CHAPTER 7

Knowledge for the Future Music Teacher: Authentic Learning Spaces for Teaching Songwriting and Production Using Music Technology

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Abstract: This study explores the challenges of the increasing impact of technology on music teaching in secondary and upper secondary school in Norway. Using the TPACK framework, we expand on earlier research where teachers' lack of technological competence has been highlighted as a main problem. Therefore, we ask: what knowledge characterizes teaching informed by music technological expertise? With understandings of authenticity, authentic learning and learning spaces as a backdrop, we present three narratives derived from ten summer school workshops, where university students specializing in music technology instructed pupils from age 11–16. Based on these narratives, we argue that a central part of these university students' teaching was their aspiration to create authentic learning spaces; a place where the physical environment, the technological tools, and the relationships between instructor, pupil and content together created premises for learning in a relevant, real-world context. Our findings highlight, among others, listening and facilitation as characteristic forms of knowledge. We believe this project is relevant for teachers and teacher educators working with music and music technology.

Keywords: authenticity, authentic learning, music, knowledge, technology, education, TPACK, learning space

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In an informal lunch conversation preceding Science Camp 2018, a summer school for youths aged 11–16, one of the workshop instructors summed up his experiences with music technology in the compulsory school system by branding it "inauthentic". By this he tried to express how his music teachers' efforts to implement technology in the music subject had failed to create any kind of real musical experience in him. These experiences were contrasted with the way he had encountered music technology in other arenas, such as playing in a band and working in his home studio, something he described as "more authentic". In these situations, music technology had been a meaningful and integral part of the music-making experience, ultimately leading him towards an educational and incipient professional path with music technology as its fulcrum. These thoughts, of "inauthentic" and "authentic" work with music technology, guided how he envisioned the workshop he was planning for the summer school – he wanted the youths to experience real and meaningful music making, where music technology played a natural role.

This little exchange highlights topics that extend far beyond the context of Science Camp 2018. First of all, it questions how and what we teach in schools. Since the introduction of *Kunnskapsløftet*[1] in 2006, the potential for technology's improvement of education has more or less been established as a truth in Norwegian school policy and the public vocabulary.[2] In spite of this, it seems that technology has only slightly changed the way we teach music, both nationally and internationally (Martin, 2012; Partti, 2017; Savage, 2017; Vinge, 2010). How can the school embrace the possibilities and challenges of the increasing impact of technology on music teaching, and what does this demand of the teachers? Secondly, considering the workshop instructor's thoughts of "authentic" and "inauthentic" use of technology in music, it questions what kinds of practices

1 Kunnskapsløftet (the Knowledge Promotion Reform) is the education reform introduced in 2006 in Norwegian primary, lower secondary and upper secondary education and training. https://www.regjeringen.no/globalassets/upload/kilde/ufd/prm/2005/0081/ddd/pdfv/256458-kunnskap_bokmaal_low.pdf

2 Report No. 17 to the Storting [Norwegian Parliament] (2006–2007) https://www.regjeringen.no/no/dokumenter/framtid-fornyelse-og-digitalisering/id2568347/, media report https://www.nrk.no/rogaland/ny-teknologi-i-skolen-1.11362391, voluntary organization https://kidsakoder.no/om-lkk/ (all web pages accessed 01.07.20).

and forms of knowledge enable teaching of music technology that is experienced musically meaningful and relevant by pupils. We are in the midst of a period of disruption, where technology increases the access to information and teaching materials, putting the school at risk of losing its status as the place to learn (Selander, 2017). Many students come to school with extensive music knowledge that they have acquired outside of school (Folkestad, 2006; Peppler, 2017), and do not necessarily perceive the school as an engaging, suitable, sought-after or "authentic" place to discover or learn music (Dyndahl & Nielsen, 2014; Weninger, 2018). The somewhat problematic concept of "authenticity" may in this way work as a lens for scrutinizing these kinds of topics. Put together, these questions define the territory of this study.

The project's data material is derived from the aforementioned Science Camp 2018 in Trondheim, Norway. At the summer school ten university students specializing in music technology instructed pupils from age 11–16 in subjects such as song writing and production using music technology. A characteristic of these university students was their music-technological expertise, built on their own incipient professional activity,[3] as well as their connection to the Norwegian University of Science and Technology's (NTNU's) study program in music technology. In this way the workshops offer an interesting take on this theme, as they present how this expertise can inform the teaching of music technology. Our research question is: *what knowledge characterizes teaching informed by music technological expertise?*

In this chapter we will explain the study's theoretical perspectives and research design, presenting the results through identifying what we call *authentic learning spaces*, where music technological teaching practices are portrayed through three narratives. The results will be discussed in relation to the TPACK[4] framework's understanding of knowledge (Gall, 2017; Mishra & Koehler, 2006), and contribute to previous research and further understanding of knowledge for the future music teacher.

3 All of the university students had a part-time professional musical practice, either as performers, producers, composers, DJs etc, which they combined with full-time studies.

4 TPACK is an acronym of the words Technological Pedagogical and Content Knowledge.

Theoretical Perspectives

In the following part, we will elaborate on why we believe this study addresses these issues, through our understanding of *authentic learning spaces,* before we move on to knowledge and expertise, as well as the TPACK framework.

Authentic Learning Spaces

Whenever discussing authenticity, we encounter a recurring problem: what is considered as authentic by any person or in any area will always differ depending on who, where and when you ask (Dyndahl & Nielsen, 2014, p. 107; Gilmore & Pine, 2007; Vannini & Williams, 2009). We see the notion of authenticity as an ever-negotiable social construct that still holds significance for people in general and especially in relation to music (Kallio et al., 2014; Moore, 2002). Therefore, the workshop instructor's use of the word "inauthentic" could host a broad spectrum of meanings and does not represent an eternal or ubiquitous truth. We see all ten of those teaching at Science Camp as representatives of their own, equally valid, authentic practice: They represent an authentic musicianship that embraces technology, in any shape or form, and sees it as integral to musical expression (Savage, 2017). Throughout our interviews we have specifically asked what the research participants find to be meaningful, significant and authentic when working with music technology, and the three narratives presented later in the text take on these different views.

Our main interpretation of the workshop instructor's use of the word "inauthentic" is that it means *different to his experiences outside of school*. It speaks to a "disconnect" experienced by many students today, especially in regard to digital tools and media (Weninger, 2018). To the workshop instructor, the content ("musical practices with music technology") might have been somewhat recognizable, but clearly the processes were not. In this way we adhere to an understanding of authenticity reminiscent of Lucy Green (2008, pp. 1–14): when applied in school, real-world content should be accompanied by real-world processes.

Over the past decades, terms and theories like *situated learning* (Brown et al., 1989; Krumsvik & Jones, 2007) and *informal learning* (Folkestad,

2006; Green, 2002) have addressed this issue. In this study we apply the related term *authentic learning,* seen as "a pedagogical approach that situates learning tasks in the context of real-world situations, and in so doing, provides opportunities for learning by allowing students to experience the same problem-solving challenges in the curriculum as they do in their daily endeavors" (Herrington et al., 2014, pp. 401–402). This perspective reinvigorates a pragmatic view on learning where the value of knowledge lies in the relevance it has to human life and the degree to which it is experienced as useful. The activities that are carried out in school must have a value in themselves that children can relate to (Säljö, 2016, pp. 85–86), hereby recognizing and rewarding skills and forms of knowledge that are applicable both in and out of school, possibly fostering life-long learning (Green, 2008; Snape & Fox-Turnbull, 2011).

Furthermore, authentic learning, like any other learning, is dependent on a setting where learning can take place: *a learning space*. In research this concept has been viewed from a variety of angles. To show the pedagogical possibilities when teaching is moved outside the classroom, the term *learning arena* (Barfod, 2018; Gabrielsen & Korsager, 2018; Larsen, 2016) has been used to describe a physical place with its inherent possibilities and limitations. The digitalization of society has also actualized what are called *virtual learning spaces* (Krumsvik & Jones, 2007; Weiss et al., 2006), *future learning spaces* (Punie & Ala-Mutka, 2008), and *The Next Generation Learning Spaces* (Radcliffe et al., 2009), opening up the space to include the learning consequences of digital everyday life. From another angle, learning space has been used as a *pedagogical concept*, including "the relations between pupil, teacher and content in design oriented tasks" (Randers-Pehrson, 2016, p. 28), understanding teaching as a social and relational practice.

Our definition of learning spaces is derived from all these modes of use, while also including approaches that we believe facilitate the possible experience of authenticity and authentic learning for the pupils. Although the Science Camp workshops took place outside the traditional classroom, this is not a premise for creating an authentic learning space *per se*. The central issue is that the physical environment was largely influenced by the instructors' experience and expertise – which we believe

to represent authentic, real-world practices. With the effort to recreate meaningful and existential experiences from their own lives as a motivation, the instructors "furnished" their learning spaces with music technology equipment, sounds, forms and working methods associated with the production of pop music genres preferred by the pupils, forming what the instructors believed to be fruitful premises and starting points for authentic language use, instruction, communication and collaboration. To sum it up, each workshop manifested itself as an attempt to create an *authentic learning space* where the physical environment, the technological tools, and the relationships between instructor, pupil and content together created a range of opportunities and limitations for learning in a real-world context relevant to the pupils.

Knowledge and Expertise

The complexity and variety of the forms of knowledge and practices we meet, as teachers, university lecturers, teacher educators, student teachers, policy-makers or researchers, demands careful thought and reflection (Georgii-Hemming et al., 2013, p. xviii). There are many possible ways of examining such a profound concept in the context of music education. Georgii-Hemming (2013) discusses the different forms music as knowledge may have on the basis of Aristotle's distinctions between *episteme*, *techne* and *phronesis*. One of the reasons why she chooses this approach is to "give a voice to different forms of knowledge, and, by doing so, these voices can be respected and valued as well as being critically observed and developed" (p. 20). An important aspect of this approach is to lift up the importance of practical knowledge, acknowledging the difficulties in verbalizing the tacit or implicit knowledge underlying the many choices made in an educational context (pp. 28–29).

In the current study's research question we differentiate between "knowledge" and "expertise". In the results and discussion parts of this chapter, "knowledge" is understood as *explicit* knowledge, meaning what the research participants themselves recognize and articulate as knowledge in the interviews. The "music technological expertise" of the research participants points to the totality of musical and technological

skills and experiences integral to their individual musical practice, including all forms of knowledge. In this study, "expertise" means that the research participants have (i) a music-technological skill level considered to be higher than what is to be expected from the average music teacher in the Norwegian school, and (ii) an individual professional music practice based on a specific set of musical and technological skills and experiences. These specifications are important in the way they connect to the understanding of authentic musicianship, where the embracement of technology, in any shape or form, is integral to musical expression. By making the distinction between "knowledge" and "expertise" we acknowledge the many different forms of knowledge at play in this specific educational context, and the way this expertise informs music teaching. In letting the research participants themselves articulate what they recognize as knowledge our task as researchers has been to facilitate and support this challenging endeavor; to tell their stories and make them comprehensible.

TPACK – Technological Pedagogical and Content Knowledge

One of the approaches that has been used to examine knowledge in the area of educational technology is the *TPACK framework* (Mishra & Koehler, 2006; Pierson, 2001; Thompson & Mishra, 2007). The TPACK framework extends Shulman's (1986, 1987) formulation of Pedagogical Content Knowledge (PCK) by including Technology Knowledge (TK), and attempts to capture some of the essential qualities of teacher knowledge required for technology integration in teaching. The motivation behind the development of this framework is the "advent of digital technology […] in most arenas of human work" (Mishra & Koehler, 2006, p. 1017). Since technology is continually changing, so will also the nature of Technology Knowledge (TK) and all intersections that include Technology Knowledge, like Technology Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and, of course, Technological Pedagogical and Content Knowledge (TPACK). Utilizing this framework may be helpful in identifying problems with current approaches, but

can also offer new ways of "looking at and perceiving phenomena and offers information on which to base sound, pragmatic decision making" (p. 1019).

The TPACK framework has been brought into a Norwegian setting (Giæver et al., 2014; Giæver et al., 2017), but has not, to our knowledge, been used to examine the subject music in Norwegian primary and lower secondary schools. Chai et al. (2013) find the same tendency internationally in an extensive review of TPACK-related research, even though more studies focusing on the subject music have been conducted in the recent years (Bauer, 2013, 2014; Gall, 2017; Macrides & Angeli, 2018; Mroziak & Bowman, 2016). Also, existing research based on the TPACK framework has prioritized "traditional" teaching situations, focusing on teachers' lack of technological knowledge as a main challenge. But the TPACK framework opens for research on alternative learning settings, where "weak" and "strong" knowledge is distributed differently (MacKinnon, 2017). The current study is an example of this and gives us an opportunity to ask different questions: How are music teaching situations affected by music technological expertise? Can research on alternative learning settings influence our view on technological, pedagogical, and content knowledge? Research of this kind is a new addition to the field and may challenge and nuance the TPACK framework, especially concerning the subject music in primary and lower secondary school in Norway.

Knowledge of context in the TPACK framework has been cited by several as crucial to the successful integration of digital tools into teaching (MacKinnon, 2017; Porras-Hernández & Salinas-Amescua, 2013; Rosenberg & Koehler, 2015). An example of this is Gall's (2017) adaptation of the original TPACK framework where she has put it into a music-specific context. The result is a conceptual profile of forms of knowledge as it looks through her studies of teacher education for secondary school teaching at the University of Bristol, England. Gall also encourages other researchers to do the same, possibly forming a starting point for dialogue between teacher educators within and across countries and contexts (pp. 306, 315). Therefore, we see the following model as a fruitful basis for our music-specific study:

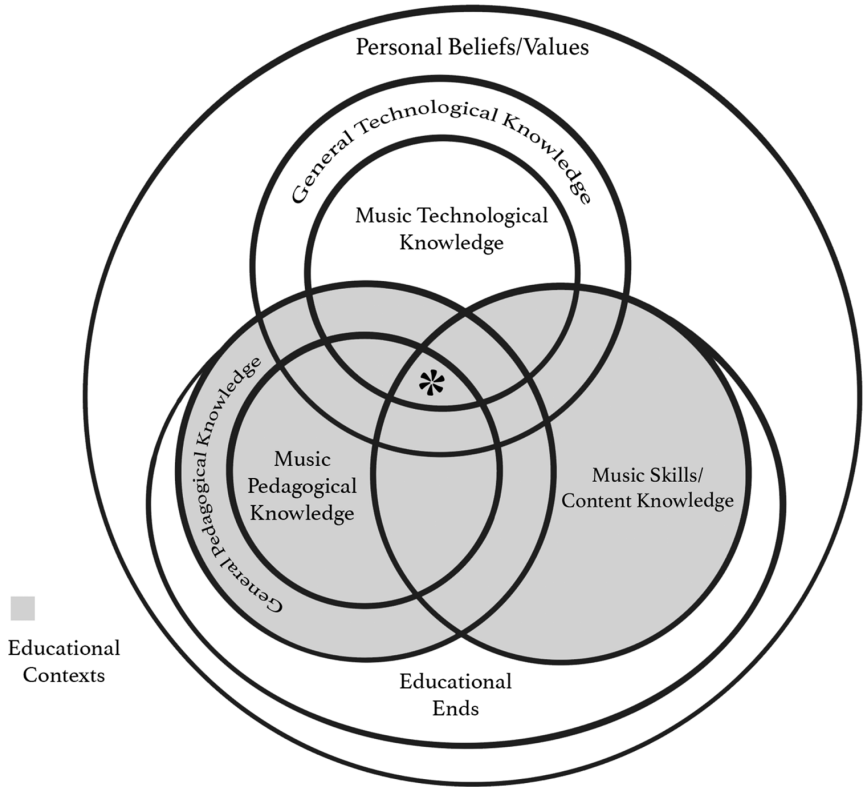

Figure 1: New Music Education Conceptualization of TPACK (Gall, 2017, p. 309).

In this model, it is highlighted that music teaching demand a high degree of music skills, music technological knowledge and music pedagogical knowledge that come on top of the general knowledge more widely applicable across different subjects. Examples of music-specific knowledge could be the teacher's proficiency on different instruments and in different genres (Music Skills), or the diversity of "teaching styles" required for instructing class bands, composition or choir (Music Pedagogical Knowledge), or all the music-specific hardware and software that might be of use (Music Technological Knowledge). The star in the middle emphasizes the teacher's knowledge of the students' technological competence, music technology skills and music preferences as a central premise for the successful integration of technology. The outer circle highlights the teacher's personal beliefs and values and has been separated from general

knowledge about educational ends, underscoring the fact that the individual teacher's self-confidence and passion for the use of music technology affects the frequency of use. Knowledge about the educational contexts is altered from enclosing the entire model to only parts of it, to take into account that we may find employees with purely technical responsibility and education in school. Although lacking knowledge of a wider school culture, they might still be put to use and contribute to music teaching. In this chapter's discussion section we will provide our own conceptualization and revision of the TPACK framework using Gall's adaptation as our starting point.

The obvious advantage of using the TPACK framework is the way it integrates technology into the established discourse of pedagogical content knowledge. It identifies new areas of knowledge and emphasizes the complex interplay of the three bodies of knowledge. Still there are some unclarities we want to address before we go on. The first unclarity concerns the TPACK's understanding of "technology". In this framework technology covers "standard" technologies, such as books, chalk and blackboard, as well as more "advanced" technologies, such as the Internet and digital video, including skills required to operate particular technologies. This classification is problematic at best, even more so in a music context. What can be considered "standard" or "advanced" technologies in the subject music? It may seem like there exists a misconception of linking the degree of "advancement" with the degree of digitalization, something that makes little sense when it comes to the practical appliance of technologies in an educational setting. For the subject music it is also unclear how "skills required to operate particular technologies" (Mishra & Koehler, 2006, p. 1027), understood as knowing how to play an instrument, does not adhere to Content Knowledge. The problematic analytical divide between Technology Knowledge and Content Knowledge points towards another unclarity in this framework concerning the understanding of knowledge. When describing the different areas of knowledge, Mishra and Koehler (2006) tend to start each definition with the words "knowledge about" or "knowledge of". Even though there are references to "skills" in Technology Knowledge (p. 1027), and "deep knowledge" (p. 1026) in Pedagogical Knowledge, the descriptions communicate an

understanding of knowledge as *explicit*, leading to conscious choices in an educational setting. Such an understanding questions the framework's capability to explore implicit or tacit forms of knowledge, something we in this study meet with our distinction and relation between "expertise" and "knowledge".

Research Design

The data material for this study was generated in 2018 at the Trondheim Municipality's summer school Science Camp, where 800 children and youths participated in a number of day-long workshops ranging from science to arts and culture. We have followed ten of these workshops, which focused on song writing and production using music technology, led by music technology students from NTNU (hereafter called "instructors"). The following data (Figure 2) was generated:

Observation notes	Observation notes from informal conversations and a selection of workshops
Video recordings	Six video recordings of workshops
Interviews	Three interviews (audio recordings and transcripts) with instructors (fall 2018)

Figure 2: Data of the study.

Participation in the study was voluntary for both instructors and pupils, none of who were previously known to the researchers. Recruitment was done after registration to Science Camp closed, meaning normal participation in Science Camp was possible without participating in the study. All ten instructors were invited to join the study while consent was collected from pupils and guardians enabling us to generate audio and video recordings from the workshops. Observation notes were taken from a range of workshops,[5] while video recordings were made from six

5 Non-participating observation (Fangen, 2010).

of these. Following the workshops, three instructors agreed to individual interviews. The interviews were conducted with the support of video-stimulated recall (VSR) (Lyle, 2003; Powell, 2005), where video clips from the workshops formed the basis for reflection. In the interviews we were especially interested in how the instructors perceived and explained the knowledge at play in the different phases of the workshops. They were invited to make connections between their own music technological expertise and the choices they made in planning and executing the workshops. The instructors were also invited to give feedback on general depictions based on the workshops, acting as member-checking and validation of our preliminary analysis. The study is approved by the Norwegian Centre for Research Data (NSD).[6]

The analysis was conducted in three phases and is inspired by the TPACK-based content analysis performed in the article "Tracing the Development of Teacher Knowledge in a Design Seminar: Integrating Content, Pedagogy and Technology" (Koehler et al., 2007). The first phase concentrated on the video recordings and observation notes. The observation notes contained descriptions of the workshops in addition to reflections made during the observation periods. By comparing the descriptions from the observation notes and video clips from different workshops we identified *differences* and *similarities* in the instructors' approaches concerning preparation of the physical environment, the use of technological tools, and in interaction with the pupils. On the basis of this we created *general depictions* where we attempted to maintain the internal integrity and relations between different factors in the workshops. In a second review of the videos we identified episodes which we found illustrative of the different approaches adhering to each general depiction, and that were to be used in the interviews. In this phase of the analysis we did not attempt to explicitly identify knowledge.

The second phase of the analysis took place on the basis of the interviews. As mentioned, the instructors were invited to recognize and articulate the knowledge at play in the planning and execution of the

6 See https://www.nsd.no

workshops. In the interviews the video episodes and the general depictions from the first phase were used as starting points for reflection. Interview transcripts were coded on the basis of the TPACK framework's emphasis on different forms knowledge. The coding categories were not mutually exclusive, making it possible for interview segments to be coded with multiple codes. Through this phase of the analysis we identified a number of forms of knowledge and areas that stood out as central to the teaching practices of the instructors. Excerpts from coded interview segments will be presented in the discussion part. Together with the instructor's input and reactions to the general depictions, this laid the foundation for a new conceptualization and the third phase of the analysis.

Finally, the results of the first two phases of the analysis were configurated into three narratives of *authentic learning spaces*. In these narratives idealized music technology teaching practices and TPACK informed knowledge are brought together expressing the pedagogical choices, work methods, content, values and focus of three music technological teacher roles, as seen through the eyes of the researchers. The narratives may be understood as "second-order narratives" (Elliott, 2005, p. 13), meaning accounts constructed by researchers to make sense of the social world and of other people's experiences. We see these narratives as *ideal typical* in a Weberian sense; that is, as a strategic, "unified analytical construct" (Weber & Swedberg, 1999, p. 248). Ideal types are not representations of reality, but they deal with and emphasize certain features in order to make a "context distinctive for us to understand in a pragmatic way" (Weber et al., 2000, p. 199). Together with excerpts from the instructors' interviews, the three authentic learning spaces form the basis for the discussion of the study.

The data material is derived from workshops planned and executed by music technology students without formal teacher training, and Science Camp exists outside of the physical and professional demands that we meet in school. While this is a definitive prerequisite for our research and might point to exciting ways forward, it may also limit the transferability because the authentic learning spaces might require competence and working conditions that are not present in school.

Results – Three Narratives of Authentic Learning Spaces

The following descriptions are developed on the basis of this study's data material, where each "person" is constructed across different workshops and instructors. The names of the learning spaces have been chosen because they resonate with words the instructors used about their own roles in the workshops, but also with terminology used in the music industry and in academic discourse. They are not meant to challenge or exclude existing definitions of, for example, the *producer role* (Burgess, 2013), but rather to make the learning spaces somewhat recognizable and relatable to the reader. In what follows we will present our identification of authentic learning spaces of *the producer*, *the beatmaker* and *the sound artist*.

The Producer's Learning Space

In the producer's learning space, the teacher is characterized as a *guide*. Her background is firmly rooted in informal band settings, she is often an accomplished musician, she is open to all kinds of music, and she has listened analytically to large amounts of it. This gives the producer a general understanding of musical conventions and what constitutes a good melody or a good song across a broad spectrum of genres. The producer uses this broad knowledge to inspire others to make music, struggling to achieve the best possible outcome from the ideas they present. Her most profound motivation is to enable others to express themselves, meaning that the quality of the finished product is given a secondary role. The creative process is more important than the finished product in the producer's eyes, and she has a strong belief in the pupils' capability to contribute musically, that they participate for a reason, and that they desire to be involved and have agency in the creative process. Therefore, the music technology equipment and tools are seen first and foremost as a means to help the pupils' ability to express themselves musically.

The producer's guided tour in music creation puts the pupils in an instant creative environment. She provides a wide variety of equipment, such as a computer, a midi keyboard, synthesizers and all kinds

of acoustic instruments, and encourages the pupils to play and explore the different sounds and possibilities. She takes on a semi-passive role but provides guidance and assistance when an idea arises or the creative process stalls. All the while, she demonstrates necessary techniques for operating the software and music technology, making the pupils gradually more independent and self-reliant.

The Beatmaker's Learning Space

In the beatmaker's learning space, the teacher is characterized as a *craftsman*. In her own work she has a keen ear for detail, and she aims to express a professional sound. Therefore, she has a vast knowledge of production techniques and genre conventions and possesses the ability to emulate and reproduce specific soundscapes through the correct use of sounds, effects and processing. Her notion of what constitutes a good song is equally defined by a great sound or arrangement, as much as it is dependent on great melodies or lyrics.

The foundation as a craftsman leads the beatmaker to provide "shortcuts" for her pupils, and through handing them pre-made musical structures or loops to start with, they quickly reach a professional sound. Hereafter, she takes on an active role together with the pupils, teaching them production techniques, effects, mixing, programming and processing. The goal is to take the pupils on a musical voyage, where the pupils experience agency and ownership to the product and process by being involved in creating music that sounds close to what they hear and use in their everyday endeavors. The equipment in use resembles a real-world "home studio", typically consisting of a laptop with a DAW, a midi keyboard, studio monitors and a headset. She is not afraid to use advanced terminology, and she has a strong belief in the pupils' previous technical knowledge and ability to understand advanced aspects of production.

The Sound Artist's Learning Space

In the sound artist's learning space, the teacher is characterized as an *explorer*. Experimentation is crucial to her work, and the main focus is

on the creative potential found in the sounds of an object, a room, an instrument, the body or whatever you might imagine using for musical expression. All sounds are treated equally, whether they come from acoustic, digital or analogue sources, and she experiments both with how she generates and collects these sounds and how she manipulates them. This is enabled by a thorough understanding of technology, where experimentation has led her to know how to "stretch" the capabilities of digital tools, using them for purposes that were not necessarily their intention.

At the start of the creative process, the sound artist takes the pupils on a journey, discovering and collecting sounds "in the field" with a handheld recorder. The collected sounds serve as the raw material for further exploration on the laptop, where the sound artist operate the technical aspects, creating instruments and soundscapes from the collected sounds that the pupils can experiment with through digital manipulation. She strives for a collaborative environment where everything is allowed and the ideas can flow freely, manifesting itself as "creative chaos". There are few, if any, references to traditional music or production, with the result that a professional sound, technical skills or advanced terminology is paid little attention. The main goal is to arouse interest and curiosity with a teacher role defined by openness, support and tolerance.

Discussion

We will now move on to specific descriptions of the knowledge we find characteristic, by employing the TPACK framework and offering our modification of the TPACK model where the context of Science Camp is taken into account. Here, we rely on Gall's (2017) modified TPACK-model, adapted to further contextualize Gall's emphasis on musical specialization according to our findings.[7]

7 When reading note that Content Knowledge is referred to as Music Skills, but we retain the abbreviation CK to show the connection to the original TPACK framework.

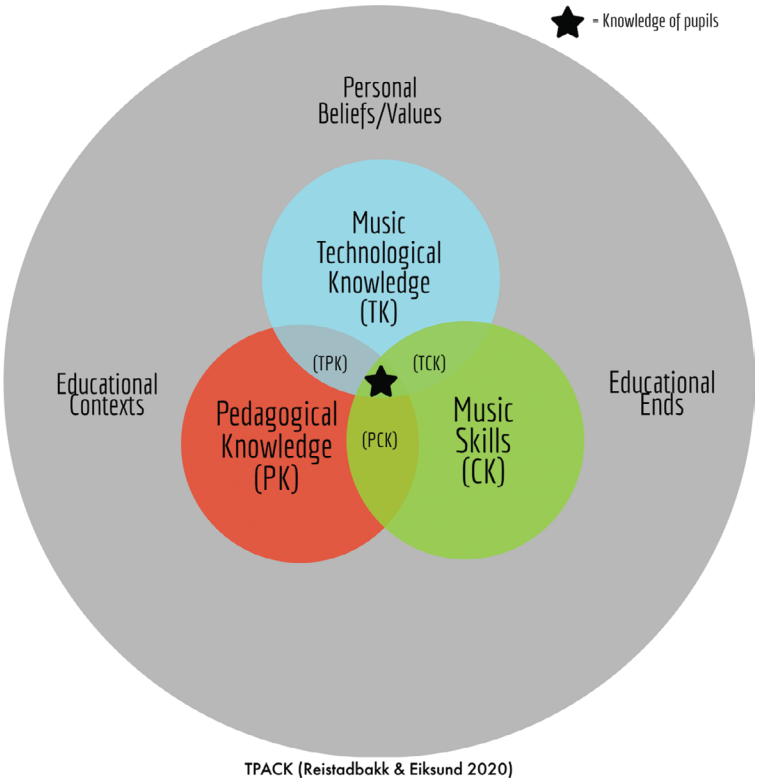

Figure 3: TPACK informed by music technological expertise.

In the following we will present our model by elaborating on the types of knowledge we found most significant and characteristic in the workshops: Music Technological Knowledge (TK) and Music Skills (CK), Pedagogical Knowledge (PK), Music Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Knowledge of Pupils, as well as Educational Ends/Context and Personal Beliefs/Values, before commenting on how these knowledge areas contribute to the understanding of Technological Pedagogical and Content Knowledge (TPACK).

Music Technological Knowledge (TK) and Music Skills (CK)

We choose to only include music-specific knowledge from Gall's (2017) model, to underline the specific expertise at play in the authentic learning

spaces. Each of the instructors describes and demonstrates a convincing expertise in the use of one or more DAWs,[8] midi-controllers, synthesizers, microphones and other relevant tools. Also, as shown in our narratives, they demonstrate a high degree of proficiency on different "traditional" acoustic/electric instruments and in different genres, both practically, theoretically and analytically. As we will see, this competence is crucial to their Pedagogical Knowledge (PK) and Technological Pedagogical Knowledge (TPK).

Pedagogical Knowledge (PK)

Pedagogical Knowledge (PK) can be understood as the conscious use of suitable teaching styles, processes and methods appropriate to different settings. (Koehler et al., 2007, p. 743) As mentioned, Gall (2017) further specifies this as "Music Pedagogical Knowledge", thereby highlighting the diversity of teaching styles required of a music teacher. Gall says, "For example, classroom orchestra or extra-curricular ensembles, which are mainly teacher-led, require very different pedagogical approaches to composing activities in which the teacher best acts as a facilitator of pupil learning" (2017, pp. 309–310).

The workshops at Science Camp clearly were "composing activities", and in our data we find that the instructors made conscious choices to apply a teaching style reminiscent of facilitation: "I just want to be flexible and cater to what the pupils want to do" (Instructor 3), and "[m]y role was to be some kind of a robot who could do the technical stuff, but I wanted the pupils to make their own artistic and aesthetic choices" (Instructor 2) are just two of several quotes implying this.

First of all, this demands an explanation of how we understand *facilitation* and, thereby, *Music Pedagogical Knowledge* in our model. In his research on American music teachers' approaches to popular music, Cremata (2017) describes the role of a facilitator as:

8 DAW is a collective term for music production software, "Digital Audio Workstation", for instance, Ableton Live or Logic Pro.

> A popular music facilitator, responding to his/her students' needs, regulates control levels and differentiates instruction by giving and removing assistance. Rather than focusing on blend, balance and uniformity (aesthetic qualities), a facilitator emphasizes individuality, differentiation and freedom (social qualities). (p. 76)

Throughout our narratives, we find clear examples of different approaches to facilitation: from the producer guiding the pupils through their ideas (medium control level), to the beatmaker providing pre-made musical structures (high control level), and the sound artist striving for a highly collaborative environment and "creative chaos" (low control level).

Facilitation can also be connected to "real-world" practices, for instance through Burgess' (2013) descriptions of the record producer. Here we find striking similarities to Cremata's definition of the facilitator: The primary task of a record producer is to inspire and enable others toward a common vision, drawing on a flexible leadership varying from determining the goal himself or stimulating others to set the goals (p. 24). Also, we can find similar descriptions in more recent research, for instance in Tuomas Auvinen's (2017) discussions on the practices of the aspiring *tracker/producer* Mikke Vepsäläinen:

> In addition to the *tracks* of a project, the tracker also acts as a social agent by working with singers and musicians to make their tracks better. Therefore, the agency of the *tracker* is a combination of artistic decision-making, aesthetic judgment, collaboration with other creative parties and using digital production technology. (Auvinen, 2017)

To sum it up, by Music Pedagogical Knowledge we mean the ability to provide leadership through varying levels of control and assistance inspiring and enabling a group towards a common vision while acting both as social agent, decision-maker, creative and aesthetic collaborator and technical assistant.

This definition might raise questions as we tap into other areas of the TPACK framework where, for instance, aesthetic collaborator might be seen as Pedagogical Content Knowledge (PCK), and technical assistant as Technological Content Knowledge (TCK). This issue tends to arise when defining or categorizing music pedagogical methods or practices as they often include a whole range of areas that might be defined as not solely

pedagogical but also subject or context specific (Nielsen, 1998). If one is to discuss Pedagogical Knowledge with a music teacher, distinguishing statements into discrete pedagogical, musical or music pedagogical categories will not be an easy task and might cloud the totality and complexity of the teacher's knowledge.

When the instructors choose facilitation as their approach to teaching they draw on their own experience with collaborative work in studio-like contexts. This experience has been acquired both through the instructor's informal experience, for instance, from their home studio or working with bands, and through formal experiences from their studies in Music Technology at NTNU. In other words: in the instructors' efforts to create authentic learning spaces, facilitation figures as the real-world reference that they craft their teaching style around. This highlights experience and understanding of both formal and informal contexts as key knowledge at play in this study. Furthermore, if you are to cater to what the pupils want to do, be a technical robot and be able to draw out the best of the different initiatives and ideas that arise at any moment, well-developed expertise in a wide range of musical and technological areas is of the uttermost importance. This also underscores the possible experience of the workshops as authentic learning spaces by the pupils, where the instructor figured as a real-world expert employing language, equipment, working methods and the facilitation of a creative process similar to what they would meet in a professional setting.

Music Technological Content Knowledge (TCK)

Although this is not specifically highlighted in our narratives we found a significant amount of time spent on listening throughout all workshops. At first this might have been understood as just "passing the time" or procrastination, but through our interviews and analysis we have found listening to be a central and explicit knowledge in the intersection between Music Skills and Music Technological Knowledge – forming a characteristic Music Technological Content Knowledge (TCK).

The instructors employed different listening states throughout the creative process, guiding the pupils back and forth between them, as listening and ideas have a mutual impact on one another: listening can

be the driving force to create new ideas, and as the process moves forward new ideas will lead you to another listening state. We have derived three listening states which we will now present together with quotations from the interviews, although we would like to stress that these states are intertwined as the creative process does not necessarily follow a clear forward-moving path from start to finished product.

The first state, *inspirational listening*, is characterized by a free and fast browsing of different sounds, samples, instruments, loops or synthesizers. In this phase it is important not to listen too critically, and you "wait for something to stand out" (Instructor 3) where a synth, a note or a sound can give inspiration which manifests through an obvious "physical reaction" (Instructor 3). When this reaction appears it can be the catalyst for the whole production or songwriting process, where the first pieces of the puzzle fall into place and you start to get "into the zone" (Instructor 1).

When you have found that "spark" (Instructor 1) which put you into the zone you might enter the next listening phase – *imaginative listening*. In this phase you try to listen ahead in time and use your "imaginative ear" (Instructor 2) to propel the creative process forward. You have to "vibe with it and feel where you're going" (Instructor 3), and the phase is characterized by continuously looping the material you have recorded so far. This might help keep you "inside the music" (Instructor 2) while you test different combinations of sounds and elements. "What you hear inside your head" (Instructor 1) changes along this process, and gradually the structure of the product takes shape and you start to hear the entirety of the song or the production.

When more and more elements are established and you are approaching deadline you use the last listening phase, *finishing,* to a greater and greater degree. This phase consists of mixing, leveling, effects and finishing touches to the arrangement and transitions. Unlike the inspirational listening phase, the finishing phase consists of critical, intense and analytical listening preferably done with a headset and without disturbances. This phase was obvious in our observations but was not specifically expressed in the interviews, maybe because it was mainly employed in solitude when the pupils took a break. This is problematic as we claim to look for explicit knowledge, but we still include it as we clearly saw this

listening phase used across all workshops: there was a definite goal for the instructors at Science Camp that the demo would sound as good as possible within the time they had at hand before it was played back for the rest of the participants and taken home by the pupils.

Music Technological Pedagogical Knowledge (TPK)

All of the instructors used professional, industry standard software, adapting their DAW of choice, like Logic Pro, Ableton Live or FL Studio, to their own specific needs. Drawing on their expertise in music technology they created educational designs and working methods in the software that they deemed manageable for the pupils while still offering real-world tools and a framework for a relevant creative experience. A common approach among the music technology students was to somewhat simplify the DAW at first, taken to an extreme in the beatmaker's learning space where she introduces the pupils to the software through pre-made musical structures before gradually giving the pupils more and more technical knowledge and control. This knowledge enabled the instructors to set the premises, take control and purposefully adapt the affordances of the software to match their specific approaches to facilitation and authentic teaching styles in the workshops.

Knowledge of Pupils

At the center of our model we have continued the use of a star from Gall's model – meaning that knowledge of pupils' technological competence, music technology skills and music preferences is of the essence in implementing technology in meaningful and relevant ways. We find that the instructors aspired to put this knowledge to play on different levels: through our narratives we describe how the instructors tried to take the pupils' capability to contribute musically (the producer), their previous technical knowledge (the beatmaker), and their interest and curiosity for sound (the sound artist), into account when creating their learning spaces. Also, through our discussions of authenticity earlier in this chapter we argue that the instructors tried to meet their pupils' musical taste

and preferences by recreating the sound, form and working methods associated with the production of music familiar to the pupils.

Educational Ends, Educational Contexts and Personal Beliefs/Values

In our adaption of the TPACK model we use Gall's categories for Educational Ends and Contexts, as well as Personal Beliefs/Values, but we have chosen to put them all in one circle encompassing the whole model. In this way we try to describe a context where Science Camp's facilities, organization and the demands from the arrangers/participants (Educational Ends and Contexts) met the instructors' own Personal Beliefs/Values in a beneficial way. At Science Camp the instructors stood quite free to create their learning spaces as they best saw fit. Without much interference they were given the chance to recreate their own practices, aim for "life-changing" experiences and facilitate what they perceived to be authentic learning spaces. This outcome might have been different in a more traditional school setting. Here it is likely that the instructors would have to follow a specified curriculum or adhere to certain assessment demands, maybe compromising their own Personal Beliefs/Values to a greater degree on behalf of Educational Ends and Contexts. On the one hand, this might obscure the transfer value of this study to other settings. On the other hand, it challenges the working conditions provided for music teachers in school, questioning their opportunities to create real-world learning situations relevant to the learners.

Technological Pedagogical and Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK) is an emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology), and is the basis of good teaching with technology. It represents the thoughtful interweaving of all three key sources of knowledge, while also including knowledge of pupils, educational contexts and ends, and personal beliefs/values. An important aspect of this

knowledge is that there is no single technological solution that applies for every teacher, every course, or every view of teaching (Mishra & Koehler, 2006, pp. 1028–1029). Our descriptions of authentic learning spaces, together with our elaboration of key knowledge, take all these aspects into account. The music technological solutions described in each learning space are intertwined with work methods, content, values, as well as musical and educational choices, brought together under the guiding aspiration of achieving *authentic* learning situations. The identification of these types of knowledge would not have been possible without the music technological expertise of the instructors, but through our descriptions they have been made accessible and visible to new groups of music teachers with less music technological expertise.

Summary and Propositions for Further Research

For many reasons it is important to envision the knowledge for the future music teacher, but at the same time it is extremely difficult. This may be even more challenging as the rapidly-changing domain of digital technology is a major part of the equation. One way of responding to this challenge is to explore situations and practices that may have something to offer in this endeavor, an approach we have applied in the current study. Instead of looking at "traditional" music teacher settings where music technology is still considered as something new and unformed, we have focused on a setting where technology is an integral and natural part of the educational design. By examining teaching informed by music technological expertise we have configurated three authentic learning spaces. The learning spaces are idealized examples of teaching practices designed on the basis of authentic work with music technology, offering music teachers a relational understanding of how content, teacher roles and working methods may intertwine while working with songwriting and production using music technology. These learning spaces may inspire and guide music teachers wanting to facilitate meaningful music making where music technology plays a natural and integral role. A way to build on this study would be to turn the attention to the pupils' experiences, examining whether or not the authentic learning spaces for teaching songwriting and production

using music technology contributes to meaningful music experiences, relevance and positive learning outcomes.

We have also highlighted types of knowledge that characterizes the instructors' attempts to create authentic learning spaces, expressed through our adaption of the TPACK model. This model highlights not only Technological Knowledge, but also ways of understanding relevant Pedagogical Knowledge, Content Knowledge and how the different types of knowledge intersect and affect one another. This study is, to our knowledge, the first that introduces and adapts the TPACK framework to the subject music in a Norwegian context, and also represents an approach that expands the methodological appliance of the framework by focusing on an "untraditional" teaching situation. We have demonstrated the usefulness of this approach by providing new content to several knowledge categories and, by this, contributed to the further development of the TPACK framework.

The approach of authentic learning spaces reinvigorates a pragmatic view of pedagogy, school, education and learning, and questions highly how and why we teach – especially in this era of disruption, rapid changes and an increasing "disconnect" felt by many both in and outside school. It shows that what we count as significant, real and meaningful knowledge might just as well be found "outside" of the traditional school and formal teacher training – thereby empowering and validating new and different forms of knowledge and approaches to education and teaching. Continued research on how authentic, real-world practices can affect and change music education is therefore of the essence, and we highly encourage more studies where TPACK is used to identify and describe knowledge in untraditional or informal settings.

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