IS THE MUSIC EDUCATION PARADIGM CHANGING? TESTING THE ELEMENTS OF CREATIVE AND PRODUCTIVE MUSIC EDUCATION APPROACH WITH STUDENT TEACHERS

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Abstract
In this article we open the focus on the productive and creative music education paradigm and test it in practice among a research group of student teachers (N=184) at the University of Eastern Finland (UEF). The productive and creative music education paradigm offers better ways of action in the use of music education pedagogy through a positive impact in pupils' motivation, self-concept, and self-efficacy beliefs, offering positive experiences and communality lifting pupils' interest to music as a school subject. Student teachers who do not have music as a minor subject were selected as a testing group for this research because they do not have a special relationship with music. In our earlier study we tested students who study to become secondary school music teachers (Ahtola & Juvonen, 2021). Our aim is to show that a change has already started in the music education paradigm from reproductive and traditional music education to creative and productive music education. In practice this is being mirrored in music educational research and in the everyday work of teachers (class teachers, class teachers with a minor in music and music teachers) who teach music from elementary classes to upper secondary school.
Our perspective is on the research of teaching practices of classroom teachers. The change of paradigm and its preconditions are visible in both practical music education work and empiric and philosophical music education research, to which we contribute with this study.
Keywords: *Creative and productive music education, change of paradigm, classroom teachers, music applications, music technology*

We mentioned the idea of a productive and creative music education paradigm and the need for a paradigm change in our earlier article (Ahtola & Juvonen, 2021; see also Juvonen, 2004b, 2006). In this article we move it another step forward, first opening the fundamental elements of productive music education paradigm and then testing some of its most important elements with future class teachers to see if it is powerful enough to become the ruling new paradigm in music education. We also offer

pedagogical solutions which could easily be carried out using the new principles in music education we have presented. We discuss motivation questions based on Eccles' and Wingfield's Expectancy-value theory (Eccles, Adler, Futterman, Goff, Kaczala, Meece & Midgley, 1983; Eccles, Wigfield, Flanagan, Miller, Reuman & Yee, 1989; Eccles, 1993; Eccles, Wigfield, Harold & Blumenfeld, 1993; Eccles & Wigfield, 1995, 2002). The concepts self-conception, self-assurance and self-efficacy expectations are based on the findings of the most important researchers in this article (Deci & Ryan, 1985a, 1985b, 1985c, 1991, 2000, 2002, 2012; Pajares, 1996, 2003; Bouffard, Marcoux, Vezeau & Bordelau, 2003; Ryan & Deci, 2017). Declarative knowledge (facts) and procedural knowledge (skills, know-how) are opened in discussing the dimensions of arts and skills in music education (Willingham & Preuss, 1995; Hietanen, 2002). The music pedagogy is also approached from curriculum's aims, teaching, and learning practices, along with the society's requirements.

Because a paradigm represents a broad view of the field of music education, we consider it necessary to reveal elements that are partly country-specific and partly international against the background of the Finnish music education and the Finnish national core curriculum. In any case, when dealing with paradigms and changing them, it is necessary to consider the various stages of development in different countries, people, and the current social situation, as well as the prevailing environmental circumstances, economic situation, philosophical and ideological differences, and other aspects of everyday life contextual issues.

Background

A. The starting points of music education

Music education recruits and combines perspectives and points of view from various disciplines in topics such as psychology, philosophy and education, acoustics, psychometry, cognitive and social psychology (Hargreaves, 1986; Hargreaves, Marshall & North, 2003). A couple of decades ago, the humanistic dimension was considered, and musicology and music education began to be explored from the human perspective and as a holistic experience. With this development, psychology and music education have converged in the research sense (Hargreaves et al., 2003).

In the United States of the 1950s, there was a perceived need for music education to find a firmer theoretical basis that could justify the importance of music in school curricula. John Dewey's educational philosophy, (trying to find a balance between the arts and skills with core subject) as well as Jerome Bruner (1960) influenced the educational philosophy of the time with their pupil-centered educational thinking. The music education philosophy was characterized by the synergy between psychology and philosophy typical of the era (Colwell & Richardson, 2002; McCarthy & Goble, 2002, 2005). The philosophy of music education reflects music education using philosophical means. Recently, the focus has shifted from psychological couplings closer to philosophical research excerpts, but it is useful to remember that the third cornerstone of music education is education. In education, music was sidelined for quite a long time: music teaching in schools was vocal instruction which was focused on pure performance and previously musicality was considered to be a talent (Stefani, 1987; Sloboda, 1993; Ahonen, 2004a, 2004b). With the elevation of the status of arts

education, music education has developed into a diverse segment of arts education, while forming an integral part of educational research (Anttila & Juvonen, 2002, 2003a, 2003b). The theoretical thinking of music education is characterized today mainly by influences derived from psychology, philosophy, and education, creating a challenge to the study of music education.

B. Definition and goals of music education

Music education can mean three things: music pedagogical research, music teaching, and education through music. Musical pedagogy may refer not only to research, but also more generally to music education activities (Väkevä, 1999; Kaikkonen, 2005). Music instruction, in turn, is defined as the development of musical abilities by pedagogical methods (Väkevä, 1999). Music education, such as upbringing, cannot generally be viewed as being detached from learning. In addition to learning music, the primary goal of music education is musical growth, which considers the full context of the upbringing and the life situation of the learner. The goal layout of music education is tied to the environment in which education takes place. From a learning environment perspective, the limits of music education are being broken. In addition to the formal learning environment (institutions such as school), learning takes place in informal learning environments (home and other social environments). The formal and informal environments differ in the decency of learning currents (Folkestad, 1996, 1998, 2006; Söderman & Folkestad, 2004; Vasil, 2019). Hargreaves (2003) also names the 'third environment', a social context in which learning takes place without teachers or parents (authority).

In the objective layout of music education, more and more frequently non-musical ambitions have begun to appear. In an extensive survey by Anttila and Juvonen (2003a), Finnish and Estonian music student teachers were asked to say why it is (or is not) important to teach music in school. The researchers divided the responses into two groups: meanings for an individual and meanings for culture. As relevant meanings to the individual, students cited factors such as emotions, creativity, and imagination, as well as an increase in mental well-being and social skills. Cultural meanings included general education, space of worldview, and meanings related to national culture (Regelski, 1981; Anttila & Juvonen, 2003a). Music is diverse and has a range of functions. Music education touches on the relationship between music and man and man and the world. In addition, music with other arts and skills offers sources of enjoyment and joy which cannot be found in other school subjects (Regelski, 1981, 1996, 1998; Reimer, 1989, 2003). These are emotional or based on emotion-focused pleasure.

C. Human conceptions in educational thinking

The premise of the review of music education is human conceptions as a system of beliefs, knowledge, and valuations about a human being. Human conception has a connection with the human perception of society and cultural specification with human conception or the view of man (Hirsjärvi, 2009). Human perception refers to the basic attitude to another human being that affects our individual interpersonal relationships (Rauhala, 2005). It is an important and ever-present basis of educational activities. Identifying one's own human perception increases the teacher's self-knowledge and ability for reflecting (Perttula, 1993; Puolimatka, 2002; Rauhala, 2005; Orpinas & Horne, 2006). The review of raising effects requires a holistic human

perception in which the use of channels of influence proceeds from holistic towards differentiated. Arts education contributes to the learner's psychic-intellectual experience (Puolimatka, 2002). The conception the pupil builds on their own activities and is based on an emotional sense of emerging which builds motivation and interest to certain school subjects leading to intrinsic enjoyment and experiences of mastery and competence (Byman, 1995, 2002; Lagerspetz, 1998).

In a practical educational field such as music education, we want answers to normative questions, namely how things should be. Music educators are often forced to justify the importance of teaching music and justifying is less effort in a society that idealizes culture. In music education, human perceptions are particularly raised in a reflection of whom music education 'belongs' to – to whom and how music is taught, and who can learn it. Changing the human image dictated by society requires modification of human perceptions (Rauhala, 2005). In a changing society, new currents of music education (e.g., special music education) require attention to new human perceptions in the layout of values, goals, and targets. In addition to these, attention is also required to music teaching practices, the classroom atmosphere, technology and pedagogical solutions and their background philosophy (Linnankylä, 1993; Kannas, 1995; Liinamo & Kannas, 1995; Creemers & Reezigt, 1999; Perttilä, Kautto, Lounamaa, Luopa, Ritamo & Rimpelä, 2003).

The literature of music education emphasizes learner-centeredness rather than teacher-centeredness (e.g., Anttila & Juvonen, 2002; Aittakumpu, 2005). Education also talks about concepts of learning (Tynjälä, Heikkinen & Huttunen, 2005). However, it has a clear difference in meaning over learner perception when referring to the theory of learning.

There is a cognitivist perspective in Western behavioral science, one in which interest is focused on describing and understanding the individual's information-building processes. The most notable variation of cognitivism is the constructivist conception of learning, which emphasizes that the individual himself, through his own actions, formulates his conception of the outside world (Piaget, 1968; Perry, 1999). To learn something, the learners must build their own understanding by tying new information to previous experiences. Cognitivist and constructivist learning theories lay the foundation for a deeper understanding of learner conceptions of music education. Learning theories affect the goals of teaching, and learner conceptions can be outlined based on a set of teaching goals. It is socio-constructivism that has been an important factor influencing the need for a paradigm shift in music education. From the traditional master-apprentice way of learning, there is a desire to move towards a modern vision in which each learner creates the prerequisites for their own learning. This way, a shift from repeating the models made by others towards creating one's own material has naturally taken place. In this case, models refer to songs, compositions, lyrics, poems, rhythm outlines, or any musical output that emerges within or outside the school context. These ideas are directly connected to creativity and creative thinking which have some demands to become true. The first is a creative way of thinking which requires active attitude towards own environment and belief in one's own opportunities to influence one's own learning processes. It means creative thinking and solving problems which did not exist in the first place. These are based on early experiences of other people in childhood, and interaction which creates the

base of the approach and attitude to different matters (Jacobs, Lanza, Oswood, Eccles & Wigfield, 2002; Running, 2008).

Defining a Paradigm

Gage (1963; see also Yoho, 1979), but especially Kuhn (1962a, 1962b), are the definers of the paradigm concept. According to Kuhn, paradigm refers to a set of beliefs adopted in the scholarly community as a framework from which the world is explored. It includes the principles, beliefs, and appreciations of the scholarly community (Collins & O'Brien, 2003). Concepts close to the paradigm include scientific school and research tradition. The concept of paradigm is used in behavioral and social sciences, like a reference framework, to specify and justify research problems and hypotheses as a compiled logical representation in which concepts are pre-defined. At best, the presentation is already verified. Then one can talk about the theory, which is a synthesis compiled by the scholars themselves from more theories. While the theory might be seen as a counterpoint to practice or empiric work when more profoundly understood, theory is the part of scholarly work that involves the analysis and organization of already compiled data (Hirsjärvi, 1982).

When using 'paradigm', Lindholm (1979) refers to norms or conceptions compiled in a particular community of researchers that influence the conceptions of scholars, as well as what should be studied and how it should be done. The underlying is the meaning created by Kuhn for the paradigm. There are three perspectives associated with the paradigm:

a) What is understood as the problem – what is self-evident and significant and what is unsolved?
b) What is understood as an explorable problem – what can be approached by scientific analysis rather than metaphysically, religiously, or unscientifically?
c) What falls within your own science and what falls outside of it?

Paradigm change is about the 'crisis of science', an escalation that leads to fracture and a new turn. There are always two sides to a crisis: one is liberation from the old, and the other is the beginning of a new one (Lindholm, 1979). However, development does not have to depend on 'scientific revolutions'. According to another view, there is a gradual paradigm shift in science and culture, including the idea of the fragmentation of reality into non-dimensional zones of knowledge or information (Tynjälä et al., 2005). Music education does not belong to the hard sciences, where changes may suddenly occur with a new empirical finding, but the sociocultural critique of music education can be seen as a new direction in the focus of scientists, and thus a new tradition of research formation.

A. The new paradigm of music education?

Dewey has been quoted in previous theories of music education (Swanwick, 1988; Reimer, 1989, 2003; Elliott, 1989a, 1989b, 1995, 2001, 2009), but interpretations can be understood in many ways. New interpretations of Dewey provide an opportunity to combine the perspectives of aesthetic and praxial music education into complementary synthesis, unlike until now. The sociocultural perspective plays a topical role in general educational activities and educational research (e.g., Anttila &

Juvonen, 2002; Hakkarainen, Lonka & Lipponen, 2005). When examining paradigm change, three perspectives must be considered: how the concept of paradigm has been featured in the philosophical theory formation of music education, how the key concepts of the new paradigm, praxialism and pragmatism, differ, and what paradigm change looks like from a learning theoretical perspective.

B. The concept of paradigm in music education

In musical education, the concept of paradigm has referred to changes in the focus of the philosophy of music education (Väkevä, 1999, 2004). Aesthetic music education represents the prevailing paradigm and praxial music education provides an alternative perspective (Westerlund, 1997, 2002).

Paradigms parse the historical and social timeline of the discipline. Väkevä (1999, 2004) notes Reimer's aesthetic philosophy of music education as representing its own paradigm, which can be seen as a generally accepted concept. Elliott's praxial philosophy of music education can either be seen as belonging to the same paradigm or may be thought of as representing an opposing paradigm depending on the way of interpretation. According to Smeyers' and Marshall's (Marshall, 1995; Smeyers & Marshall, 1995a, 1995b) interpretation, both perspectives represent a fundamental-pragmatist philosophy of education, whose quest is to clarify concepts describing music education and structuring the principles of music education activities, each striving for different routes to the same fundamental-pragmatist goal, allowing them to be considered as belonging to the same paradigm (Väkevä, 1999, 2004).

An individual-centric and socio-cultural paradigm can be distinguished in education, as well as in music education. In the paradigm of music education, learning is considered primarily from the perspective of the individual, and the perception of the learner can be called an individual-centric paradigm. According to Kuhn's, (1962a, 1962b) definition, there is a paradigm shift in science when the way of looking at the world is replaced by a different one (see Collins & O'Brien, 2003). The paradigm shift in music education is all about change in the musical worldview. The transformation process is described by how learning in music education today is to be seen as a holistic psychic-social process, with the background factors of learning more widely considered (Anttila & Juvonen, 2002). To replace the individual-centric learning perspective, a new perspective is sought from the tradition of pragmatist philosophy.

C. Praxialism and pragmatism

Elliott's praxialism has been one impetus for the paradigm revolution in music education. But praxialism has been heavily criticized. Westerlund (2003a) states that praxialism and aesthetic music education cannot be considered as contrasts because in both aesthetic experiences is seen in an individual context. Music as a value combines praxialism with aesthetic musical education. Learning music requires an understanding of what is being done, or learning doesn't happen (Elliott, 1995). For this reason, Elliott cannot disassociate himself from the autonomy of music, despite criticizing aesthetic music education for just the same reason. However, those music education philosophers who oppose aesthetic philosophy as the basis of music education do not deny the aesthetic value of music (McCarthy & Goble, 2002, 2005).

How is Elliott's praxialism different from pragmatism, which means pure practice? In Elliott's praxialism, the value of music is measured not by a conscious action, but by the right kind of practices (Aittakumpu, 2005). Due to the difficulty and contradiction of the concepts, Elliott's philosophy cannot be directly transferred to Finnish music education, although its objectives are undoubtedly in the right direction (Aittakumpu, 2005). A clear cognitive constructivist learning conception underpinning Elliott's vision is observable, which emphasizes the importance of action and practice in a learning event. Määttänen (1997) also notes that Elliott's mindset is quite close to cognitive psychology. Westerlund (2002, 2003b) demonstrated how one can combine the perspectives of aesthetic music education and praxialism through Dewey's philosophy. Dewey does not reject the importance of individualism but sees the experience of aesthetic as relevant to the individual. On the other hand, emphasizing the action does not exclude abstract values.

Paradigm Shift from the Learning Theoretic Perspective

Based on the study of cognitive perception, problem solving and reasoning, a good understanding of the nature of human intelligent operation has been achieved in education. However, traditional cognitive research has begun to be considered limited and there has been increasing interest in how communal participation supports individual learning (Hakkarainen et al., 2005). Learning theoretical discussions have created a synthesis of different approaches and started to regard them as complementary structures (Anttila & Juvonen, 2002). The basic premise of modern constructivism is the assumption that knowledge is structured both socially and cognitively (Tynjälä et al., 2005), which is also true in music education.

The Finnish constructivist focus is challenged by a realistic view: the purpose of teaching is to bring the learner into contact with reality (Puolimatka, 2002). There has been an emphasis on the social and cultural context in education. The focus of the human sciences is the development of a socio-cultural environment and contexts and networks containing the development and activities of the individual and community (Hakkarainen et al., 2005). The evolution of cognitivism towards sociocultural power thinking radiates into musical education, in which an individual's experience should be incorporated into action and the sociocultural environment. The learning theoretical perspective on music education embodies a change of direction from cognitive perspective towards socio-culturalism, and learner's conceptions of music education involve the entire spectrum of constructivist learning theory from cognitive-constructivist to the socio-cultural dimension.

The Formation of a New Paradigm

A new parsing of the paradigmatic state of music education has been sought in recent years from socio-cultural criticism to refer to the discourse leaning on the tradition of Dewey's pragmatist philosophy (Westerlund, 2002, 2003a, 2003b; Väkevä, 2004, 2006). In this study, we have not taken a position in favor of an aesthetic or praxial musical education perspective, but we have mainly looked at the change of paradigm from the perspective of changing in the fundamentals of teaching, and how the transformation and development of the world has created new conditions for music

education, offering a starting point for new music education that is quite different from those of traditional music education. In other words, the basic structures of traditional music education are changing and losing their previous dominance as being the only proper basic premise of making music, since new devices and methods provide a new way to activate creativity, understanding music and a shortcut to making music and its world of expression. This is not to say that all traditional music education completely loses its relevance, but that a traditional edifice based on a hierarchical musical worldview changes its order within the hierarchy and shifts towards cultural and autonomous emphasis.

Music education needs a reassessment of the theoretical basis, and taking the socio-cultural educational perspective as a basis for the values and goals of music education is an important step towards shaping a new paradigm. Quite recently, pragmatist philosophy has been seen as providing tools for the explication of the sociocultural approach to music education. In turn, this has increased the importance of interaction in upbringing in general, and in music education in particular. All educational activities are about interaction, and its importance can easily be understood to be emphasized in musical activities, especially in music playing and singing. From our point of view, the paradigm shift in music education is not such an essential division of the emphasis on individual and sociability perspectives. The perspective of this article does not attach itself to the essential priorities of practical music education activities, but instead seeks to find solutions where both mentioned perspectives are balanced. The interaction and the individualist's perspective are well suited to the thought patterns of productive music education, supporting and reinforcing each other.

Paradigm transition is all about re-outlining the temporal dimension. From the point of view of productive music education, it can be considered that the development has brought music closer to the everyday life of every person and its relevance. In turn, this is likely to highlight the arguments that justify the value and importance of music, both in the school world and as part of people's daily lives. Changing the paradigm is a natural demonstration and consequence of the development and transformation of the industry and its basic premise, the music itself. To achieve its full measure, it needs both scholarly research and practical verification in music education.

The research at hand relates to the changing paradigm of music education from one of the essential parts. There have been major changes in practical music education through the changing genres and styles of music, the development of devices and attitudes, the changing and molding of essential musical concepts, and the development of other contextual aspects. These have contributed to the reallocation of teaching priorities and new objectives throughout the field of music education. There have also been many changes in the mainstream content of music, and the power relations between different musical styles and subgenres have experienced major overhauls and changing of emphasis. These have led to the faltering and changing of musical institutes, concert practices and training, both in content and goals. The transformation of basic concepts of music has contributed to the change in the actions of people working with music, and the development of the professional titles they use in utterly new directions.

In this study, we examined the ongoing transformation of the reproductive paradigm into a productive one (see also Ahtola & Juvonen, 2021). While the reproductive

approach to music education is not necessarily about a totally new paradigm, it has nevertheless contributed to a major shift in thinking patterns of music education and practical music education. Underpinning the change are major changes in teaching-learning perception, music perception, perception of composing and the knowledge of music theory it requires, the perception of how to handle musical material utilizing new digital instruments, applications, and a considerably changed perception of how music is understood in general and how it is produced. This change of paradigm is also closely connected with motivation, winning challenges, self-competence, mastering one's own learning, experiencing success, and creativity appearing in diverse issues and forming a starting point for a productive approach to all music education (Bandura, 1997; Eccles et al., 1998).

Traditional instrument management, a thorough knowledge of music theory, knowledge of stages and stylistic aspects of music history, or so-called musical craftsmanship for managing sheet music writing and other musical expression have been changing decisively during the last decades. On these grounds, a paradigm shift may well be considered to be underway in music education. In this study, we take no position on a sociocultural or individual-centric approach, nor do we take any viewpoints of Elliott's praxial or traditional aesthetic musical education, even though our approach is close to a praxial thinking base.

Our perspective is based on the reproduction (reproductive) of pre-composed and produced music and the creation of new music and material (productive), which produces new musical expression and self-created material, based on music education and music education in a destabilizing fundamental premise difference that results in verifying the content of music education, reforming teaching methods and refreshing musical thinking. This process is also connected to creativity and ascending motivation of pupils as their independence, mastering their own learning and self-efficacy beliefs get stronger through experiencing success in their productive projects. The efficacy beliefs take advantage of cognitive, social and behavioristic skills and it points to the belief of an individual to be able to carry out the given task successfully (Deci & Ryan, 2012). These positive changes are connected to the increasing use of divergent thinking which is more highlighted in creative processes of creating one's own music which are closer to playing and gaming than planned proceeding. The traditional music education was more based on convergent thinking which bases on conscious thinking. One can also consider that the general musical worldview changes because of the above considerations. Although it is not a 'scientific revolution', one could speak of a kind of 'crisis' in a traditional music education, because the change is needed. Table 1 outlines the differences between productive and reproductive music education. When approaching the paradigm of productive music education, the previous music tradition is not to be forgotten, but what is learned from the past is utilized by adding new methods of music education (Ahtola & Juvonen, 2021).

Table 1. The differences between reproductive and productive music education

Reproductive music education	Productive music education
– The material played in the class consists of previously composed music, familiar classics represented by a range of music styles. – Knowledge of music theory is needed to be able to create music and compose. – Music is learned by studying, learning to play instruments, by listening and by reading literature. – Instrument skills are needed to be able to create music. – Music is made based only on real instruments. – The study of music theory is obligatory and learning music cultures is teacher-led and does not offer opportunities for creative work. – Creativity cannot be expressed without some knowledge about music theory and instrumental skills. – Pupils' musical skills are measured by tests which often cause anxiety and can lead to a negative self-image in music in general.	– The pupil is regularly offered opportunities for improvisation, composition, lyricizing, arranging and other creative musical activities. – No need to avoid making mistakes. – Anyone can be a composer; no music theory knowledge is needed. – Instrument skills are not needed to be able to create own music. – Music can also be made using technological applications. – Real instruments can go hand in hand with virtual instruments. – Learning to create different soundscapes using sounds from everyday life. – Creativity can be used immediately in practice. – Anyone can create music that sounds like recorded in a professional studio. – Music can be learned through playing real sounding virtual instruments. – Music theory as well as music cultures are also approached in creative ways where the students can use their creativity. – Motivation ascends. – The experiences of success and mastering one's own learning rises. – The self-efficacy beliefs strengthen. – Strengthening social skills through collaborative projects.

A Peak in Creative and Productive Music Education

A. Composing music

Composing and other creative and productive activities are significant parts of music education in the Finnish National Core Curriculum 2014. However, school music lessons still focus on playing and singing readymade songs. When pupils often work in large heterogeneous groups in classrooms, many teachers find it a too great challenge to implement productive music education in form of composing own music at regular music lessons (Ruthmann, 2009; Karjalainen-Väkevä & Nikkanen, 2013). Teachers often perceive a lack of equipment, knowledge, and that too much time is required to

take on creative or productive tasks that require more organization and group knowledge from the teacher (e.g., Partti & Westerlund, 2013).

At its best, whether a primary school pupil or university student, music, productivity, and creativity work together to create a totally new learning situation in which participants learn to tolerate and resolve conflicts, learn empathy, listen to others, think more creatively, and throw themselves into the flow and uncertainty of music, without knowing the outcome but still enjoying it (Csikszentmihalyi, 1997a, 1997b, 2000, 2002; Lehtonen & Juvonen, 2009). This process has a lot to do with intrinsic enjoyment which produces intrinsic motivation and enables self-expression, which is difficult to find in other school subject activities (Regelski, 1996, 1998). Intrinsic motivation is connected to lifelong learning, which is one of the goals of the curriculum at school. The human development and learning in this way take some time, but as it is based on practicing, it creates experiences of succeeding, gaining competence, and mastering one's own life. Young pupils also consider the visual and musical stimuli as a part of their own identity, which makes their significance even bigger as time passes. This way the productive and creative music education is also connected strongly with affections and emotional development. In relation to self-expression the whole creative process has an impact on children's development of self-concept, self-assurance, and self-efficacy beliefs. Our point of view is based on the target-orientation theory and self-determination theory, as the elements of self-determination and affective factors are especially prevailing in music education (Deci & Ryan, 2012; Ryan & Deci, 2017; Yang, Shen, Lin & Lin, 2021).

Productive music education is focused on the various processes of musical invention, improvisation, arranging, composing, and utilizing music technology. Traditionally composing was seen possible only by professionals or experienced musicians with a high level of instrument control and knowledge about music theory. The studies in composing focused on western classical music and the composing process was aimed merely at the final product, the final composition (Ojala, 2009; Ojala & Väkevä, 2013). A lot of this has changed. The process of composing can be seen as a research process which helps to discover music cultures in a new way. By studying composing as a process, we can find new perspectives emphasizing individual growth and opportunities for community interaction (Ojala & Väkevä, 2006, 2013; Ruthmann, 2009). Music can be seen as a practice through which sound is used as a means of action aimed at influencing oneself or others (Ojala, 2009). When composing, we relate sounds to our past experiences, our ways of thinking, and our perceptions, and each new experience either reinforces or challenges them, and leads to new interpretations of the meaning of sound. This makes it possible to present experiences and situations with the help of musical sounds that linguistic communication is not capable of. One important point in making up one's own songs in the way described is the immediate feedback received from peers and the teacher, maybe even from friends on another continent via the Internet. The teacher works as a co-composer, motivator, helper in problem situation, and documenter (Ruthmann, 2009; Muhonen, 2013, 2016). All these are motivation factors which strengthen through meaningful learning experiences.

It is important to see composing from the perspective of music education as a part of musical activity for everyone (Muhonen, 2013, 2016). Such a perspective allows for a broader view of the composing process and the perception of all the music as a

meaning-seeking activity, contrary to what has traditionally been the custom in Western music culture and music education (Ojala & Väkevä, 2006, 2013). From this point of view the pupils feel that they are important and are heard by the others, which is important. This immediate feedback from the teacher and school mates is important as it also brings immediate enjoyment of success (Eccles, Wigfield, Harold & Blumenfeld, 1993). It is also easy for a teacher to offer tasks which are challenging enough to commit the pupils (Eccles et al., 1998). The tasks can also be divided into smaller parts which support the intrinsic motivation building (according to the target-orientation theory) (Bandura, 1997). In the best possible situation this leads to gaining experiences. The more pupils feel they are able to impact the results of activities, the more the motivation grows. Deci and Ryan speak about control-beliefs (Deci & Ryal, 2000; Ryan & Deci, 2000).

Technology and a variety of applications have become available to everyone. Making music no longer requires a wide understanding of music theory, special technological skills, or instrumental skills. What are needed are just creativity, enthusiasm and some idea of what the creator wants the result to sound like. The whole concept of composing has changed, it has become possible for anyone, and the line between professional composers and enthusiasts has blurred (e.g., Partti & Westerlund, 2013). As earlier mentioned, creative and productive musical activity is an important part of the Finnish school's music education (Finnish National Core Curriculum, 2014). It was defined in the 2004 Curriculum, but it seems not to have been carried out in every-day schoolwork. Still, as the pupils are strongly motivated to use technological gadgets (like laptop computers, smart phones, and tablets) it also works in music lessons as a source of energy and provides direction for the behavior affecting intensity, stability and choosing the action and carrying it out (Roberts, 2001; Lundberg, Malm & Ronström, 2003; Mollborn & Fomby, 2020).

Balkin (1990) defined the concept of creativity by comparing it to talent, which is an innate, unlearned gift, while creativity is a learned, acquired, and developable behavior. Talented can be creative and creative can be talented, but there is no causal correlation between these concepts (Balkin, 1990). Elliot (1989b) sees creativity as a combination of concepts that are often confounded with originality. The creative process is engaged in through activities such as composing and improvising, which lead to a product which becomes a combination of familiar, previously learned and the unknown. Laczó (1981) found that children's improvisation skills are primarily determined by musical skills and previous musical experiences, whereas age is not a significant factor. According to Clark (1986), a teacher can offer the tools to be creative, but it doesn't necessarily lead to a creative product. He sees that is impossible to separate the creative product from the process. This idea is also supported by numerous recent studies (e.g., Ojala & Väkevä, 2013). Clark believes that using examples is an effective way to teach creativity and the teacher can pass on openness to creative practices to students (Clark, 1986; Running, 2008). Behind the enjoyment that this kind of activity creates, there is the individual's attachment to the group and community, which require equality, trust and feelings of safety connected to positive feedback, linked to enjoyment at school and interaction skills. Creation of one's own songs and music feeds the pupil's emotional concept about own survival in different areas of life, at the same time lifting their appreciation and motivation of other school subjects (Eccles & Wigfield, 2002; Running, 2008; Ruthmann, 2009; Muhonen, 2013, 2016).

B. Technological revolution in music education

The variety of ways to practice, consume and learn music has extended exponentially over the last few decades. Today, anyone can produce, compose, and create music, making it sound professionally produced for free. The devices are no longer computer-based, and with applications, music-making is possible with tablets and mobile phones. In addition to schools and colleges, the Internet with its offerings has significantly expanded the field of informal music education environments and practices (e.g., Salavuo, 2005; Myllykoski, 2009; Partti & Westerlund, 2013; Vasil, 2019). Online music communities are diverse platforms for musical activities and interaction, as well as a broad field for research of informal learning. In addition to the use of technology in music making, one can chat with others and appraise music made by peers (Myllykoski, 2009). This is also an element which enhances pupils' enjoyment at school, which has traditionally been poor in Finnish schools. The creative work at school also has its therapeutic aspect, something which should not be forgotten. The rapid development of computers and applications has made the devices familiar to even small children before they start school (Mollborn & Fomby, 2020). When they go to school, they often know how to use a computer or a smart phone, which can be turned into a positive learning aspect by using their skills in productive and creative music making. This meets their three important psychological needs (which come from the self-determinate theory): experiences of efficacy, autonomy, and social cohesion. When these needs are fulfilled, strong motivation follows (Deci & Ryan, 2000).

It is also possible to publish and earn with self-made music on the large publishing platforms like Spotify, Soundcloud or YouTube, and the use of these has expanded lately. People in Spain, Italy, and the United States have chosen musical activities in addition to exercise as the most effective coping mechanism for the COVID-19 pandemic (Hansen et al., 2021). Music makers and teachers have learned to use the various music platforms in a new way. Online communities make it easy to share and compose music together, and new platforms are constantly being developed. Touchscreen devices (like iPads and Chromebooks) can be found in schools, and pupils are already accustomed users in elementary school. Tablets also make it easy to play virtual instruments (Kaikkonen & Laes, 2013a). A variety of applications make studying music theory fun, not to mention the ease of composing and creating one's own contemporary music and own pop-rock songs. The process of making one's own music is a significant experience which adds meaningfulness to the whole of life. Until ten years ago, most applications remained at the experimental level (Folkestad, 1996, 1998), but today they are usable thanks to their versatility, low cost, and easy interfaces. Technology and the Internet's new platforms have revolutionized the opportunities of composing with peers around the globe (Kaschub & Smith, 2013). In collaborative creative activity with peers in live situations or via the Internet the opportunity to come up with one's own solutions and decisions is high and the pupil gets to deal with experiential learning connected to emotions (Deci & Ryan, 2000; Ryan & Deci, 2000, 2017; Jalovaara, 2005; Kutnick & Blatchford, 2014). This usually leads to the use of task-oriented strategies. This strategy is in connection with positive self-concept, motivation, expectations of success, persistence in trying, concentration on the current task, and active planning. All these together usually lead to success in the given task (Aunola, 2001; Onatsu-Arvilommi, Nurmi & Aunola, 2002).

There are four factors which can explain the pupils' enthusiasm in using technological devices:

- Intrinsic motivation, which has grown in their early childhood when they have learned to use computers and smart phones to play numerous games. Simultaneously they have learned to use the computers well, including the use of the Internet.
- The benefits of being able to use the device. Starting from the joy of playing, modern children have learned to find the issues in which they are interested from the Internet. They have found it to be quite useful in many connections, including several school subjects.
- The value of attaining something. This usually starts with the playing of games. Children compare their achievements in different games by trying to attain better results than their friends. Later this changes into other targets, which can include making their own music with applications.
- All the need for practicing, and all troubles the child must go through before learning how to use applications, the rules of a game or finding solutions to problems on using the internet (Applied according to Eccles' and Wigfield's motivation theory) (Eccles et al., 1983, 1998).

C. Study targeting and starting points: Studying music offered during teacher training for class teachers at the University of Eastern Finland

At the UEF, the classroom student teachers study music as part of teacher training in skills and arts subjects during three courses which include art and skill subjects. The first of those courses was a major group lecture course in 2021 which was executed as distance learning, covering skills and arts subjects in general. The next two courses included the pedagogical basics of skills and arts subjects and both were eight credit courses, of which the second one was conducted in the fall of the second year of studying to be a class teacher and the last one in the spring. The courses include the pedagogical basics of physical education, crafts, skills, and music, and in the subject of music, in fall the focus was specifically on learning the basics and the application of skills learned in spring. Teaching takes place as a close education.

The intervention was carried out as part of the last course (of the three mentioned). Second-year student teachers improvised, wrote lyrics, composed, and produced music in groups using music technology (see a more detailed description of the program at UEF in Ahtola & Juvonen, 2021).

In the study at hand, we looked at the central elements of productive music education, producing music in its multifaceted occurrence (improvising, composing, lyricizing, rhyming, re-arranging songs, creative musical exercise, movement, improvisation, and creating own musical ideas and styles). This intervention is generated by a course which is offered as part of the program studied by class student teachers. Our goal was to anticipate and shed light on a real-life future situation for the (general) student teachers where new ideas and approaches to music education come into practice. In our previous article, we considered a similar approach for music student teachers (N=8) (Ahtola & Juvonen, 2021). We can consider that the music student teachers' orientation to music, i. e. orientation towards speciality, is considerably greater, deeper, and stronger than the orientation of general classroom student teachers who

do not have music as a minor subject and have only general musical orientation (Juvonen, 2000, 2008a). They mainly represent the overall musical orientation which does not include active instrument playing as a hobby (Juvonen, 2000, 2003a, 2008b). Another big difference between the two sets of students under study is the size. The number of students studying to become music teachers was small (N=8) and the number of general student teachers was much larger (N=184) and all of them were second year student teachers who had not yet chosen their minor subject. This division quite adequitely describes the real-life situation where about 10% of the incoming student cohort chooses music as their minor subject.

Research Set, Its Acquisition and Description

The data were collected using an electronic questionnaire which the students answered in their own time. In the initial inquiry we asked about student teacher's general relations with music and technology, and their memories about creative or productive musical activities or the use of music technology during schoolyears. 67% of the participants were female, and 33% were male. The median age of respondents was 23 years.

A. The intervention

In January 2021, the first author of this article (S.A.) taught second-year teachers who participated in an intensive period of productive music education, which was a section of their multidisciplinary skills and art subjects. During four teaching sessions, each lasting 90 minutes, students learn how to use several different music applications that run on an iPad. The course was carried out using a variety of creative tasks and practical exercises. The purpose was to introduce students both to using music technology and creative music education practices, and to test their abilities of and attitude to new ways of teaching music, which we call a productive music education. Applications were varied from a pedagogical point of view, yet easy to adopt during a single teaching session.

Ten student groups (17–23 students per group) studied eagerly for four weeks to become familiar with the practices of creative and productive music education using new technology and music applications. This was offered to them as part of their music education. It was obvious that there was high demand (and need) for a course like this (see Juvonen & Anttila, 2006, 2008; Anttila & Juvonen, 2006, 2008). No prior musical or technological skills of any kind were required of students to participate in the course. In addition to our research targets, the purpose was to expand the musical tool pool of students and teach tangible practices to how improvisation, composing, lyricism, music production and a range of creative and productive activities can be taught in the school's music class, regardless of the age, skill level, group size, or status of the students.

Students worked either in pairs or in small groups planning small music tasks whose configurations varied depending on the task. Typically, the groups comprised three or four students, and the goal was to achieve an active participation of each in the design, execution, and presentation of the final output to the rest of the student group. It was possible to disperse small groups of students into different spaces, allowing each group to have peace to work. Such a situation is ideal when implementing the

practices of productive music education, as this allows each group to work without distraction and the teacher can monitor the work effortlessly.

For each assignment, students were first allocated iPads and other necessary tools, and a teacher-guided assignment was first illustrated as well as the basic functions of the music application indicated. Subsequently students were divided into small groups and the groups started by brainstorming the structure of the project. The time limit set for this work was within the frame of half an hour and an hour, and finally, the finished output was presented to the rest of the group at the end of the teaching session. The applications used at the first teaching session were easy, and as the period progressed, the user interfaces of applications also got diversified as the students' skill level became more accessible. Students welcomed the presentation of the outputs to the rest of the group and there was a positive, supportive, and safe atmosphere at the lessons. As the period progressed, students felt that it was easier to introduce their own ideas from hour to hour, and their own technological know-how became more accessible.

iPad apps used in the month-long period to encourage musical creativity were:

- Launchpad (application for making and remixing electronic music with beats, basslines, melodies, vocals, and effect loops);
- Incredibox (music-making application in which the user can create a mix by managing seven animated beatboxers and twenty different sound icons that are categorized to beats, effects, melodies, and voices);
- Samplebot (application for crafting songs with recorded or imported samples that can be looped;
- GarageBand (fully equipped application for creating music and podcasts. Enables user to record voice or real instruments, create multiple tracks with sound libraries, presets, and audio loops).

Applications that facilitate future music education in the work force as well as their own musical perceiving included:

- Ukeoke (application for learning ukulele; chords, strumming and accompanying);
- Rhythm Swing (playful application for learning rhythms and how they are written with music notation);
- Chordify (online music education service that transforms music into chords and makes accompanying easy to follow).

B. Purpose of research and research questions

The purpose of our research was to find out the elements which prove the attendance of a new productive music education paradigm through testing the elements and applications of creative and productive music education with traditional music education-oriented student teachers as a novel approach to composing, improvising, arranging and all forms of independent producing of musical material in a primary school classroom context. The starting point is that most of the future class teachers in this research have almost no musical background or skills whatsoever from areas of music theory, history, or especially composing, composition, matching, or improvisation when they start studying to be a class teacher. In the group, there might

be some students who already know how to write music and are otherwise interested in music, but overall, the set is completely heterogeneous, unselective, and have no specific musical orientation. Through the intervention in this study, we explored students' prepositional attitudes to music, its various dimensions, technology, and its use, as well as self-expression and the use and application of their own creativity in new productive tasks. In turn, these represent the key starting points and elements of the productive paradigm of music education.

To talk clearly about the paradigm change, or the need for it, there must be a need to find new practices and to abandon the old basic premises. In traditional music education, one of the more important basic premises has been learning and management of sheet music writing, which has formed the basis for all activities in examining styles of music, historical study of music genres, and various musical analyses, for chords matching and composing as well as for voice-leading in polyphony, homophony, and in the use of other musical styles in the areas of light music as well as the so-called classical music.

Research questions

RQ1 What music relationship do the student teachers have?
RQ2 What attitudes and relationships did the student teachers have to music, music technology and creative and productive music education before the intervention?
RQ3 How did attitudes to music technology and creative and productive music education change during the period?
RQ4 What experiences did students get with the application of technology?
RQ5 How do future class teachers perceive the use of technology thinking about the future – what hopes and expectations will they put in their future work?

Results

More than half of students in this research (56%) responded that they still had or used to have music as a hobby, which might be a good starting point for studying music education. Almost two out of five respondents (38%) said that they actively listened to music and only few (6%) said they did not listen to music nor had a musical hobby. Those who reported that they had, or used to have music as a hobby, reported that their instruments or way of making music were piano, accordion, guitar, ukulele, cross flute, violin, drums and other percussion instruments, bass, trumpet, vocals, chorus, clarinet, or band playing. In addition, there were mentions about DJ jobs and making their own songs with music programs (nine respondents 5%). Band playing was mentioned by seven respondents (4%). Music perceived as being significantly important by about 30 respondents (16%) and, accordingly, music was of little importance or of no relevance to eleven respondents (6%). For most of the respondents, the importance of music was neutral (78%).

A. The respondents' relationship with music

Many of the respondents (104 people) had had music as a hobby (15%) or had music as a hobby by the time this research was undertaken (41%). Two thirds of respondents were active music listeners (69 people, 37%) and only 11 people (6%)

hardly ever listened to music or played any instrument as a hobby. Typical answers from music hobbyists described their music playing since they were children. Some had stopped the hobby as a teenager but started again with teacher training.

Music hobbyists:

- *Music has a big role in my life. I listen to music a lot and I have been playing piano since I was a very small kid.*
- *I played flute for 10 years in music school. I have learned to play the piano, ukulele, and guitar by myself. I play these instruments from 3 to 10 hours per week.*
- *I listen to music a lot. Music is very important for me to recover and relax, I can play the piano.*

Former hobbyists, active listeners:

- *I listen to music a lot; I played piano for several years as a child.*
- *Earlier I played piano for 10 years, but I have not played in a couple of years. I listen a lot to music, and it works as a means of concentration and relaxation, I am interested in all kinds of instrument playing. I was in special music classes in grades 3 to 9.*
- *I listen quite a lot to music and play guitar for my own pleasure, I used to take lessons in it at music school.*

Music has no significance and listens hardly ever:

- *Very weak relationship with music, I listen seldom to music, and I never have had music as a hobby.*
- *I do listen to music, but not much. I don't have music as a hobby; it is totally strange to me because music teaching at my school was lousy. Also, musical concepts are strange to me.*

B. The respondents' attitudes and relationship with technology

More than half of respondents (66%) had a positive attitude to technology at a general level and 12% were negative. About every fifth respondent (22%) had a neutral relationship with the general use of technology. When asked about the use of music technology at the respondents' school years, most respondents (84%) did not recall anything related to music technology being used. Those who had experiences in music technology mentioned the GarageBand application, which comes with the iPad and is a versatile music recording program. In general, the technology was welcomed by most respondents and reported that they used it daily in forms of writing, listening to music or spending time with social media applications (WhatsApp, Instagram, Facebook, YouTube etc.).

Table 2. Attitudes to music technology before the intervention

Before intervention	Completely or almost same opinion
I was familiar with the use of music technology before the course	16%
I have a positive attitude to the use of music technology in teaching	90%

Positive attitude towards technology in general:

- *It is present in my every-day life. I think that it brings a lot of benefits, help but also brings entertainment into my life.*
- *I was born with a tablet on my lap; technology is interesting and helps in every-day life, easy to use.*
- *To me studio applications and audio/music plug-ins are really familiar; they form a big part of my hobby.*

Neutral attitude:

- *I don't get very excited about technology, but I can use it quite well, I think.*
- *I am not dependent on technology. I can live without using it. Still, I try to keep up with the development.*
- *My attitude is controversial; in future technology probably will be the main working instrument in the world. I don't like when technology takes the place of social life.*

Negative attitude:

- *Using new technology makes me anxious.*
- *I have generally quite poor abilities in technology. That is not my area of strength.*
- *It is an every-day necessary obligatory evil.*

These results show that the respondents have a clear need to get more knowledge about the use of the technological applications in music teaching, but also in general use of technology and applications. A part of this need shows as a negative attitude against all technology or the use of it, not always depending even on the skills of the respondent.

In some areas it may be that technology usage has been brought to schoolwork too fast. The teachers who are already working have not been ready to take the use of technology in their management as they were forced to use it in distance teaching during the covid-19 pandemic. These messages have been heard among the student teachers in UEF, for example, during their practice periods at schools.

C. The student teachers' attitudes and relationship with creative and productive music education before and after the intervention

According to latest research, 60% of Finnish classroom student teachers feel it challenging or even impossible to teach music, although class teacher training should provide (according to the curriculum and the teacher's certificate) the skills to teach

all skills and art subjects (Suomi, 2020). This percentage (60%) is the average of all Finnish teacher education institutes, but in UEF Joensuu campus the measures are much better than the average (see Suomi, 2020; Mäkinen, 2021).

As one solution to the situation the intervention in this study is aimed to expand the tool pool of Joensuu campus' class student teachers to teach music through various technological applications. One of the biggest reasons for believing not to be able to teach music at school is caused by low self-confidence and self-concept. The musical self-concept is built in the childhood and at home, peers and the first schoolteacher have a big influence on the structure of the musical self-image and attitudes towards music (Juvonen & Anttila, 2008). Teaching various practices and utilizing applications are also tought to unravel a certain kind of stigma from around, for example, composing and improvisation, which, in principle, before the episode began, were perceived challenging and being possible only for the musically gifted and those who have studied a lot of music theory.

In addition, only one third (36 %) of the target group of this research remembered doing anything creative at music lessons. This percentage may seem quite high, but our classification of creative tasks is permissive, and we tried to see responses in a positive light.

Change is happening slowly but surely

In traditional Finnish music education creative tasks like improvising and composing songs in a classroom have been rare. This was due to the basic thinking model: to be able to compose music one should first know the music writing quite well, to be able to write down the melodies of the new composition. Secondly, to put the chords in the melody requires a lot of knowledge about harmony and tone-leading to make it sound good.

Even more important is the starting point of the music education: a big part of working music teachers still have the aesthetic starting points in their music educational thinking, because of the education they were offered during the time of their studies. The modern thinking about music education of, for example, David J. Elliott reached Finland only about two decades ago, and even to this day has not reached all music teachers who still are working. So, there is also a change of generations going on in Finnish music education and it takes several years of time, maybe even decades.

In this research we classified all tasks with even a small hint of creativity as creative music teaching. So, such tasks as making new words to a song (11%), writing an own song (16%), or arranging an existing song for school instruments (6%) and improvisation (3%) we counted as creative memories from music lessons, although the reality may have been quite different also in these cases because of the reasons told before. All these counted together make the 36% which we mentioned in the beginning. There are some mentions about writing one's own songs, but they are more exceptions than a rule, and they have appeared usually only in special music classes:

- *We wrote new lyrics to familiar songs, but never composed anything new.*
- *I was on special music class, and we made among others, a song built of one pupil's lyrics.*

- *We made a musical and composed all songs for it. (Pupil from special music class.)*
- *In upper secondary school we learned some GarageBand, but I remember nothing else.*
- *I don't remember anything creative, we mostly concentrated in readymade material and playing it.*
- *There was one time when we tried to make our own lyrics.*
- *In high school we made a record full of our own songs.*
- *In a band club we tried to make 'an own song' but mostly it was just messing around with friends.*

The school years of the respondent group were mostly 2006–2017. The Finnish core curriculum of music education already then mentioned diverse musical agency, functionality, development of creativity and self-expression, and integration with other subjects (Finnish National Core Curriculum, 2014). But still, well over half (64%) of respondents said they had no recollections of creative music education from their school days, which means that the curriculum demands were not fulfilled on that part.

Table 2. Improvisation and making up one's own songs before the intervention

Before intervention	Completely or almost same opinion
I find improvisation easy	52%
It is nice to make own songs	58%

Despite the issues discussed earlier, the respondents still found improvisation mostly easy, and they liked writing their own songs (see Table 2). This probably means that they had tried to devise their own songs outside the school because only every sixth respondent (6%) said that they had composed their own songs at school.

The change of attitudes during the intervention

The creative and productive music education intervention seems to have revealed a lot of new creativity and invention abilities in the respondent group, but also new courage to present their own ideas in the student group (See Table 3). Most of the respondents (92%) felt they had discovered new creativity in themselves and more than two-thirds (70%) felt it easy to invent musical ideas (melodies, lyrics, rhythms). Almost everyone (90%) felt it was easy to present their own ideas working in small groups. This type of musical creative activity requires a student to throw into, tolerate uncertainty, as well as trust the other members of the group to dare to bring their own ideas out. It also means stepping out of the comfort zone. The results show that the groups achieved a safe and confidential atmosphere and a positive emotional climate as required by all forms of creative musical activity (Muhonen, 2013, 2016; Karjalainen-Väkevä & Nikkanen, 2013). This may be because of the common feeling of being at the same level as most of the peers at the lesson, so that no one had to feel that they were coping less well than the others.

Table 3. Creativity and one's own ideas after the intervention

After intervention and in future	Completely or almost same opinion
I found new personal creativity during the course	92%
I found it easy to invent musical ideas (melody, lyrics, rhythms)	70%
I found it easy to present my own ideas in the group	90%

A pre-survey study showed that previous experiences of using music technology were sparse. Only one sixth (16%) of the respondents responded that they had familiarized themselves in some way with music technology mentioning the GarageBand app, which had come up in school music classes at some point during upper secondary school or in special music classes. Music technology was also positively viewed; 90% of respondents saw the use of music technology in teaching as a positive thing. Although only one in six respondents knew music technology before the intervention, nine in ten respondents had a positive attitude to music technology. The following quotations mirror the respondents' attitude and low level of experience in music technology:

- *We tried a little to use GarageBand.*
- *Sometimes we watched bands on YouTube.*
- *I used a mixer during upper secondary school and GarageBand in upper school.*
- *The lyrics were projected on the table…*
- *There was an electric guitar …if it is counted.*
- *Sometimes we watched Karaoke videos from an old TV and sang along.*
- *Once we tried GarageBand during upper secondary school, but we were not taught at all, just told to make a song out of nowhere…*
- *The most technological issue we used in my elementary school was listening to a CD record.*

The target group was heterogeneous, and they had no particular interest in music. The level of their interest and skills in music was highly variable. In our earlier article (Ahtola & Juvonen, 2021), we examined subject student teachers in music education who had a strong musical special orientation (Juvonen, 2000), as well as extensive musical skills. Everyone had a strong desire to improve from the professional music teacher's point of view. The situation in this second group is quite different concerning the development and especially about becoming and developing as a music teaching class teacher. This is probably because the teachers who teach at large schools have an opportunity to choose the subjects which they do not wish to teach as many teachers are willing to teach those subjects (for example, music).

After the intervention period, student teachers were asked if the music technological applications which were used and the creative tasks executed during the period had influenced their creative musical expression, attitudes towards music, and their competency to teach music in future.

Students training to be classroom teachers in music education expressed a strong need for this type of activity. Our study generated no ambiguity on this matter. The

teacher education students felt strongly that applications in music technology were facilitating teacher's work, as well as diversifying music education in general. Most respondents also felt that apps and creative musical tasks expanded their musical competence and brought certainty to their own music teaching. All 184 respondents intended to take advantage of the working practices and tools they had learned in their future working life.

Table 4. Attitudes to music technology during and after the intervention

During intervention and in the future	Completely or almost same opinion
The use of music technology makes music teaching more versatile	99%
Music technology makes the music teacher's work easier	95%
I like to learn using new technological applications and their use in teaching	97%
Learning and using new applications widened my musical abilities	98%
The learning and using a range of assignments brought more self-confidence to my music teaching	96%
I am going to take advantage of the tools I have learned for creative music education in the future in the work	100%

The variety of students and big, heterogeneous groups pose their own challenges for the teacher. For some, however, improvisation or musical invention may create feelings of anxiety and a chaotic environment in which the pupil does not know how to act (Kaikkonen & Laes, 2013a; Karjalainen-Väkevä & Nikkanen, 2013). Creative tasks with clear instructions and various technological applications diversify music teaching, as they provide the opportunity for a wide range of work in different groups and allow access to a pleasant-sounding musical outcome for all kinds of learners. Directing composing and other creative tasks always needs boundaries to work in the best possible way (Karjalainen-Väkevä & Nikkanen, 2013). Looking at the results, it can be noted that the tasks were clear enough in terms of guidance but did not limit the students' own creativity too much.

Before the period, only 16% of students had been familiar in some way with the music technology. After the period, most respondents (97%) felt that learning new technological applications and programs were meaningful and they liked to learn and use the applications.

Content like this had been the aspiration for student teachers in music education for almost twenty years, when music education students from several universities in Finland and Estonia were asked what their development needs for music education. It was widely hoped that music technology could support education through practical learning and creativity development (Juvonen & Anttila, 2003). Also, in special music education, creative musical activities, and music technology can allow a variety of learners to perform productive activity in a music class. As recently as eight years ago, a range of applications had been perceived as having limitations for longer-lasting teaching of improvisation and composing (Kaikkonen & Laes, 2013), but today the

applications have been developed well enough for extended working periods and it is possible to implement extensive creative projects using technology in school music classes, regardless of age, skill level and group size. Music subject student teachers felt that the intervention course with a variety of applications and creative musical tasks significantly increased their competency to supervise and teach composing, improvising, and arranging and other creative musical activities in the school class. These tools for productive music education were added to the other pedagogical material for students undertaking music education in 2019–2020 at the University of Eastern Finland (Ahtola & Juvonen, 2021).

After the period, students gave extensive feedback about using the technology applications in music teaching and their responses to how it diversifies music education and expands their competency in the subject. From the responses, we saw that the attitude of many students to the use of technology changed towards a much more positive direction during the period, when students realized that using a range of applications and music programs can facilitate the work of the teacher and offer new ideas in music education's working habits. It is also essential that the teacher knows how to take advantage of various creative tasks that are suitable for each age group in addition to using technological applications. Several music applications were used throughout the period, which were found to be suitable for a range of educational situations. Some of the applications are particularly planned to fuel creativity and are suitable for composing, recording and other creative activities, while one of the apps was a more functional tool for special music education, perceiving music or practicing co-playing.

Students' attitude and experiences with the music technology after the intervention

Students evaluated each of the music technological applications used in the intervention individually so that we could find out which applications were perceived as the most pleasing in terms of learning. The most popular of the applications was Incredibox (96% of respondents liked it much or somewhat; 3% absent). Incredibox was found to be the most accessible. The application was introduced at the beginning of the intervention to feed the creativity of students. The task was: select a self-pleasing genre, (e.g., Hip-hop, Latin etc.) and in a small group (3–4 people) create a short song with the use of loops that includes the beginning, a surprising element, and an ending. Finally, the songs were introduced to the group. The app features numerous high-quality loops that suit being played simultaneously always producing a good sounding outcome. However, there are many loops and musical genres in the application, which make each product sound different, even if the songs are made using the same genre and partially same loops. The app is easy to use, and suitable for all ages, starting from early years of primary school classes, but it equally inspires adults in creative work.

Of the other apps, GarageBand was also highly liked (92% liked; 4% disliked; 4% absent). GarageBand has the most versatile interface of the applications and enables a professional auditory outcome with its recording capabilities. The task was to compose a soundscape based on images shared to small groups. The images were from the book *"The Walkabout Orchestra"* (Perarnau, 2019). Images were large and colored, showing a wide range of events to inspire producing diverse sounds. Students used real instruments, but also the app's ready-made audio libraries in recordings.

They also learned to use an external microphone paired with an iPad to offer better sound quality. The students learned how to edit the tracks and combine intact and fine ensemble from several sections. In the end, the images were projected onto a big smart board and the groups presented their compositions to the others.

Similar feedback was received by Samplebot (79% liked; 11% disliked; 10% absent) and Launchpad (78% liked; 17% disliked; 5% absent). Samplebot is visually clear and colorful. The recording features are simple and therefore recording is successful after a short training session even for young pupils. When the application opens, a colorful grid appears, one in which it is possible to record a different sound, rhythm, or melody in each color box. After that, the boxes can be played by touching and thus record the desired auditory outcome. The task for small groups was to record a radio advertisement-style jingle with the themes *"New Year"* and *"Study Motivation"*.

Launchpad also offers ready-made loops, and the theme is very suitable for the DJ world. The main idea is that the application allows practicing DJ functions easily and simply. There are a limited number of musical themes, all of which are strongly connected to the electronic music world. The task was to choose a prepared poem from the given Internet site, which students used as a song lyric and on which they composed the background using the app. Several songs became rap style, as only a few groups interpreted the texts through singing. The songs were introduced to the rest of the group at the end of the session. The background that had been composed was played through the class sound system and one student acted as DJ with the iPad, with the rest of the small group performing the song singing or rapping through amplified microphones.

In addition to applications fueling creativity, during the intervention three applications that facilitate the work of a music teacher were introduced. These were UkeOke for playing ukulele, Rhythm Swing (74% liked), a musical game-style application designed to perceive music and especially for practicing time values of rhythms and notes, and Chordify, which facilitates directing playing music together in class. Both UkeOke and Chordify were highly liked and more than 90% of respondents responded with both of them that they liked the app. UkeOke and Chordify are similar in a certain way, as both are used specifically for training instrument playing skills, both applications make it easier to track chord signs and song structure and the app plays a background that makes the playing music together sound instantly good and all of the group members remain more easily in rhythm.

Conclusions

The results obtained in our former article *"Towards a Paradigm of Productive Music Education"* (Ahtola & Juvonen, 2021) with student teachers specializing in music showed that with this approach it is possible to diversify music education into a new direction: increasing the appearance of creativity and productivity in music education, as well as to increase the teacher's competency in the issue. The findings already gathered in our earlier research reinforced our assumption that through productive music education as a base of music lessons it is possible to facilitate the work of teachers of all ages and students at all levels.

Encouraging future teachers to engage in creative use of technology in music teaching is essential if we want to take advantage of informal learning as well. Informal learning takes place outside the walls of the school, when pupils can use their own creativity and technological know-how in creating, producing, and composing their own, new music using numerous applications and online platforms. This means also, that new, diverse, and different learning environments must be considered in a new way in teaching, learning, and evaluating music (Myllykoski, 2009; Vasil, 2019). While more and more music teachers start taking advantage of informational learning in how they teach music (Vasil, 2019), productive music education also enables it much better, and implementation does not depend on school resources.

Throughout the decades, music teachers have found it challenging to keep up with contemporary and up-to-date music trends, genres, and changing styles (e. g. Väkevä, 2006). This has even become more complicated and today it is almost impossible to be able to know all music styles and genres not to speak about all the artists.

Productive music education contributes to the fact that the teacher does not always have to be familiar with the latest hit songs, but the teacher offers the tools for pupils to create one. With music technology and easy-to-use applications, pupils can create songs of which they have an idea of by using advanced sound banks and, at the same time, they can develop and learn creativity, social skills from working together, perceive music through its structures, and evolve to become skillful and versatile users of the latest technology. When a pupil knows they are being skillful in some area, it lifts self-confidence, self-assurance, and finally strengthens the self-concept effectively (Hietanen, 2002).

Still, in music teaching today, the dominance of formal training is prevalent (Vasil, 2019). Older teachers have not received any specialized training in the use of music technology and teaching creativity in their work. That is partly because of the extremely fast development in technology and applications for the use of teachers, musicians, composers, and all kinds of music enthusiasts; the equipment just did not exist when older music teachers were educated. The creativity education as a concept is a newcomer, but it does not mean that there would not have been any creativity in music education earlier. Creativity has naturally been present all the time in all art and skill subjects. The way that creativity has been understood, taught, and carried out in the music education field have gone through a major change due to technological developments (which was exposed earlier in this article, see the section entitled: A Peak in creative and productive music education).

One solution to these problems is strengthening the offerings of Finnish continuing education, which would allow teachers with a traditional music subject teacher education to learn and understand and gain skills to enable them to use today's technology and opportunities. This is necessary, because not everyone has the motivation to learn new practices and to discover the use of ever-changing applications independently in their own time without any supervision.

In Finland, music teachers are highly trained in playing several instruments, music history and theory. They also have high level knowledge about the pedagogy of music. One key in jumping from traditional music teacher education to new ideas means letting go of the notes and unleashing creativity without the traditional way of

building the teaching and learning leaning only to the use of notation and traditional musical rules and aesthetics. Traditional music education must also be added with drama as a means of teaching because that is also a newcomer in the curriculum.

There has been a huge increase in the development of web-based music-making programs and applications over the past decade, which has led to the evident appearance of a paradigm shift. Technical problems, network slowness and files that take up too much space and their sharing, will no longer produce problems that were common even in the early 21st century. Online assisted study was predicted to grow in the future at that time, and this is exactly what has happened (Salavuo, 2005). However, innovative applications that develop creativity are not enough alone; already in teacher education, efforts must be made to find pedagogically functional applications that are as diverse and timeless as possible to work in future music education (Bondarenko, 2020).

Technology makes music lessons more creative, dynamic, interactive, and allows music lessons to have a more diverse content. It also offers the pupils more experiences of mastering and controlling their own work which strongly increases their motivation. Compared to traditional teaching methods (reproductive music education), using technology and creative tasks offer new opportunities to shape the lesson plan and more versatile classes for a bigger group of pupils. Through productive music education, it is possible to improve the quality of teaching while also increasing and strengthening the creative abilities and thinking of pupils, their self-confidence in music and motivation for learning or even having music as a hobby (Hernández-Bravo, Cardona-Moltó & Hernández-Bravo, 2016).

Compared to traditional music education, the creative and productive approach to music education seems superior in many dimensions especially in fostering creativity education on a much more solid base than earlier. This point of view is spreading rapidly in Finnish music education, but it does not necessarily demand extensive renovation of the curriculum. What it requires is offering traditionally educated music subject teachers an opportunity to get more education in the use of modern technology and music applications. This should be arranged so that it would not lead to costs or difficulties in their work at school.

A wide discussion about the importance of the changes which the ideas described here offer (creative and productive music education), is needed to spread the ideas, to make them more understandable, and maybe even talk about whether creative and productive music education may be seen as a new paradigm. Our opinion is that it suggests such changes in the practices of everyday music teaching in addition to old aims and targets of traditional Finnish music education including the praxial and aesthetic points of view that it could and should be called a paradigm change. We will research and report the issue more and deeper in our subsequent research.

The creative and productive music education also offer solution to the big problem about not being willing to teach music among the class teachers in Finland. This problem has been researched quite a lot (Juvonen, 2004b; Suomi, 2020; Mäkinen, 2021) and some progress has also been made, thanks to the changes in teacher education curricula. Still, the problem exists, and music seems to be a school subject which divides future teachers strongly. We can even talk of polarization in the issue: a

group of future teachers is eager to teach music and another group of them is not at all willing to teach the subject. The curriculum changes in the teacher education curriculum were made to make the classroom student teachers realize that they do not have to be skillful musicians or professional instrumentalists when teaching the pupils. What this means is that the ideas presented considering the creative and productive music educational approach, offer opportunities for future class teachers which enable music teaching without deep skills in instrument playing or knowledge of music theory. This should be one measure to solve the problem, and the student teachers should notice that it is possible to carry out good music education with lower-level skills in music itself. This is a fatal question for the future of music education which is carried out by classroom teachers and classroom teachers who have music as a minor subject as they actually carry out the most of music education in classes 1–6.

Another matter is the substance and content of music education. That is described in the teacher education curricula, and it is in the direct connection with the Finnish national curricula for primary schools. In this area the creative and productive music education presented also seems superior as it offers good opportunities for widening the content of music teaching significantly in the direction of the creativity. This is an important point of view, as the creativity is much more underlined in the last round of Finnish curricula for all school levels (from 2014, implemented from 2016). Creativity is also seen as being important for the development of the whole Finnish nation as mentioned in the Vanhanen's government program (2003–2007). Creativity was called for in the 'innovativeness' government program, obviously referring to new technological and economic innovation which could offer Finland a better future in the economic field.

The world is continuously in the middle of a rapid change, exclusively in the field of music, which is especially important for children and young people because music has a major impact on their identity and personality development, as well as the happiness of their future life gained through significant events and experiences. Therefore, the music curriculum should be renewed according to a quite fast schedule to keep up with the technological and other developments in music and the world in general. Creative and productive music education also solves this problem by offering pupils an opportunity to create just the kind of music which they happen to like at a certain moment without the teacher having to know all possible music genres, styles, and artists. This is a major change in a music teacher's work. It is certain that a music teachers' own musical worldview and musical taste are the issues which have a strong impact on their teaching and the decisions they make about what music styles and artists they use as examples to their pupils. The new ideas give the pupils a chance to control their own learning and make own choices which builds motivation much stronger than in teaching in which all decisions are made by the teacher.

The new ideas of the approach we have presented also give the teacher more time and freedom to stay away from sitting behind the piano (or other instruments) and to concentrate more on supporting the pupils' independent, voluntary learning. The teacher can act as an escort and supporter of learning as it is defined in the latest learning theories, including the social constructivist learning concept. This also makes the new ideas more suitable in the modern teaching-learning conceptions, superior when compared to traditional music education models.

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