providing fresh perspectives to explore in future research. The use of GAI typically raises questions concerning safety and age limitations. One of the significant benefits of this research is its potential to create a secure GAI learning environment within schools, leveraging also on the expertise of experienced teachers.

When studying teachers as users of GAI, the TPACK-21 instrument will be adapted and tested. This instrument will hold great importance within the academic community for assessing and researching teachers' GAI competencies. It will also represent a significant step forward within the TPACK community, as it updates their perspective for the AI age. This research also provides an international perspective on the topic. This allows for comparative research across various educational contexts and target groups with diverse backgrounds.

As part of the GAI environment for school children, the project explores and develops a suitable large language model (LLM) in Finnish. The development uses existing models, such as FinGPT-3 from the TurkuNLP research group. The models will be developed further to fit the school education context by finetuning them. Functional Finnish LLMs are few, especially for GAI safety and elementary-school children.

According to Mishra et al. (2023), new technologies introduced into schools do not bring about significant changes. Instead, it is the new technologies integrated into our broader

society that drive these changes, with impact on schools. GAI can be viewed as one technology poised to reshape the world, with its effects extending to schools and classrooms. From this perspective, this research, aimed at developing insights and models to harness the potential of GAI for supporting learning and addressing the new challenges, holds paramount importance. When implemented effectively, this study can provide opportunities to exert a strong influence on children's and young people's reading skills and their interest in reading and writing. These outcomes are particularly valuable, given that recent PISA results have indicated strong declines in reading and writing skills in many countries.

Simultaneously, the results of this research offer societal benefits on a broader scale. The utilization of GAI at the elementary level places students at the forefront, enabling them to acquire valuable experiences in learning and collaborating with GAI. These experiences will be of importance in the future, as they provide students with essential skills for their future studies and eventual careers. Additionally, profiling teachers' readiness to incorporate GAI in supporting student learning will be necessary in the future when designing and implementing pre- and in-service training programs for educators.

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