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| RESEARCH ARTICLE

The Experiences of Teachers in Teaching Computer Music in Selected Colleges and Universities in Hubei China

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| ABSTRACT
This study intends to determine the expectations of teachers as well as the experiences that they have had while teaching computer music composition in a selection of colleges and universities located in the province of Hubei in China. In order to gather the perception of a particular respondent in order to detect a structured pattern, this study will be based on a descriptive correlational research design. A numerical score rating will be issued to each respondent. According to Health Research Funding (2018), quantitative research enables researchers to be objective, collect data quickly, and analyze the data in a statistical format, which can provide a comprehensive perspective of the investigations being conducted. The majority of those who participated in the survey were of the opinion that students are not capable of mastering computer music production technology and need to demonstrate specific knowledge of music theory in order to develop and produce music. There was a significant amount of disagreement among educators regarding the notion that students have become more enthusiastic about participating in learning and that head teachers have already prepared multimedia courseware prior to the start of class. This courseware demonstrates the key points and difficulties involved in theoretical courses, which can directly reach the teaching purpose and optimize the organizational structure of the classroom.

| KEYWORDS
Computer Music, Computer Music Language, Music Education

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1. Introduction
Since the 1990s, the computer music major has been extensively established in Chinese colleges and universities. Additionally, the relevant teaching theories and teaching techniques have been continuously improved. This development also occurred during the same time period. The vast majority of educators and students have a profound affection for computer music, which has steadily evolved into a new field that combines contemporary technology and music, music theory and practice, professional education, and social concerns. Nevertheless, because the development of the field is still in the process of discovery, in addition to the dearth of professional skills, particularly those leaders who have an international perspective, the computer music field in

Due to the fact that the "information society" requires alternative methods of instruction to traditional methods of instruction, music educators have been conducting research and implementing new methods as a result of the inadequacy of traditional education (Altakhyneh & Abumusa, 2020; Elliston, 2020; Perdana, Jumadi, & Rosana, 2019; Wallace-Spurgin, 2018). Within a very short period of time, the accuracy of knowledge can shift in the century in which we do not live. It is vital to cultivate individuals who think creatively rather than persons who think in stereotypes in order to keep up with this shift (Mason & Moniz, 2005; Watson, 2006). This is because it is necessary to keep up with this development. One more thing to consider is the fact that people have different educational experiences. There may be variations in the manner in which each learner gains musical information and skills. For this reason, it is advised that music education make use of contemporary technologies, as well as a variety of methodologies and techniques (Cain, 2004; Dorfman, 2006). A teaching method known as computer-assisted instruction (CAI) is one in which a computer is used as an environment to enhance the teaching process and the motivation of students. It is a combination of self-learning principles and computer technology, and it allows students to benefit according to their own individual learning pace. According to Abdullah and Mustafa (2019), Soparat, Arnold, and Klaysom (2015), and Sünbül, Gündüz, and Yılmaz (2002), computer-assisted instruction (CAI) can be defined as the activities in which students engage with the courses that are coded on the computer. The instructor serves as the guide, and the computer serves as a learning environment.

As it continues on its path toward development and maturity, China is encountering an increasing number of challenges and practical issues. Some examples of such issues include problems with the creation of teaching equipment and teaching materials, problems with the construction of professional curriculum systems, problems with the design of teaching content, and so on. Therefore, the current professional teachers' thinking has shifted to focus on how to accurately understand the development connotation of computer music, how to grasp the development direction of the computer music discipline in China, and how to overcome the practical challenges encountered in the development of computer music. The purpose of this paper is to provide some theoretical basis and reference for the development of computer music teaching in colleges and universities through the research that is conducted in this paper. The paper will analyze the current situation of computer music teaching in selected colleges and universities, as well as discuss the development connotation of computer music majors.

2. Review of Related Literature

2.1 Composition and Digital tools in Music Education

Recent years have seen the development of perspectives on creativity and learning in interval-based (pop) and sound-based music education, respectively. These perspectives have been created in empirical research that is primarily qualitative and carried out on a smaller scale. Research on creativity through digital composition tools in schools, on the other hand, has primarily concentrated on the widespread use of notation and sequencer software (such as GarageBand, Jam2jam, and eJay), which involves organizing pre-made instrumental samples into sound file representations that are typical for specific types of pop music. Fewer empirical research has been conducted on sound processing software (such as SoundHack, SoundEffects, Compose with Sound, DSP1, and ProTools) for the purpose of composing and thinking in sound or sound-based music. Across types of digital tools and music domains, areas of music education research that are relevant to our topic include studies of implementation and use (Brown, 2007; Dobson & Littleton, 2016; Gall & Breeze, 2008; Hewitt, 2009; Savage, 2007; Vratulis & Morton, 2011), learning and creative processes (Dillon, 2004; Gall & Breeze, 2005; Hewitt, 2009; Nikolaidou, 2012; Rudi & Pierroux, 2010; Wolf, 2013;) and teaching and assessment approaches (Webster, 2007; Wise, Greenwood and Davis, 2011).

2.2 Teaching and assessment approaches in Music courses

According to Higgins and Jennings (2006) and Wolf (2013), the connection between the development of concepts and the abilities necessary for music appreciation highlights special issues that arise when teaching composition in sound-based music. These challenges include the fact that this is a new realm that students may experience as being "alienating." There are a few specific issues that have been identified as a result of research conducted on the subject of teaching sound-based music education. These issues include the requirement for listening curricula that help students develop their conceptual and critical thinking skills (Wolf, 2013) and the need for teaching methods that can assist students in working with longer phases of creative work in an abstract problem space. Approaches to facilitating creativity and learning with more open-ended composition tasks and tools present an additional challenge for teachers in sound-based music education. This is because teachers are required to listen to the content of the sound development in students' works in order to comprehend the processes that students have been working through. Therefore, in a large-scale study that was carried out in three middle schools in the United Kingdom, Wolf (2013) established a curriculum and teaching methods that examined the growth of students' appreciation of sound-based music in accordance with the concepts of active, collaborative, and self-regulated learning, respectively. According to the findings of the study, structured listening training and the teaching of key concepts of electroacoustic music led to an increase in appreciation, a broadening of students' vocabulary for describing their listening experiences, and positive learning outcomes in the factual, conceptual, and procedural knowledge of inexperienced listeners. In a different study conducted in Ireland by Higgins and Jennings (2006), advanced preparation that included listening activities was also recognized as important for achieving targeted learning results. The study involved a teacher and ten 16-year-old students who were enrolled in a school with the purpose of gaining knowledge of how pedagogical designs might build and support students' higher-order critical thinking skills in relation to electroacoustic music; this research was created using three different versions of instructor assistance in composition classes. Following each round of composition work, the works of the students, instructor observations, and student interviews were studied. This analysis included a comparison of the processes of guided and unguided creating, cooperation, and learning through the use of a digital audio editor program called Cool Edit Pro by the students. The following are some of the effective teaching strategies for electroacoustic composition that have been identified by Higgins and Jennings (2006): preparatory work (such as having adequate technical skills, prior knowledge of sound materials and how they can be transformed, familiarity with musical context and composition elements such as time, pitch, change, structure, and balance); being available without being intrusive; and focusing attention through appropriate questions.

The structure and affordances of sequencer software such as GarageBand, on the other hand, have been shown to be able to constructively scaffold student work with minimal assistance from the teacher, according to research conducted by Wise et al. (2011) studying the use of sequencer software in the classroom for the purpose of teaching writing. Participants in both types of settings were able to "instinctively, with minimal effort, produce music collaboratively by selecting, listening, and evaluating samples and arranging them on a graphic page, on which they could visualize and discuss their work," according to Dillon's findings. This was made possible by the eJay tool's design, which featured a powerful visual interface and immediate feedback. As a result, the function of the instructor shifts more toward that of a facilitator for a creative process that unfolds in a rather straightforward manner, beginning with searching, listening, and selecting samples, then moving on to phases of contemplation and editing, and then culminating in group consensus regarding sounds and compositional structure (Dillon, 2004). To summarise, when digital composition tools are employed in interval-based music education and sound-based music education, respectively, there is a need for distinct teaching methodologies.

According to Odena and Welch (2012), teachers' perceptions of musical creativity vary depending on "past experiences, current working context and teaching, and potentially any other musical activities undertaken outside school." This is due to the fact that teachers' perceptions of musical creativity are influenced by a variety of factors. Because of this, it is essential for educators to possess "practical knowledge of various musical styles in order for the knowledge to impact on their teaching" (this is cited in the original source). According to Wise et al. (2011), the criteria that teachers use to evaluate students' composition work while employing 'looping' tools vary. This is done to accommodate differences in individual students' musical knowledge and abilities. Teachers' perceptions ranged from skepticism about the creative value of working with pre-recorded loops and 'drag and drop' compositional approaches to endorsements of the software for allowing less advanced students to enjoy and complete composition courses without understanding Western music theory and notation (Wise et al., 2011). The study was conducted on nine teachers who worked with GarageBand over a longer period of time at four different schools during the course of the study.

These several lines of inquiry, when taken as a whole, demonstrate that the digital composition tools that music educators use most frequently are the ones that promote student engagement and learning in traditional popular music creation. Furthermore, sound-based music composition necessitates an organized listening curriculum and learning activities. We also find that questions surrounding how the design of digital composition tools in these respective fields enhances creativity in learning contexts have not been thoroughly studied. This is something that we have discovered. Savage (2005) framed this challenge when writing that “the relationship between music and ICT is not one of servant and master, but rather a subtle, reciprocal and perhaps empathetic one” (…) and that technologies “could lead pupils and teachers to engage with and organise sounds in new ways, challenging the very nature of music itself at a fundamental level” (p. 168). In the beginning, there were more critical perspectives on this dynamic (Folkestad, Hargreaves, & Lindstrom, 1998; Truax, 1986). These perspectives expressed concerns that some forms of software may potentially lead to a shallow grasp of sound concepts by restricting students' creative range to the affordances of the tools. Students have reported feeling frustrated when attempting to compose personal musical expressions due to limits in software that are related to genres. This demonstrates that creativity can be encouraged, but it can also be confined by tools and domain orientation (Cooper, 2009; Gall & Breeze, 2005). The use of digital tools in music education primarily reinforces existing paradigms of interval-based music by facilitating more efficient production methods (Beckstead, 2001). This is in contrast to drawing on new affordances to transform learning and creative processes, such as the possibility to directly develop and change unique sound material, as well as the ability to organize sounds according to principles and systems that are different from those found in styles of conventional pitch-based music. These concerns are supported by studies that demonstrate this phenomenon.

2.3 Teaching Computer Music

According to Liu Tingting (2022), from the point of view of those who create music, we ought to take the initiative to include cultural connotations in musical compositions and employ a variety of expressive approaches in a flexible manner. The complete utilization of computer music technology has the potential to lessen the difficulty of the creation process. Additionally, the creative notion is relatively unique, and the forms of creation also demonstrate diversity. The purpose of this paper is to describe the ways in which computer music technology can be utilized in the process of creating music.

A comment was made in the article "Computer Music and Composition Foundation" (Yi, 2020) regarding the utilization of computer music production software in the process of music creation. People are paying an increasing amount of attention to the development of a spiritual life that is of a high quality as the standard of living and quality of life of the general public continues to improve. Music, along with the incorporation and use of computer technology, has been a driving force behind the creation and development of computer music production software. Music is one of the art forms that helps the general public improve their body and mind. Computer music production software has transcended the application of the conventional music creation mode and has become the standard form of modern music composition. This is due to the fact that the software is faster, more convenient, and more intelligent than traditional music creation modes.

Regarding the research conducted by Yi (2021) on the utilization of electronic music production technology in the production of films, it was found that When it comes to the making of films, electronic music production technology plays a significant role that cannot be overlooked. This technology is of extremely far-reaching relevance in terms of promoting the overall development of China's film industry. When combined with the overall link of film creation, it is vital to make use of the power of music to render freely in order to fully convey the actual feelings that are going to be expressed in the plot of the film. At this point in time, it is essential to enhance the audio-visual effect of the film by utilizing electronic music in order to ensure that the audience is able to successfully connect with the film.

According to Guangpu and Mengmeng (2021), the utilization of contemporary computer technology in the production of musical works As a result of the ongoing development and improvement of information science, numerous fields have begun to implement computer technology. Computer technology is utilized in the majority of industries and fields, and the music field has also begun to implement computer technology. By utilizing digital tools within the computer, it is possible to create a variety of musical textures, which in turn makes the process of music creation more convenient and convenient.

According to Luo Changhua (2019), the application of computer music technology in music creation and the development of computer music technology have led to the introduction of new vitality into the process of music creation, the enrichment of music creation techniques, and an effective improvement in the efficiency and popularity of music creation. This paper will integrate the aspects of music creation, taking into consideration the tools used for music production on computers. In order to illustrate how computer music technology can be utilized in the process of creating music, we will use examples such as Sibeilius, MAX/MSP algorithm composition software, and Cubase music workstation software.

Because of the advancements and developments that have taken place in society, the public's spiritual life is experiencing an increased level of demand, and as a result, people will choose to listen to a wide range of musical styles in their day-to-day lives. As a result of the development of computer music production technology, the process of producing music has become more convenient, and the overall aural effect of music subjected to technological processing has been enhanced (Yixuan, 2021).

It was explained by Xiuming and Qian (2020) that the scientific use of computer music production software could save a significant amount of money on the high cost of music production. Additionally, music producers are able to use limited funds to create a greater variety of music. It is also possible to say that computer music production software has expanded the market for music production to a certain extent. As a result of its powerful production functions, low production costs, and convenient music creation mode, computer music production software has emerged as the most preferred option for music production.

It was revealed by Li Yanmei (2018) that the teaching of composition in colleges and universities began to appear to undergo a revolutionary change as a result of the influence and drive of computer music production technology. This change greatly expanded the space and thinking of composition, and it also promoted the generation and development of computer composition thinking. The instructors of composition at colleges and universities should, in this regard, direct the students to use the calculation in a manner that is both scientific and suitable.

Junlin (2020) explained that music education in colleges and universities should pay attention to the application of computer music technology, stimulate the students' interest in learning so that they can better understand the knowledge that they have learned, and allow them to use the computer for training. Additionally, music education should be continuously improved in terms of both its quality and its efficiency. For the sake of reference, one should concentrate on the staff production software Finale, the music host software Cubase, and Camtasia Studio when it comes to applications related to music teaching.

The research conducted by Wang Fan (2018) revealed that in recent years, in conjunction with the rapid growth of digital and network technology, computer music technology has been playing an increasingly essential role in higher music education. Furthermore, this technology has been utilized extensively and significantly. On the basis of this, it is required to re-recognize and assess computer technology, as well as to cultivate strengths and bypass shortcomings, in order to make the most of its distinctive worth and function.

It was explained by SeyyedPooya, HekmatiAthar, and Anwar (2021) that the advancements in digital technology have made it possible for researchers to develop a wide range of applications that are related to computational music. These kinds of applications are necessary in order to record, process, and produce data that is associated with music. As a result, it is essential to express music digitally in a manner that is both music theoretic and succinct. For the purpose of making use of music theory, the methods that are currently in use for representing music are ineffective. In this research, we propose an open-source representation tool that is based on music theory in order to solve the gap between music theory and computational music. We demonstrate the effectiveness of the music embedding that we have built by doing an analysis of classical music compositions. This analysis is carried out across a wide range of use cases.

Wessel and Wright (2020) discuss the work that they have been doing to produce computer-based musical instrumentation that may be used for live performances. The initial ease of usage, together with long-term potential for virtuosity, minimal and low variation delay, and clear and straightforward methodologies for programming the relationship between gesture and musical outcome, are some of the design objectives that they have in place. A programmable connectivity processor, a communications protocol known as Open Sound Control (OSC), and a range of metaphors for musical control are among the things that they present. Additionally, they present custom controllers and unique adaptations of common gestural interfaces. In addition, they provide a description of how our technique might be applied to a wide range of actual musical performances and provide suggestions for the direction of future study.

2.4 Lived Experiences of Teachers in Teaching Computer Music

As the state of computer technology continues to evolve, one of the most important roles that it performs is the use of multimedia-assisted instruction toward education and research. Students might constantly and frequently study and practice unfamiliar topics in order to attain mastery learning through the use of multimedia-assisted teaching resources, which could help teachers in their teaching and boost the amount of independent learning that students are able to accomplish. For this reason, the teaching of computer multimedia is continuously encouraged; the function of multimedia is dependent on the popularity of computer technology as well as the various developments that have occurred in this field. Additionally, the use of teaching and multimedia can have significant effects in this scenario. Therefore, "computer multimedia teaching" assumes the role of both a traditional learning method and a teaching technology that assists in instruction. When it comes to education, computer multimedia instruction has the potential to successfully improve teaching quality, thereby breaking through the limitations of time and place. Additionally, it can provide learners with an immediate learning effect, which can be of assistance in traditional instruction, and it can also help students demonstrate their capacity for multiple learning and invention. It is possible that the implementation of multimedia and the Internet, in addition to the accumulation of fresh information, could result in improved instructional quality.

A. Multimedia, as defined by Aziz and Siang (2014), is characterized by the ability to handle texts and media consisting of graphics, photos, audio, animation, or video inside the same working environment. This is accomplished through the integration of computers (Lan et al., 2015). According to Maruping, Bala, Venkatesh, and Brown (2017), it was assumed that the program presentation would involve the integration of two or more two different types of media in order to convey both static and dynamic sound and light effects. According to Freina and Ott (2015), "multimedia" does not just constitute the presentation of a single message in a variety of ways; rather, it can be used to complementarily apply several kinds of media in order to have an integrated effect that is greater than the independent application of media. Lan et al. (2015) referred to it as both an educational idea and the teaching process that directly applies a computer communication model in order to offer instructional materials and govern a tailored learning environment (Lan, 2015). (Lan et al., 2015) The characteristics of picture and audio that are merged by interactive computer multimedia teaching with communication and media technology have a diversified and open learning environment. This further enhances the role that computer multimedia assisted teaching technology plays in the process of educational reform. Teaching outcomes are difficult to break through and improve since traditional computer-assisted multimedia instruction is restricted to drawing abilities and only communicating meanings through texts or simple graphs. This results in educational outcomes that are difficult to improve. Traditional computer multimedia assisted teaching has been able to combine the sound and light effects of tape recorders with the process ability ever since the invention of computers and recorders. Additionally, multimedia computer assisted teaching systems that combine computers with slide projectors and projectors also enhance computer multimedia assisted teaching as it enters the context of the multimedia era (Lan, 2014).

Learners are able to actively receive knowledge and accomplish their learning goals at any time, according to Mutterlein and Hess (2017), who described computer multimedia teaching as teaching activities that are not constrained to time and space. In addition, multimedia-assisted instruction successfully integrated, systematized, and arranged texts, photos, video, images, and animation into computers in order to satisfy learners who are willing to embrace advances in information technology that are both visual and auditory in order to effectively boost learner satisfaction rates. Freina and Ott (2015) mentioned that the design principle of programmed teaching, which is learner-centered, behavioral goal-oriented, and presents contents step by step, had an effect on multimedia-assisted instruction. This was done in order to achieve learner satisfaction with constantly repeated practice through stimulation responses and immediate reinforcement. According to Lan (2015), computer multimedia instruction has the potential to deliver multiple sensory stimulations, draw children's attention through vivid graphics, text symbols, and sound, as well as boost learning interests and deepen learning impressions. The use of computer multimedia in the classroom was defined by Bhagat et al. (2016) as providing students with the opportunity to self-grasp learning schedules and achieve learning satisfaction through feedback. Following is a hypothesis that can be deduced from the aforementioned literature.

The present-day education of computer multimedia offers the benefit of scenario development, in addition to the qualities of interface visualization and element reusability. The technology could be applied in a flexible manner by teaching designers in order to deliver instructional ideas. When applied to automobile education, computer multimedia teaching could be used to research, develop, and design instructional materials in the field of media production. These materials could include point organization, pictures, photos, close-up pictures, continuous replay, subtitles, slow motion, distance switch, color effect, dynamic effect, sound effect, fast turning effect, and background music. Aside from that, the help of pictures and photos might specify lecturing topics that static pictures or photos could be introduced in a timely manner in dynamic audio teaching materials, such as relevant photos offered by teachers. Data from the network that is delivered in computer multimedia instruction is presented with objects and integrated with visual metaphors in order to make full use of the scenario memory that is available in the space and to provide students with additional resources for their continued education. Moreover, it could offer texts or categories for the purpose of searching.

There is a growing consensus on a global scale that distance education is a feasible alternative for enhancing the accessibility of basic education in rural areas, as well as the equity and quality of this education. Both the various sorts of tactics for remote learning and the impact that distance education has made on the reduction of socio-economic gaps between developing regions and developed regions have been the subject of extensive research and discussion in a significant body of literature.

The implementation of advanced information and communication technology (ICT) in underdeveloped nations, where children and adults lack even the most fundamental living conditions, has been called into question by a number of academics with regard to its potential benefits. It has been suggested by Shalni Gulati, for instance, that when developing countries conducted education initiatives that were aided by information and communication technology (ICT), the efforts that were intended to provide educational opportunities to disadvantaged and underprivileged populations ironically often worsened the socio-economic gap. Due to the high cost of Internet service, conventional technologies such as print media, radio, and television continue to be more effective in these nations (Gulati, 2008, pp.11-12). This is because the high cost of Internet service prohibits these individuals from having access to it. Gulati's finding appears to be supported by a number of effective remote learning programs that have been implemented all over the world. According to K. Sujatha, who conducted a study on India's National Open School, which is the most comprehensive distance learning program in the country, the school's delivery model is described as "combining self-study and Study Center support, complementing these with electronic media in a very limited way." This model is designed to provide secondary education to students who come from low-income and disadvantaged social groups. Specifically, Sujatha (2002), pages 95 and 96.

Education about music is one of the most important factors in the dissemination of musical information, abilities, and appreciation. Either in a more formal setting, such as a school, or in a more casual setting, the process may start off with the beginning of the process. According to the National Commission for Culture and the Arts (NCCA), the essence of music interpenetrates the daily lives of indigenous culture groups, which is beneficial to sustain the rich cultural legacy of the country. Taking into consideration the addition of this new subject to the curriculum, the basis of knowledge in music is still just as vital as the methodologies in teaching in order to demonstrate that the instruction is effective. According to Temmerman (2005), the examination that was conducted on their policy and practice of music education revealed that even the Australian music education curriculum, which begins in primary and secondary schools, was found to be in an unsatisfactory state. This was due to the fact that generalist teachers were handling the subject matter, which is a mirror image of the music education curriculum in the Philippines (Jacinto, 2019). In Gordon's theory of music learning, de Bruin (2018) cites musically challenged learners as individuals who struggle with music aptitude, tonal and rhythmic audition. These learners are considered to be having problems with music. In the same vein, educators in this field are tasked with the difficult task of instructing pupils to develop their musical creativity, which is actually quite a challenging endeavor. Therefore, the methods that teachers use establish a common ground for pupils, which helps them bridge the gap that exists between themselves and the concepts that they are learning.

The participants recognized interest as one of their top concerns, which is a fact that generalizes the entire learning experience as one of the central variables that govern the path that a learning journey takes. Interest is a primary factor in learning. According to Renninger and Hidi (2011), interest in the context of learning is a crucial knowledge and behavioral motivation moving component that helps to lead the attention span and promote schooling in the process of varied contexts. Participants in this study understand that curiosity is a fuel that propels students to move forward for learning; hence, it is not directly related to achievement outcomes (Van Yperen, 2003). A specific relevant component in learning to grasp good music performance and recognize varied music talents is interest in learning. This interest helps learners get closer to music and prevents them from becoming emotionally detached from it.

According to the findings of the research conducted by Rotgans and Schmidt (2011), the application of a boosted interest in learning in the classroom has the potential to increase the intrinsic motivation of the students as well as other approaches to achieving this goal. It also reveals that poor musical background is considered the thought-out culprit of the phenomenon, which then later emerges to the differing levels of musical ability among the learners; hence, based on the study, there is the establishment of a clear association between musical exposure and the musical ability of the learners (Whidden, 2010). When it comes to dealing with a problem that has a strong relationship to the attitude that teachers have toward their students, it has been discovered that patience plays a considerable role. It is believed that the manner in which teachers respond to the phenomenon is influenced by their personalities and their abilities.

2.5 Computer-Assisted Instruction on Piano Education

Altakhyneh & Abumusa (2020; Elliston, 2020; Perdana, Jumadi, & Rosana, 2019; Wallace-Spurgin, 2018) states that the "information society" demands alternative approaches to traditional teaching, which has led to the research and application of new approaches by music educators. This is due to the fact that traditional education is insufficient. Within a very short period of time, the accuracy of knowledge can shift in the century in which we do not live. It is vital to cultivate individuals who think creatively rather than persons who think in stereotypes in order to keep up with this shift (Mason & Moniz, 2005; Watson, 2006). This is because it is necessary to keep up with this development. One more thing to consider is the fact that people have different educational experiences. There may be variations in the manner in which each learner gains musical information and skills. For this reason, it is advised that music education make use of contemporary technologies, as well as a variety of methodologies and techniques (Cain, 2004; Dorfman, 2006). A teaching method known as computer-assisted instruction (CAI) is one in which a computer is used as an environment to enhance the teaching process and the motivation of students. It is a combination of self-learning principles and computer technology, and it allows students to benefit according to their own individual learning pace. According to Abdullah and Mustafa (2019), Soparat, Arnold, and Klaysom (2015), and Sünbül, Gündüz, and Yılmaz (2002), computer-assisted instruction (CAI) can be defined as the activities in which students engage with the courses that are coded on the computer. The instructor serves as the guide, and the computer serves as a learning environment.

In the current era, where the influence and significance of computers and computer products in the processes of learning and teaching are continuously growing, it is widely believed that it is of utmost importance to provide training to teachers who play a crucial role in the system. These teachers are individuals who can change and improve their behavior in order to ensure that these technologies are utilized appropriately within the education system and that their potential benefits are realized at a high level (Apeanti, 2016; Aşkar & Umay, 2001; Baş, Kubiatko & Sunbul, 2016; Demirer, Özdinç, & Şahin, 2009; Koçak-Usluel & Seferoğlu, 2003; Yılmaz, Köseoğlu, Gerçek, & Soran, 2004). The profession of teaching has evolved into one that calls for a higher level of skills and expertise in today's world. The abilities, attitudes, and self-efficacy of teachers who will be using computers and computer-assisted educational software are of utmost importance in the utilization of this technology, as stated by Demirer, Çintaş, and Sünbül (2010) and Özçelik and Kurt (2007).

The creation, of course, of supporting materials for CAI in music lessons can be accomplished with the help of sound recording and musical notation programs, in addition to the use of fundamental computer activities such as typing, drawing forms, creating inventories, or graphing. In addition, these systems might make it possible to create works that are focused on creativity, such as compositions and arrangements, on a smaller scale. The listening and music reading stages, which are extremely important in the field of music education, can also be made easier with the assistance of the computer. According to Lehimler (2016), it is essential to ascertain the attitudes and self-efficacy views of pre-service music instructors with regard to computer-assisted instruction (CAI) in music education. This is because it is for the purpose of establishing the required circumstances for the implementation of new technologies in music education. Generally speaking, the use of computers in music education is centered on specific tasks that are associated with regular musical activities. This is done in an effort to reduce the amount of uncertainty that arises from such an open-ended domain. Several instructional methods, ranging from straightforward concept presentation to more exploratory methods, have been implemented in order to accomplish specific educational objectives (Brandao, Wiggins, & Pain, 1999). These methods have been successfully implemented.

It has been said that CAI has a good impact on the learning speed and creative thinking skills of students who get music education in a variety of different ways (Alan & Sunbul, 2010). Through the application of CAI in the field of music education, many pieces of information may be combined, and audiovisual assets can be utilized in their entirety. According to Portowitz, Peppler, and Downton, as well as Upitis and Brook (2016), the objectives of music instruction can be easily accomplished in a relatively short amount of time. According to Barry (2004), the utilization of CAI in the education of pre-service music instructors, with the goal of enabling it to integrate and interact with the different teaching processes that are already in place, will result in significant contributions to this discipline. In spite of the fact that numerous universities in Turkey have implemented technology-assisted instruction in the field of education, the implementation of this method has not yet begun in the field of music education (Kasap, 2007). Nevertheless, it is of the utmost importance in this day and age to disseminate technology-oriented teaching settings within the realm of music education and to instruct preservice music teachers on how to make use of the programs that are associated with technology, particularly in courses that are related to technology. Additionally, technological materials have the potential to assist in overcoming some inadequacies that may be faced throughout the process of education and training in music education departments. An essential issue is that a significant number of students play their instruments by themselves since they are unable to locate someone to accompany them on the piano while they perform the composition. Because of this, students are robbed of the numerous advantages that come from playing with other people. Increasing student motivation, providing a pleasant working atmosphere, growing self-confidence, listening to other instruments, making clear intonation, and developing polyphonic hearing are some of the expressions of these advantages that have been found in numerous studies on music education (Mustul, 2005; Yuksel & Mustul, 2015).

It has been demonstrated beyond a reasonable doubt that piano education, which is considered to be among the most significant aspects of music education, has the ability to effectively contribute to the individual's other musical elements, in addition to the ability to play the piano. According to Napoles et al. (2017), the degree of piano playing performance of an individual who is receiving education is directly proportional to the training performance of that individual. The piano instructor should also assist the student in precisely determining the path that leads to the desired outcome. According to research conducted by Deal (1985) and Dannenberg et al. (1990), persons who are learning to play the piano in today's world just read the notes, memorize them as quickly as they can, and then forget them and have difficulties performing the same piece of music ever again.

Throughout the entirety of piano education, the utilization of supportive teaching resources and the incorporation of these materials into the teaching process make the learning process more efficient. Therefore, the instructor is able to provide a piano education that is both efficient and successful by utilizing various teaching technologies. In a music education program, the piano course lasts for one academic year and two semesters, with one credit being awarded for each semester. According to Lehimler (2016), the Music Teaching Program requires students to take four credits of computer-related classes during the first semester of the first year and again during the fourth semester of the second year. When it comes to education and training applications, interdisciplinary studies are regularly found alongside scientific investigations. In addition, these courses are applicable to instruction on the piano and the computer. Students gain a fresh perspective on music analysis when they attempt to find solutions to the challenges they have when playing the piano, particularly in terms of rhythm and melodies, by utilizing audio technologies.

2.6 Computer Music Languages

There has been a strain of utopian discourse going on ever since the introduction of electronic sound production, and it has been proposed that the new technology could produce any sound that could be imagined (Théberge 1997). These kinds of assertions have been made regarding early recording, analogue synthesis, and digital synthesis, and they are prominently featured in the marketing of novel digital musical instruments (McPherson, Morreale, and Harrison 2019). As a matter of fact, utopian forecasts are an integral part of the launch of numerous new technologies. From a historical perspective, it is clear that the range of sounds that could be produced by early analogue electronics was, in reality, extremely restricted. This is true regardless of whether the statements made about music technology are intended to be literal or metaphorical. As for the possibilities of control and interaction, it is possible that future retrospectives will demonstrate that the digital instruments we currently have are similarly restricted in their capabilities. With that being said, even if we were to realize the utopian vision of an infinite area for musical discovery, we would still be left with the question of what possibilities musicians would choose to explore inside that space. It is possible that the design of any instrument will provide preference to particular ways of thinking, particular ways of interacting, and particular outcomes over others. The non-neutrality that exists within the realm of music programming languages is the subject of the investigation that we undertake in this essay.

In musical interaction, as in many other artistic domains, limitations can serve as a potent source of inspiration for innovative endeavors. In his article "Learning a Digital Musical Instrument," Magnusson (2010: 65) characterizes the process of learning a digital musical instrument as "getting a feeling" for the instrument's limits rather than engaging with its affordances." In spite of this, even the most basic digital musical instruments (DMIs) are capable of producing a wide range of stylistic variations (Gurevich, Marquez-Borbon, and Stapleton 2012). Furthermore, comparative research has shown that increasing the number of degrees of freedom available on a DMI may paradoxically limit the options available to a performer (Zappi and McPherson 2018). On the one hand, the limitations of acoustic instruments were frequently regarded as motivating; however, with digital music instruments (DMIs), they were more frequently regarded as aggravating. This could be partially attributed to the notion that the instrument ought to be capable of anything. In contrast, Magnusson and Hurtado Mendieta (2007) discovered that imposing constraints on music software was sometimes desirable. However, respondents drew a contrast between musically 'directive' software (ProTools, Cubase, GarageBand) and ostensibly open-ended music programming languages such as Csound, SuperCollider, ChucK, Pure Data (Pd), and Max. This contrast was found to be significant. It is important to examine this final point. When compared to digital audio workstations, there is no doubt that programming languages like Pd and SuperCollider, which are focused on the construction of sounds from the fundamental principles, offer a more expansive range of possibilities with fewer constraints. Is it true that these tools are less directive than others? The question is, to what extent, despite the fact that these languages have the potential to communicate every conceivable acoustic consequence, may they nevertheless be imprinted with their own distinct aesthetic ideals and ideologies? Which methods could we use to uncover these ideologies?

These concerns are investigated in this article by looking at them through the prism of idiomatic expressions. We are primarily concerned with the development of new digital musical instruments, which are instruments designed for live performance and use a software component that was developed using a music programming language. However, the primary focus of this article is on the idiomatic patterns that are suggested by the software. Although many of these instruments also feature a hardware interface, this is not the case for all of them. Although we do not directly examine fixed media composition, many of the ideas presented in the article may be equally applicable to software-based electroacoustic music that extends beyond the world of digital musical instruments when taken into consideration.

Fundamentally, we contend that the activities of DMI designers will be influenced by what a particular language makes the most obvious, natural, or easy to perform, independent of the constraints that the language imposes (or does not impose). We will attempt to gain an understanding of some of the fundamental assumptions and models that are present in each language by conducting a literature review and communicating with the developers of the computer music languages that are most often used. Following this, we will conduct a survey of DMI developers in order to investigate the ways in which the particular programming language was able to impact the aesthetic perspective of the instrument. Our discussion comes to a close with some musings on the factors that may be responsible for the idiomatic patterns of a language, as well as the ways in which we can see the connection between the person who creates a language and the person who designs instruments.

2.7 Idiomaticity and Influence

There is a term used by musicians to describe a section of music that is idiomatic to a certain instrument. There is a correlation between the difficulty of a sentence and the idiomaticity of the passage. An idiomatic passage is one that, according to Huron and Berec (2009: 115), "of all the ways a given musical goal or effect may be achieved, the method employed by the composer/musician is one of the least difficult." In other words, an idiomatic passage is one that is very idiomatic. In the field of instrument design, one might draw a parallel to Jordà's musical instrument efficiency, which is defined as the ratio of the complexity of the musical output to the complexity of the input while taking into account the variety of control (Jordà 2005: 187).

The idiomatic structure can be found in a variety of musical contexts. Improvisation is characterized by the tendency for patterns that are inherent to the interplay between the body and the instrument to serve as the foundation for musical material (Sudnow 1978; de Souza 2017). Composers frequently learn how to write idiomatically for instruments, and a great number of virtuosic showpieces are composed in such a way that their seeming musical complexity is greater than the real difficulty of performing on the instrument. Vasquez, Tahiroğlu, and Kildal (2017) investigate the practice of idiomatic composition as a means of generating a repertoire for new digital instruments. Additionally, they investigate the development of a common framework for performance practices of novel instruments (Tahiroğlu, Vasquez, and Kildal 2017). On the other hand, Gurevich (2017) investigates how repertoire can be utilized to inspire new instruments. There is a connection between idiomaticity and the development of individual style, as stated by Tahiroğlu, Gurevich, and Knapp (2018: 129).

A set of playing skills for the new musical instrument can be established through the use of a gesture vocabulary that is idiomatic to the instrument. This, in turn, is an essential component of the process of building a performance practice. It is not until such a repertoire of gestures and approaches has been formed that the individual variances that occur between performances can start to develop the possibility for 'expression' or style. Challenges to idiomaticity can also be found in both acoustic and digital performance practices. For example, jazz guitarist Kurt Rosenwinkel's "voluntary self-sabotage", or retuning his guitar to challenge his typical improvisation patterns (de Souza 2017), is an example of a challenge to idiomaticity. Another example is the potentially engaging effect of incorporating disfluent characteristics into digital instruments (Bin, Bryan-Kinns, and McPherson 2018). In the context of traditional practice, idiomaticity is sometimes associated with virtuosity; nevertheless, virtuosity is also frequently questioned in the context of digital instrument practice (Gurevich and Trevino 2007; Morreale, McPherson, and Wanderley 2018).

There is no requirement that idiomaticity be restricted to embodied activity. An example of this would be live coding performances, which require different sorts of feedback and decision-making than traditional instrumental performances (Goldman 2019). However, certain structures will still be more natural to the language that is being used than others. The Cognitive factors of Notation framework, which was developed by Green and Petre in 1996, is applied by Nash (2015) to two different music software settings. He analyzes each environment based on a number of factors, including viscosity (the resistance to change), visibility (the ease of looking), and hidden relationships. It is important to keep in mind, as Nash (2015) does, that these dimensions may not have a single global quantity across a language but rather that they may apply differently depending on the specific idea or structure that is being expressed in the language. This is something that we should take into consideration when determining what constitutes idiomatic writing in a musical programming language.

2.8 The Latent Influence of Tools

The article by Sergi Jordà (2005) includes a debate in which it is said that "music instruments are not only responsible for transmitting human expressiveness similarly to passive channels." They are accountable for arousing and agitating the performance through their own interfaces, and they do so through the feedback that they provide (cited in Gurevich and Trevino 2007: 108). In a similar vein, Magnusson (2018: 79) asserts that "instruments are actors: they teach, adapt, explain, direct, suggest, and entice." Musical instruments are infused with information that is expressed in the form of music theory; they provide an explanation of the world. As an illustration, the piano keyboard "tells us" that microtonality is of little significance (and a significant portion of Western music theory has completely subscribed to that script); the drum-sequencer tells us that 4/4 rhythms and semiquavers are more natural than other types; and the digital audio workstation, by virtue of its affordances of copying, pasting, and looping, reassures us that it is perfectly normal to repeat the same short performance over and over again within the same track. Magnusson (2009), page 171-172

Music, like other fields of technology, requires that an object be understood in the context of the larger social and cultural environment in which it functions (Green 2011). This is true for both music and other fields of technology. As an illustration, the guitar is not only a physical instrument consisting of six strings and a fretted fretboard; rather, it is the site of a rich and intricate interaction between cultural connections and embodied behaviors (Harrison, Jack, Morreale, and McPherson 2018).

When it comes to the creation of new instruments, the challenge that both the luthier and the organologist face is figuring out how to take into account the role that pre-existing cultural connotations play in the new technology (Bijsterveld and Peters 2010; Horn 2013; Magnusson 2018), as a result of the performer's identification with an instrument, Bates (2012) proposes that even the performer's personal identity could be altered. The encoding of epistemic information into technology is not something that is exclusive to musical instruments; it has also been noticed with regard to scientific equipment (Baird 2004; Tresch and Dolan 2013). According to Akrich (1992: 207–8), sociologists of technology have argued that when technologists define the qualities of their objects, they must unavoidably make hypotheses about the entities that make up the universe into which the object is to be introduced. This is because technologists are attempting to define the characteristics of their objects. The process of "inscribing" this vision of (or prediction about) the world into the technical content of the new thing is a significant portion of the labor that innovators do.

On the other hand, the influence of music programming languages on creative practice is not necessarily articulated in terms of formal constraints on what is possible to create. This is because a Turing-complete programming language is theoretically capable of anything. It is more accurate to say that languages will differ in terms of the concepts and structures that are the easiest or most evident to code (Nash 2015). Programming is analogous to the reflective dialogue between practitioner and material that has been theorized for other craft disciplines (Ingold 2009; Karana, Barati, Rognoli, Der Laan, and Zeeuw 2015). Analogies have been drawn between programming and craft practice (Lindell 2014; Blackwell 2018), in which code functions as a material. In this context, code functions as a material. It is fascinating to ponder the ways by which a script that is idiomatically integrated within a musical technology contributes to the formation of human behavior.

From the point of view of human–computer interaction, the emphasis may be placed on affordances, whether they are obvious or concealed (Gaver 1991); however, the investigation of restrictions may also be of equal importance (Magnusson 2010). In the context of embodied interaction, Tuuri, Parviainen, and Pirhonen (2017: 503) propose the concept of experiential control. What they mean by this is that they look beyond "control spaces merely as instrumental spaces delineated by sensors, physical performance, and the related input information" and instead focus on the "subjective and intentional viewpoint of the musician playing the instrument." According to this point of view, instruments have the ability to tug the performer toward behaviors that are convenient or natural while simultaneously pushing them away from actions that are difficult or do not appear to serve any visible purpose. In their study, Jack, Stockman, and McPherson (2017) observe the rapid emergence of these push and pull effects when percussionists encounter an unfamiliar instrument. They note that initial techniques derived from hand drumming give way within minutes to techniques that are narrowly directed to the sensing modality of the instrument.

The influence of technology on action is not restricted to corporeal interaction in any way, shape, or configuration. In the context of the design of digital musical instruments, Newton and Marshall (2011: 251) developed a toolkit with the expectation that designers would begin with concepts of gesture and sound. However, they discovered that designers instead took a technology-focused approach: "They began by examining the sensors that were available to them, the parameters that these sensors could detect, and location on the instrument where they could be easily mounted." They would not consider the gestures that the sensors could be used for until after that point. Materials with acoustic qualities, such as elastic bands, are purposefully removed from

Andersen's'magic machines' creative ideation workshops with musicians (Andersen and Wakkary 2019). This is done in order to prevent making associations that are either easy or obvious. Using this workshop technique as a foundation, Lepri and McPherson (2019) discovered that building fictional instruments with non-functional materials brought the aesthetic priorities of the individual designer into clearer light. However, according to their findings, even non-functional materials cannot be considered a neutral medium for ideation.

2.9 Instruments and Pieces

In the community of digital instrument creators, whose focal point is the NIME (New Interfaces for Musical Expression) conference, there is an ongoing discussion about whether or not traditional musical roles that can be separated from one another can be applied to musical practices that involve NIMEs (for example, composer, performer, and instrument builder) (Dobrian and Koppelman 2006; Gurevich and Trevi 2007). According to Gurevich (2017), the concept that roles in NIME are "contingent and dynamic" is supported by Johnston (2016). This means that instruments may change identities, composers may build interactive systems rather than notated scores, and performers may place a higher priority on exploration and discovery than virtuosity. According to Goddard and Tahiroğlu (2013), it is important to have a specific awareness and understanding of the evolving nature of the performer-instrument composer relationship within specific contexts and cultures of new instruments. This understanding could assist us in gaining a better understanding of how these relationships can be facilitated in various ways during the design process of new instruments. "Composed instruments," which are inseparable from a certain piece, were found to be prevalent among NIME designers, according to the findings of a survey conducted by Morreale et al. (2018).

2.10 Idiomatic Patterns and Aesthetic Influence in Computer Music Languages

The question that needs to be answered is where the line between composed instruments might be located. A great number of live coding practitioners have established their own languages or language variants; whether or not these languages are composed instruments is important to consider. Regarding the utilization of the ixilang live coding language, one of the individuals who participated in the poll conducted by Magnusson and Hurtado (2007) stated, "Like, the pieces wouldn't be by me, they'd be by you." Would it be possible for more generalist music programming languages such as SuperCollider or Pd to also, to a certain extent, be considered composed instruments? Is it possible to claim that any instrument, including conventional acoustic instruments, might be considered "composed" in the sense that its identity is inextricably linked to the components that were present at the time that it was created? "Whether the propensity of digital systems to "script" action really is a special property of a given device or class of device when we consider the instrument as an assemblage of material and immaterial resources rather than as a single artefact..." Green (2011: 141) asks. "When we consider the instrument as an assemblage of material and immaterial resources, rather than as a single artefact."

The reason for posing these questions is not to imply that every piece composed using SuperCollider (or with a violin) is a version of some hypothetical meta-composition; rather, the objective of these questions is to emphasize that no instrument, whether it be acoustic or digital, originates from a cultural vacuum. The basic theories of music, as well as specific pieces that were significant to the designer and the time period in which they were created, are two of the factors that have an impact on specific instruments and music languages. It would be reasonable for us to anticipate that these influences will be mirrored in the idiomatic productions that are produced by the instrument. As a result, we have observed that the idiomatic has a significant impact on the ways in which succeeding musicians who use the instrument think and behave.

2.11 Values of Computer Music Languages

According to Suchman (1987), the design of any new technology is located within a social and material environment, and the design will respond to the values and concepts that are encoded in the tools. New digital instrument designers will most likely be influenced not only by their own pre-existing aesthetic values (Lepri and McPherson 2019) but also by the assumptions and conveniences of the software and hardware they employ to make their instruments. This is because designers are likely to be influenced by both of these factors. Every single version of the computer music language will arrive with its own unique perspective. It is possible, for instance, that the interpretations or transformations of sonic aspects that take place in real-time audio synthesis plug-ins could be quite different from those that take place in data flow programming languages or in pattern-based object-oriented languages (Lyon 2002).

The disparities in audio processing that exist between languages may have more to do with the fact that different fundamental paradigms for manipulating data exist than they do with the fact that individual language developers place distinct aesthetic priorities. In the process of establishing a domain, "an abstract model of computation," the design process of a music programming language constitutes both a method and an approach (McCartney 2002: 61). In point of fact, this is the primary distinguishing feature that makes it possible for these environments to be programmable. This does not result in an ever-increasing complexity in the process of problem solving; rather, it enables us to consider an intuitive approach to working on problem domains "without worrying about details that are not relevant to the problem domain of the program" (Zicarelli 2019). The low-level music language strives to "provide a set of abstractions that makes expressing compositional and signal processing ideas as easy and direct as possible." This is the problem that the language faces. However, the kinds of thoughts that one intends to represent can be quite different from one another, which can result in the implementation of very distinct instruments (McCartney 2002: 61). In the event that the designers of digital musical instruments are influenced by the fundamental operational assumptions of the languages that they employ, then it would be beneficial to highlight some of these assumptions and explore the ways in which they differ among the tools that are traditionally utilized.

We distributed a brief questionnaire to the creators and developers of five widely used languages in order to gain an understanding of the assumptions that underlie popular languages. These languages are as follows: (Zicarelli 1991; Puckette 2002; Clayton 2019; Zicarelli 2019), Pure Data (Puckette 1997; Grill 2019; Puckette 2019), SuperCollider (McCartney 2002; Baalman 2019), Csound (Lazzarini, Heintz, Brandtsegg, and McCurddy 2016; Lazzarini 2019), and ChucK (Wang, Cook and Salazar 2015; Wang 2019). The questions focused on the fundamental paradigm of manipulating data and parameters within the language, the perceived differences between the language and other languages, and the ways in which the language influences music or instruments that are made within it. Listed below are some of the recurring topics that have emerged from these exchanges.

2.12 Open-Endedness

Throughout the interviews and the publications about the languages, one common element that emerges is the desire for the languages to be sufficiently open-ended so that the practitioner can express their own acoustic ideas without being influenced by any one ideology. The architecture of the Max family of languages (Max/MSP, Pd, and jmax) "goes to great lengths to avoid a stylistic bias on the musician's output," according to Puckette (2002: 12), who writes about the Max family of languages. "Pd's low-level primitives (phasor, but no band-limited sawtooth generator, for instance) – which is intended to encourage users to develop their own "sound" rather than guide them through the process" is what Puckette emphasizes in response to our query regarding Pd. 2019 edition of Pucket. "I guess there is no such "canonical" organization on a perceptual sonic level at all," comments Thomas Grill (2019), who is in agreement with this statement. It was Joshua. Max/MSP is described by Kit Clayton (2019) as having the following characteristics: "Specific sonic features are prioritized less within the environment than the ability to access information at any level, prototype quickly and interactively, and build relationships between different types of data streams."

The following is an excerpt from an article written by Marije Baalman (2019) about SuperCollider: "The environment by itself does not prioritise particular sonic features; rather, the user creates her own sonic units from the smaller building blocks." Zicarelli (2019), on the other hand, considers Max/MSP to be a method that acknowledges limitations in order to facilitate learnability. He states, "We want to look at a problem space and imagine how someone could design within some subset of the space in such a way that there are only a few basic gestures that you need to learn; then you can combine the basic gestures in mostly arbitrary ways to make what you want."

The method that we are taking does not aim to cover one hundred percent of the things that can be done within the domain. An aesthetic focus on "a more immediate, deterministic mindset for specifying computer music programs" may result from the language's strong emphasis on explicit timing, according to Wang, Cook, and Salazar (2015): 13. This is because the language places a significant emphasis on timing.

2.13 Abstraction

The authors of the languages also place an emphasis on abstraction and encapsulation as values that are associated with their languages. Victor Lazzarini (2019) states that Csound is primarily "object-based" rather than class-based because all the user sees are objects that implement a specific unit-generator behavior. However, it is also mentioned that the fact that its variables carry signals enables the direct specification of signal processing procedures. In SuperCollider, the journey from low-level unit generators to SynthDefs (which are essentially "blueprints for synthesis units") to instantiated synth instances within its audio engine is highlighted by Baalman (2019). "the combination of flexibility (the possibility to livecode change code on the fly) and the capacity to make abstractions (in SynthDefs, but also classes) to create building blocks of your own design," is what she considers to be the most significant characteristics. According to Zicarelli (2002: 45), one of Max's original design principles was to implement only a few primitive objects while allowing the creation of abstractions from combinations of those primitive objects. Zicarelli states that "with encapsulation, users need not be concerned with whether an element was one of the basic ones Miller provided or one they made themselves." The fact that Max objects may be coded in a wide variety of languages is something that Clayton (2019) wants to highlight.

2.14 Rapid Prototyping

There are a number of language developers who are concerned about iteration time. "ChucK is supposed to facilitate quick experimentation through a form of "on-the-fly programming" or "live coding," according to Wang (2019), who states that the application was developed. Live coding is another important topic for SuperCollider, which is a programming language that allows for the evaluation of code blocks on demand.

Over the last ten years, SuperCollider has been utilized to host various live programming languages, including ixilang (Magnusson 2011). Additionally, its synthesis engine, which is distinct from its language, has emerged as a well-liked back-end for live programming languages, such as TidalCycles (McLean 2014), whose syntax is derived from Haskell, Overtone and Sonic Pi (Aaron and Blackwell 2013), both of which are based on the Clojure Lisp dialect. According to Baalman (2019), the quick iteration of SuperCollider allows for "the experimentation and exploration of a new concept to happen at the same time." "I can type faster than I can move the mouse," Baalman says, referring to the text-based aspect of the platform, which he believes enables rapid experimentation. According to Clayton (2019), one of the most important aspects of Max is its capacity to "prototype quickly and interactively."

2.15 Dynamism

When it comes to the dynamic instantiation of synthesis processes, there is a difference that develops between the data flow languages (Max and Pd) and the other languages. Csound "uses the notion of an instrument as a class that may be instantiated a number of times (any, in the case of Csound) for a set period (which in Csound may be unlimited) beginning at any given time from now into the future," according to Lazzarini (2019). Baalman emphasizes the significance of being able to dynamically define and create Synth units in SuperCollider. Lazzarini also explains that Csound "uses the notion of an instrument as a class that may be instantiated a number of times" Zicarelli (2019), on the other hand, makes a comparison between Max and modular synthesis and has the following to say about it: "The thing that Max can't do easily is manage N of something, where N is dynamic." This kind of dynamic instantiation is something that I would most likely use SuperCollider for if I were concerned about it. Static systems, on the other hand, cover a significant amount of music. Puckette (2019) makes a similar observation, stating that "the fact that signal connections are static makes it easier to make instrument-like patches and less convenient to make things that spawn variable numbers of voices."

2.16 Aesthetic Influence

Puckette argues in his article on Max from 2002 that "The design of Max goes to great lengths to avoid imposing a stylistic bias on the musician's output." He makes reference to the blank page that meets the new user, which is something that Zicarelli (2002) also emphasizes. Nevertheless, Puckette (2002: 13) acknowledges that it is possible that we may eventually come to the realization that regardless of how much effort is put into making a software program culturally neutral, it is always possible to identify ever more glaringly obvious assumptions that are built into the program. But this is not a cause to stop building new software; on the contrary, it inspires hope that there may be many fascinating discoveries still to be made as more and more fundamental assumptions are questioned and somehow peeled away. More and more fundamental assumptions are being questioned and peeled away.

Explicit specification of time in ChucK, scheduling and simultaneous access to high-level objects and low-level DSP in Csound, dynamism and flexibility of syntax in SuperCollider, an instrument-like paradigm, and flexible data connections in Pd and Max are some of the themes that have already brought to light the fact that different languages have different priorities. It is quite probable that Puckette is correct in asserting that it is impossible for any software program to be culturally neutral, and this is also consistent with the observations made by other authors (Haworth 2015; Nash 2015). In the following section, we will investigate the ways in which the influence of these languages could be conveyed in the production of digital musical instruments and compositions.

2.17 Composition and Digital Tools in Music Education

Recent years have seen the development of perspectives on creativity and learning in interval-based (pop) and sound-based music education, respectively. These perspectives have been created in empirical research that is primarily qualitative and carried out on a smaller scale. Research on creativity through digital composition tools in schools, on the other hand, has primarily concentrated on the widespread use of notation and sequencer software (such as GarageBand, Jam2jam, and eJay), which involves organizing pre-made instrumental samples into sound file representations that are typical for specific types of pop music. Fewer empirical research has been conducted on sound processing software (such as SoundHack, SoundEffects, Compose with Sound, DSP1, and ProTools) for the purpose of composing and thinking in sound or sound-based music. Across types of digital tools and music domains, areas of music education research that are relevant to our topic include studies of implementation and use (Brown, 2007b; Dobson & Littleton, 2016; Gall & Breeze, 2008; Hewitt, 2009; Savage, 2007; Vratulis & Morton, 2011), learning and creative processes (Dillon, 2004; Gall & Breeze, 2005; Hewitt, 2009; Nikolaidou, 2012; Rudi & Pierroux, 2010; Wolf, 2013;) and teaching and assessment approaches (Webster, 2007; Wise, Greenwood & Davis, 2011). In this study, we do not examine research on creativity in music performance and composition in general because these topics are not within the focus of this particular investigation.

2.18 Implementation and Use

Savage (2007) conducted a study on the use and implementation of information and communication technology (ICT) in music education in schools in the United Kingdom. The findings of the study revealed that students experienced feelings of pride, enthusiasm, and increased motivation when they created music. Additionally, the students took responsibility for their own creative and learning processes. In addition, Savage cautioned that schools might develop an excessive focus on the technology that is used in teaching. He pointed out that practical and technical challenges might require an excessive amount of concentration, which could lead to a decrease in the amount of interaction that occurs between students. The study was conducted with eighteen schools as participants. According to Savage's findings, schools would be better off if they were more open to the possibility of incorporating technology into music education. He also found that it was simpler for students to compose music when they used technology rather than when they did not use technology. According to the findings of several research conducted in North America, information and communication technology (ICT) improved students' engagement in music education. These studies also discovered that students were more likely to put in more effort in music technology classes than in other classes (Webster, 2007; Cooper, 2009). DSP is an abbreviation that is commonly used to refer to "Digital Signal Processing," which in this context refers to the name of a particular piece of software that was designed for the aim of music education development. Both the implementation and the use of digital tools lend credence to the widespread belief that these tools contribute to the enhancement of music education.

2.19 Learning and Creative Processes

In recent decades, the study of creativity and learning has been increasingly framed by constructivists (Way & Webb, 2007) and sociocultural views (Sawyer, 2012). These approaches place an emphasis on the function that contextual resources play as mediators in the processes of creativity and learning (Rudi & Pierroux, 2009). Interactions with teachers and classmates, as well as the learning organization of group cooperation in classrooms, are examples of situated contextual resources. Such resources may also include digital tools and representations. Dillon (2004) conducted a mixed methods study that utilized a contextual framework to investigate the discussion and collaboration that occurred among young people who composed music using eJay in both official and informal training environments. A primary objective of the research was to evaluate the ways in which students' meaningmaking and shared comprehension were influenced by creative, collaborative processes in the process of composing interval-based music. According to Dillon's findings, the software, the musical abilities of the participants, and the learning organization all played a role in mediating collaborative interactions that are in accordance with the generally accepted definitions of creativity in music (Webster, 2001; Kozbelt, 2017). These definitions include the development of divergent and convergent thinking in stages over the course of time, which ultimately results in a musical product that is unfamiliar to the creator. Jam2jam and Ejay were found to be beneficial for younger children in terms of fostering collaboration, externalizing ideas, and stimulating action and reflection, according to research conducted by Brown (2007a) and Gall & Breeze (2005). Research within the realm of sound-based music education has also studied the creative and learning processes. Electroacoustic music was first taught to two students in upper secondary school as part of a study conducted by Falthin (2014). Following this, the students were given the highly structured task of synthesizing spectra and composing with the outcomes of their synthesis. The students' concept development was shown to be as strongly linked to listening and music appreciation activities as it was to composition tasks in sound-based music, according to one of Falthin's findings, which was verified by other studies (Holland, 2015; Wolf, 2013, for example).

2.20 Teaching and Assessment Approaches

According to Higgins and Jennings (2006) and Wolf (2013), the connection between the development of concepts and the abilities necessary for music appreciation highlights special issues that arise when teaching composition in sound-based music. These challenges include the fact that this is a new realm that students may experience as being "alienating." There are a few specific issues that have been identified as a result of research conducted on the subject of teaching sound-based music education. These issues include the requirement for listening curricula that help students develop their conceptual and critical thinking skills (Wolf, 2013) and the need for teaching methods that can assist students in working with longer phases of creative work in an abstract problem space. Approaches to facilitating creativity and learning with more open-ended composition tasks and tools present an additional challenge for teachers in sound-based music education. This is because teachers are required to listen to the content of the sound development in students' works in order to comprehend the processes that students have been working through. Therefore, in a large-scale study that was carried out in three middle schools in the United Kingdom, Wolf (2013) established a curriculum and teaching methods that examined the growth of students' appreciation of sound-based music in accordance with the concepts of active, collaborative, and self-regulated learning, respectively.

According to the findings of the study, structured listening training and the teaching of key concepts of electroacoustic music led to an increase in appreciation, a broadening of students' vocabulary for describing their listening experiences, and positive learning outcomes in the factual, conceptual, and procedural knowledge of inexperienced listeners. In a different study conducted in Ireland by Higgins and Jennings (2006), advanced preparation that included listening activities was also recognized as important for achieving targeted learning results. The study involved a teacher and ten 16-year-old students who were enrolled in a school with the purpose of gaining knowledge of how pedagogical designs might build and support students' higher-order critical thinking skills in relation to electroacoustic music; this research was created using three different versions of instructor assistance in composition classes. Following each round of composition work, the works of the students, instructor observations, and student interviews were studied. This analysis included a comparison of the processes of guided and unguided creating, cooperation, and learning through the use of a digital audio editor program called Cool Edit Pro by the students. The following are some of the effective teaching strategies for electroacoustic composition that have been identified by Higgins and Jennings (2006): preparatory work (such as having adequate technical skills, prior knowledge of sound materials and how they can be transformed, familiarity with musical context and composition elements such as time, pitch, change, structure, and balance); being available without being intrusive; and focusing attention through appropriate questions. These findings are then used for the description and analysis of a DSP workshop that is described further down in this article.

In contrast, studies that have been conducted on the subject of teaching composition utilizing sequencer software like GarageBand have consistently found that the structure and affordances of the tool can effectively scaffold student work with minimum support from the teacher (Wise et al., 2011). Participants in both types of settings were able to "instinctively, with minimal effort, produce music collaboratively by selecting, listening, and evaluating samples and arranging them on a graphic page, on which they could visualize and discuss their work" (p. 155), according to Dillon's findings, which were based on the fact that the eJay tool design featured a powerful visual interface and provided immediate feedback. It is, therefore, more appropriate for the instructor to take on the role of a facilitator for a creative process that cycles in a rather basic fashion, beginning with searching, listening, and selecting samples, then moving on to periods of contemplation and editing, and finally culminating in group consensus about sounds and compositional structure (Dillon, 2004). To summarise, when digital composition tools are employed in interval-based music education and sound-based music education, respectively, there is a need for distinct teaching methodologies.

The perceptions of musical creativity held by instructors have been proven to differ depending on "past experiences, current working context and teaching, and, potentially, any other musical activities undertaken outside school" (Odena & Welch, 2012, p. 43). This is something that has been demonstrated in relation to the assessment of musical creativity. Because of this, it is essential for educators to possess "practical knowledge of various musical styles in order for the knowledge to impact on their teaching" (this is cited in the original source). According to Wise et al. (2011), the criteria that teachers use to evaluate students' composition work while employing 'looping' tools vary. This is done to accommodate differences in individual students' musical knowledge and abilities. From skepticism regarding the creative value of working with pre-recorded loops and 'drag and drop' compositional approaches to endorsements of the software for allowing less advanced students to enjoy and complete composition courses without understanding Western music theory and notation, teachers' perceptions ranged from skepticism to endorsements in a study that involved nine teachers who worked with GarageBand over a longer period of time at four different schools (Wise et al., 2011).

These several lines of inquiry, when taken as a whole, demonstrate that the digital composition tools that music educators use most frequently are the ones that promote student engagement and learning in traditional popular music creation. Furthermore, sound-based music composition necessitates an organized listening curriculum and learning activities. We also find that questions surrounding how the design of digital composition tools in these respective fields enhances creativity in learning contexts have not been thoroughly studied. This is something that we have discovered. Savage (2005) framed this challenge when writing that “the relationship between music and ICT is not one of servant and master, but rather a subtle, reciprocal and perhaps empathetic one” (…) and that technologies “could lead pupils and teachers to engage with and organise sounds in new ways, challenging the very nature of music itself at a fundamental level” (p. 168). In the beginning, there were more critical perspectives on this dynamic (Folkestad, Hargreaves, & Lindstrom, 1998; Truax, 1986). These perspectives expressed concerns that some forms of software may potentially lead to a shallow grasp of sound concepts by restricting students' creative range to the affordances of the tools. Students have reported feeling frustrated when attempting to compose personal musical expressions due to limits in software that are related to genres. This demonstrates that creativity can be encouraged, but it can also be confined by tools and domain orientation (Cooper, 2009; Gall & Breeze, 2005). The use of digital tools in music education primarily reinforces existing paradigms of interval-based music by facilitating more efficient production methods (Beckstead, 2001). This is in contrast to drawing on new affordances to transform learning and creative processes, such as the possibility to directly develop and change unique sound material, as well as the ability to organize sounds according to principles and systems that are different from those found in styles of conventional pitch-based music. These concerns are supported by studies that demonstrate this phenomenon.

2.21 Analyzing Mediated Processes of Imagination and Creativity

The topic that we proceed to in light of prior research on sound-based and interval-based music education is how the characteristics of digital tools may be assessed in terms of whether they encourage or inhibit creativity when it comes to the process of learning composition in various musical domains. Digital resources can mediate various types of "possibility thinking" in composition work, even when the tools themselves are not physically present, as Dobson and Littleton (2016) discovered in their research on higher music education. For example, students can anticipate how the tools will be used, imagine solutions and how tasks will be divided, and negotiate a shared understanding of the tools and their affordances through the use of digital resources. The usage of tools is thereby firmly ingrained in the process of composition, despite the fact that the mediating role of interactive software elements is frequently overlooked when modeling creative processes (Gall & Breeze, 2005). Studies of the "creative process in music as being divisible into certain 'types' of thinking (reflected in participants' on-task behavior) has been a significant movement in the music psychology literature." Composition processes that do not involve the use of technology are frequently depicted as "sequences" of activity, with distinct stages and types of thinking that individuals must progress through in order to produce the creative outcome, according to Hewitt (2009), page 4. Common types of composition techniques and phases have been characterized across solo, group, and teacher-led contexts. These descriptions are based on observations and other data obtained from realistic settings. Frequently, these processes involve interconnected circular or recursive processes, such as "generating" (playing with ideas, exploring, inventing, and improvising), "realizing" (practicing, playing, establishing a fixed version, recording, transcribing, and notating), and "editing" (manipulating, modifying, adjusting, evaluating, self-criticism, appraisal, and aural judgment) (Wiggins, 2007, p. 456).

Even while research has identified general principles, concepts, and procedures in teaching and learning composition, it has been claimed that studies of imagination in creative processes must also involve the examination of resources utilized for envisioning, such as sound material. This is because imagination is a significant component of creative processes. According to Zittoun and Gillespie (2016), "The specificity of the loop of imagination is that it operates with this material, displaces, condenses, transforms, and makes it acceptable to the situated ongoing activity" (pp. 88-89). This concept is explained in greater detail in the following sentence. For this reason, in order to conduct an analysis of the realm of "possibility thinking" that is made available by various types of digital tools, we draw not only on models of creative processes in composition but also on perspectives on imagination that place an emphasis on the mediating role of multimodal tools and the semiotic properties of the sound material, such as provenance (Gall & Breeze, 2005). DSP is a non-commercial composition program that combines synthesis and signal processing methods. It has been used in different countries, including Norway, Sweden, Denmark, the United States of America, Great Britain, Italy, and Brazil. The tool that has been chosen for analysis is GarageBand, which is a composition program that is freely available from Apple and is ostensibly the most popular and common composition program used in classrooms around the world. Over the course of more than a decade, both programs have been implemented in educational settings. GarageBand is a piece of composing software for music that is interval-based

GarageBand, which was initially released in 2004 as a basic program, has seen major developments since then. It is now widely used in educational settings as a sophisticated Digital Audio Workstation (DAW) that teachers perceive to be "easy to use" (Vratulis & Morton, 2011). GarageBand is now in its version 10.2.0. There is a home screen that shows in GarageBand whenever a new session is started. This home screen contains tracks and the instruments that can be mapped to them. The user makes their selections from a menu of instruments (sound samples), and then they adjust the time signature, tempo, and key by themselves. The instruments are made up of loops that have been synthesized or recorded, and the pitches can be keyed in or recorded via a MIDI device. It is possible for the software to provide the user with immediate audible feedback, which can stimulate curiosity about how to create and alter the sound of the loop (Wang, Trueman, Smallwood, & Cook, 2008). After the loop has been formed, it can be copied and moved around, which makes the process of producing a track quite straightforward.

Add-on plugins and sounds are available from both Apple and third-party distributors, and GarageBand comes pre-loaded with sound files of a variety of instruments that are taken from a big library of prepared loops that is part of the Apple ecosystem. In terms of its function as a resource, the sound material is more directly connected to pop music than it is to score-based instrumental music. Despite the fact that ready-made samples restrict the shaping of emotive qualities that are normally a part of performances on acoustic instruments, the sounds of the instruments can be altered to some degree through the use of a variety of dedicated tone controls, which are similar to those that are found on the instruments themselves or in typical studio use. The user composes while keying in or playing pitches on a digital instrument or on screen (Fig. 1), and a major aspect of the software is an automatic drummer where the style may be customized in a relatively flexible manner. The user can also play pitches on the screen. It is also possible to record sounds into the program using a microphone; however, the library of instrument sounds, tracks, and the keyboard that maps computer keys to pitches do not provide any suggestions for the option of importing sound files that are not included in the software package. In the event that the user decides to import more sounds, they will need to be loaded into a track that has been pre-set for recording using Apple's iTunes. The default sound processing for imported sounds is restricted to a compressor and an equalizer, and there is no option for spectral manipulation or any other techniques that significantly affect the sound.

With the understanding that imagination is a dynamic and mediated process (Zittoun & Gillespie, 2016), the composition process that is mediated by GarageBand is depicted below. The graphical user interface of GarageBand is intended to facilitate the selection, listening, and evaluation of ready-made samples (also known as "loops") of musical instruments. These samples are referred to as tangible semiotic means in the model. The process is "triggered" by curiosity and interest on the side of the user(s) in the placed setting (Roth, Woszczyna, & Smith, 1996), or what Csikszentmihalyi & Hermanson (1995) refer to as a "hook" in their understanding of what constitutes intrinsic motivation. In general, interest is described as a like, preference, or engagement with a specific subject in a specific context at a certain point in time, both individually and in groups (Valsiner, 1992; Renninger, 2009). Interest can be characterized as a psychological state that develops in different stages, but it is most commonly understood to relate to a liking, preference, or engagement with material. The material that was chosen is then sequenced into melodic, harmonic, and rhythmical structures inside a musical composition. Playback is then used to expand and deepen the idea behind the song by adding or eliminating material and adjusting the settings for the key and meter. Those semiotic means, settings, and sequencing hierarchies that are most frequently encountered in interval-based popular music are the ones that determine the parameters for the generalization process and the compositional creative end. To summarize, GarageBand is a tool that facilitates the exploration of ideas within a well-structured, familiar, and constrained creative area. It also offers the possibility of mastering some of the hierarchical compositional rules that are prevalent in popular music.

2.22 Computer Software

Over the course of the past two decades, the utilization of computer software in the composing and performance of musical works has become increasingly widespread and widespread in practice. Digital audio workstations, often known as DAWs, are setups of hardware and/or software that are utilized for the purpose of generating, recording, and editing audio files. By the early 2000s, these DAWs had evolved into the predominant mechanism utilized, particularly in popular music genres. According to Holmes and Holmes (2002), they offered a vehicle that not only allowed for the generation of music that had been edited and perfected but also allowed for the performance of electronic music in a live setting. A time-base or linear format was utilized by digital audio workstations. This format was derived from a magnetic tape approach that provided a highly sequential experience. When it came to the expression of creativity, musicians who performed electronic music using the linear format or model considered the software to be limited and difficult to utilize, particularly when it came to live performances. Turntables, MIDI keyboards (which stand for Musical Instrument Digital Interface), digital drum machines, and other types of hardware technology were incorporated into the system, which resulted in an increase in the number of opportunities for live music performance and creative expression. Despite the fact that these technological advancements were made, the experiences of the musicians who specialized in electronic music were still devoid of creative expression (Holmes & Holmes, 2002). According to Collins and Rincón (2007), the limitations of digital audio workstations (DAWs) that many performers have experienced served as the impetus for the investigation or creation of alternative approaches that would permit a creative and expressive conversation between the musician who specializes in electronic music, the music technology software, and the audience. The development of live electronic music performances led to the creation of three new interactive technologies by software designers. These technologies were developed with the primary goal of facilitating creative expression for live performers (Hook, 2013). "Ableton Live" was a piece of software that was developed in 1999 by three German software developers. It was one of the innovations that made it possible for live performances to be more expressive and creative (Ableton, 2016; Henke, 2016). "Ableton Live" is built on a software design that combines two different graphical user interfaces. This is the cornerstone of the production. The very first graphical user interface is a format that is highly sequential and linear, and it is a reflection of the architecture of earlier linear digital audio workstations. According to Pecko (2016), the second interface is an abstract or nonlinear format that was introduced with the intention of improving live performances. The linear format offers recording and audio editing functions for electronic music, while the nonlinear format offers a variety of other functions to assist electronic music composers. Both interfaces are included within the same application, although the linear format is more efficient than the nonlinear format. The nonlinear format not only includes the capabilities of recording and manipulating audio, but it also gives the user the ability to produce or compose music in a manner that is either abstract or random. That is to say, the user is not restricted to a sequential (or linear) technique of generating or constructing some kind of musical composition. It is possible for the composer and/or performer of electronic music to achieve greater flexibility of creativity and musical expression through the use of the nonlinear format. When compared to the linear format, the experience of creating music in this manner is a more fluid one. Additionally, the nonlinear format gives an alternate approach for writing electronic music as well as improvisation, which contributes to a significant enhancement of the experience of attending an electronic musical performance. Taking into Account the Most Important Differences It is the mental process of musical and procedural thought formation that is at the heart of the difference in user experience that exists between the two formats (models) 4. In order to structure the components of the composition process into a hierarchical format that is founded on chronology, the linear format, and consequently the linear composition software model, was utilized. When using software that is based on the linear paradigm, for instance, the beginning of the song or composition can be the first item that a user encounters. The beginning is the initial part of time that a person would encounter in their lifetime. Following this, the user moves on to the other components of the musical product, ultimately completing the music at the conclusion of the process. (The section of the song that comes toward the end of the song in terms of chronological order.) Within the temporal foundation of this kind of software model, we even discover a model that is considered to be semi-hierarchical. It's possible that we could envisage a top-down strategy. The first step in this process involves establishing the melodic and major musical components. After that, the secondary and harmonic features are incorporated. Those components of the music that are supplemental or helpful are the next ones to be discussed. The process of composition continues in this manner. moving from left to right and from top to bottom. The issue is that a significant number of musicians do not think of music in such a formulaic manner. When a musician is writing a song, he or she may initially have a musical concept or passage in his or her head that he or she considers to be an amazing approach to conclude the song. However, the musician may not have ever conceived of what may be termed the opening, head, chorus, bridge, or any other typical segment that comes before the song. It is possible for him to mentally conceive of the music with a different sequence, and in many circumstances, he does. Specifically, in a manner that is nonlinear. One example that could be considered equivalent is the process of producing a paper for a creative writing class. If we provide a pupil with some very fundamental parameters and give him or her the opportunity to conceive of the various components of the writing, the end result may occur in a manner that appears to be random or abstract. It's possible that he begins by imagining the kinds of characters he wants to incorporate into his writing. As well as the kind of story. Perhaps he comes to the conclusion that he wants his dog to play a significant part. The next step is for him to determine how he would like the story to conclude. It is possible that if we provide a student with a series of instructions that are highly structured and hierarchical, and then we also provide her with a computer with a blank document that she is to fill with text, the student may have a tendency to begin at the beginning and work her way through the instructions until they reach the end. Therefore, a significant portion of the user's choice is limited and improved by software that is meant to be, for lack of a better term, favorable to a particular style of the compositional process. This limits and facilitates the user's ability to make choices. The description is nonlinear. It is possible to compare the nonlinear interface to a table that has several columns and rows, which are arranged in a grid-like fashion. Each column is a virtual track that contains a particular item, such as an instrument, drums, synthesizer, or audio effects. Additionally, each column may hold audio or MIDI data. The musician is able to populate the cells with a variety of musical information that he is making or composing by using this interface. Each individual row in the nonlinear format is capable of performing many functions, and any row can be shifted in any order with other rows from one position to another. Furthermore, a row has the ability to allow variations in time signature and tempo adjustments. It is possible to play all of the cells that are located in each column in that row, thanks to the software. When the electronic musician is executing a row to play during a performance, they have the ability to perform the rows in either a sequential or random order. It is not the case that the architecture of the interface is limited to playing only individual rows; rather, it permits the playback of random individual cells. The ability to play random cells provides the composer or performer with the opportunity to show their creative side during the process of making music or composing music. Providing a real-time creative response to improvisational and compositional ideas, the nonlinear interface is a one-of-a-kind design that offers exceptional functionality.

2.23 Historical Background of Music Composition

It is impossible to build and manufacture the nonlinear composition model in its current form without the incorporation of a number of advances that have been developed since the early 1980s. A platform for the performance and composition of electronic music was established as a result of these improvements, which include advancements in hardware, software, and interactive designs. Providing a foundation and a reference point for this study will be accomplished through the examination of some of these developments. The personal computer (PC), the disc drive, breakthroughs in audio converter technologies, and software designs are some of the first examples of technological advancements. The basis of the digital domain was established as a result of the convergence of several of these technologies. Creating and recording digitized sound and video information was made possible by the creation and utilization of personal computers (PCs) and their frameworks of hardware and software operating systems. This offered the environment or digital domain for both of these activities. One of the most important aspects of the computer was the development of the internal disk drive, which made it possible to access the data that was stored on the drive in a sequential, random, and direct fashion. The recording of digital sound and the conception of the electronic musician were both made possible by this important piece of gear. The quick development of music recording software and audio digital converters was a major contributor to the continued developments in computer technology that occurred during this period of time. The transition of recorded audio from magnetic tape to digital audio files, including wave, MP3, AIFF, and a variety of other formats, was made possible as a result of these breakthroughs. The use of these multiple formats allowed for significant reductions in the size of the audio files, which in turn made it possible to store audio on digital media. One of the factors that contributed to the significant enhancement of the structure and processing capability of the personal computer was the acceleration of the processing speed of the CPU (Computer Processing Unit). In light of this, it became feasible to convert video from magnetic tape to a digital format at a speed of seven times the speed of light. Additionally, the rise in the speed of the central processing unit allowed for an increase in the internal data transmission rates, which made it possible to edit digitalized audio and video data at a fast speed. The standard for video and audio editing was established by software that was initially developed during this time period. The idea of nonlinear editing of video and audio data was initially developed as a basic framework, and it eventually became the norm for editing software for both video and audio (Rubin, 1995). Since the late 1990s, nonlinear editing has been utilized in the broadcast and entertainment industries. It has now become the norm for editing in commercial media, including film, video, and audio. The nonlinear composition software model was constructed on top of this core software and hardware architecture, which served as the platform. The creation of music through the use of computer programs that employ linear and nonlinear formats is both new and old. One of the two fields, composing in computer programs using linear models, is the one that has been around longer and has greater experience. An approach that is significantly more modern is the composition of music through the use of nonlinear models in computer programs. As a consequence of this, the respective literature is exclusive (to one format or the other), differ significantly in terms of depth and rigor, and provides very little in the way of substantial additions to either theory or practice. This is especially true in the context of educational settings where instructional pedagogies and practices have been investigated. In light of the fact that there is a scarcity of effective empirical research, it is essential to combine literature that is both directly and indirectly related to one another. Literature from the fields of creativity, intuition, musical creativity, music composition, music education, and even some aspects of music history are primarily incorporated into this work. This literature includes research as well as various types of publications. The purpose of each section is to shed some light on the numerous factors that are actively involved in the process of music composition, as well as how these elements connect with computerized music composition and real-time production. 8 Creativity There is little doubt that the acts of musical composition that are outlined here are a good example of how creativity overlaps with these activities. It belongs to the category of what is known as a general or ruling mental phenomenon that has a significant amount of influence over the creative process in any field. There is a widespread belief that each and every aspect of life is connected to creativity in some manner. Having the conviction that creativity is required in order to solve problems, for instance, highlights the value of this ability in a variety of fields, including business, government, science, and education (Gardner, 2007, 2008). There appears to be a significant amount of interest in the topic, as seen by the extensive and varied history of creativity literature. When Guildford gave a speech to the American Psychological Association in the 1950s, he urged psychologists to do research on creativity from a scientific perspective (Guilford, 1950). This was the beginning of the research. It is possible that this event marked the beginning of research on creativity, which has proceeded uninterrupted up until the present day. When conducting research on anything, one of the most difficult problems is to arrive at a definition of the topic that is being investigated that is both precise and simple. According to the information that is presented below, it has been challenging to define creativity in a way that is acceptable to a large number of people. First, creativity is defined by Barron and Harrington (1981) as an accomplishment that is both socially recognized and innovative. Secondly, creativity is defined as a talent that is displayed by an exoteric performance during a key period, such as an examination or a challenge. According to Simonton (2001), creativity is characterized by the "capacity to produce ideas that are both original and adaptable" (p. 2). There is consensus among researchers such as Amabile (1996), Csikszentmihalyi (1996), Gardner (1993), and Randles (2009) that creativity can be defined as either the act of producing something or the description of a process that results in a final product that is both beneficial and original. Creativity is defined by Feldhusen and Goh (1995) as the following: 9. ....a concept that lies in parallel with intellect. In contrast to intelligence, however, it is not limited to cognitive or intellectual functioning or activity. This presents a significant distinction between the two. Instead, it is concerned with a complicated combination of elements, including those related to motivation, personality, environmental conditions, chance, and products. Studies (Amabile, 1996; Guilford, 1950) reveal that people who demonstrate creativity or creative insight include talents or abilities that characterize the traits of creativity. These individuals are also more likely to be creative. Through the process of observation and analysis, similar creative characteristics and patterns have been discovered for individuals who are working on creative tasks. These characteristics or patterns are the underpinnings of creativity, which are what make it possible to come up with original ideas or find answers to difficulties. The analysis, identification, and building of creativity models were made possible through the observation of similar creative patterns or processes (Sawyer, 2006; Webster, 1992). This discovery was made possible through the observation of creativity. Theoretical models of creativity Csikszentmihalyi (1996) and Amabile (1993) claim that creativity is best stated as a model consisting of three parts: the domain, the field, and the creative result. This model is the most complete representation of creativity. The creative product must fulfill both of these requirements in order for it to be considered meaningful to the domain. The product must fulfill two requirements: first, it must be novel and distinctive; second, it must be an original and exceptional accomplishment. In the context of the creative product, the domain is a representation of the discipline, subject area, or sphere of influence that is applicable. The definition of a field can be defined as the territory or a particular area of the creative work, and it can be described as a subset of the domain. Earlier works of literature have a variety of instances of creative models. As evidence of the numerous conceptualizations that have been used to frame creativity over the course of history, the Wallas Model for the Process of Creativity (Wallas, 1926), Rossman's Creativity Model (Rossman, 1931), Osborn 10 Seven Step Model for Creative Thinking (Osborn, 1953), The Creative Problem Solving (CPS) Model (Parnes, 1992), A Model for Strategic Planning (Bandrowski, 1985), and Fritz Process of Creation (Fritz, 1991) are all examples of models that have been developed. Models of creativity that have been identified through cognitive science are examples of the creative process. Among these, Wallas' model has been detected in a variety of fields and has received support from the literature (Wallas, 1926; Webster, 1992). This model outlines the following four stages: 1) preparation, 2) incubation, 3) illumination, and 4) verification (see Figure 3 for further explanation). A step toward the final creative result is represented by each stage. It is during the preparation stage that the breadth of the problem is outlined. During the incubation stage, time is spent away from the challenge in order to reflect on the product creation process that is currently taking place. When the concept or solution to the problem is first conceived, this is the point that we are said to be in the illumination phase. The idea is put to the test, validated, or put into practice during the verification stage, which is also the time when it is refined. Csikszentmihalyi (1996) proposes a paradigm that consists of five steps, one of which is elaboration. Csikszentmihalyi's model features the following components as its framework: 1) preparation, 2) incubation, 3) illumination or insight, 4) verification or evaluation, and 5) elaboration (see Figure 4 for further explanation). It is the integration with the problem or task that constitutes the first step, which is preparation. Integration is defined as a state of absorption into the music or art in such a way that the thought processes are focused fully on that work. This level of absorption is referred to as the observation of integration. The processing of thoughts that occur below the level of consciousness is referred to as the second step, which is called incubation. The third step, illumination, offers a moment in time when different aspects of one's thinking come together to form a comprehensive whole. At this point, musicians and artists come to the realization that something has occurred that has resulted in the birth of a new concept. In the fourth step, which is known as verification or evaluation, the creative person is responsible for determining whether or not the idea is beneficial. According to the restrictions imposed by the researchers, the innovation may be novel to the individual but not to the field. Csikzentmihalyi (1996) defines the final step, 11 elaborations, as a laboriously intensive procedure that entails processing the specifics of the innovation. This stage is the culmination of the innovation process. According to Webster (1992), the 1980s marked the beginning of a resurgence of scholarly interest in creative thinking and creative innovation. It was during this time that researchers in the realm of music maintained their search for clear solutions, while the field of psychology was struggling with the notion of creativity. Research in the field of music was influenced by psychological research, namely multiple intelligence theories and novel evaluation procedures (Gardner, 1985, 1993, 1995, 2000; Guilford, 1967; Torrance, 1968). These ideas and approaches provided inspiration to researchers in the field of music. Systematic thinking By the middle of the 1900s, the organizational structure of capitalistic businesses was mainly acknowledged as being the primary contributor to the economic success of the United States (Kemdall, 1966). Some awareness of Henry Ford's creative approach to the assembly line in automotive manufacture is probably not too much of a stretch of the memory. In fact, it is probably not particularly difficult to recall. When it came to wide-scale production, the organizational structure led to increased efficiency and effectiveness. Chandler (1977) found that this mechanized and methodical approach to industry was essential to the achievement of high levels of productivity and profitability in virtually every sector of the American corporate sector. Both the design of a systematized organizational structure and the way of thinking that is linear and methodical have become commonplace in the commercial world in the United States and, consequently, in society as a whole. The phrase "organization men" became a common term that was used to refer to the persons who designed, propagated, and functioned inside bureaucratic systems (Kendall, 1966). This was due to the fact that the term "organization men" became a widespread term. According to Ivancevich and Konopaske (2013), the term "systems thinking" is still used in the business sector today. This term refers to the ability to conceive of operations, structure, regulations, and policy within the framework of systems. In spite of this, by the middle of the 1900s, the "organization man" and the bureaucratic processes and structures he imposed were increasingly seen as inhibiting innovation and information flows (Chandler, 1977). A rigidity-related connotation came to be attached to the phrase. By the latter half of the twentieth century, the phrase had come to denote an antiquated and almost outdated construct that was more of a problem than an advantage. Business environments in the United States and around the world are undergoing fast change, which has led to an increase in both complexity and competitiveness. Efficacy alone was no longer a substantial advantage in this competition. On the other hand, business executives of this era considered intuition, sometimes known as intuitiveness, to be an essential capability of management (Peters, Waterman, & Jones, 1982; Rowan, 1986). Similar to creativity, the idea of intuition was initially met with a great deal of criticism, which may be attributed, at least in part, to the ambiguity of the concepts involved. Just what was the meaning of intuition? The word was connected with emotion-driven gut sensations or hunches that may potentially play a role in decision making, according to the perceptions of many people working in the business sector throughout the middle to late part of the twentieth century. Mishlove (1996) and Leavitt and Walton (1975) found that this gave the impression that the subject was strange and unreliable. The ability to precisely describe, quantify, and exert control over one's intuition was a critical factor in determining whether or not the corporate sector would take intuition seriously. Advocates and consultants for intuitive management sought advice from the field of neuroscience, which would later be known as neuroscience (for example, brain scans), as well as research on creativity, with the intention of gaining a deeper comprehension of intuition. The mere comprehension of intuition, however, was not sufficient to render it workable. It was necessary to comprehend the topic in terms that were comprehensible. 13 The intuitive capacity was also regarded to perhaps be a trait of personality type (Akinci & Sadler-Smith, 2012). This was in addition to the impacts that came from the fields of neuroscience and creativity study. Even if it were a characteristic that was linked to other characteristics, such as intelligence or creativity, intuition would still need to be investigated from a psychological point of view. Because of the potential relationship to personality, psychological testing acquired an even greater level of significance. According to Lussier (2016), a number of different tests, including the Human Information Processing Survey, the Hermann Brain Dominance Instrument, and the Aptitude Inventory Measurement, were all designed to investigate the intuitive capacity or function in some fashion. Among these, the Myers-Briggs Type Indicator (MBTI) was the one that gained the most notoriety. Based on the responses that examinees provided to a series of written questions, the Myers-Briggs Type Indicator (MBTI) was (and still is) a measurement that indicated a personality style or type. Extraversion and introversion, thinking and feeling, evaluating and seeing, and intuition and sensing were the four categories that were made up in the taxonomy that was employed. These categories were organized into scales or lines. The final category, which is concerned with intuition and perceiving, is especially pertinent to our conversation. The Myers-Briggs Type Indicator (MBTI) was founded on Jung's theory of intuition and sensing capacities, which were assessed by the instrument. According to Jung (1971), in his book Psychological Types (1923), he defines intuition as a sort of perception that extends beyond the five senses and encompasses abstractions, imagery, symbolic representations, and even mental conceptualizations. In other words, intuition is independent of the five senses. Contrarily, the concept of sensing was based on empirical evidence. In other words, something that can be perceived by one or more of the senses. According to Jung's view, individuals have a tendency to make use of their intuition or their senses as a means of interacting with the environment that surrounds them. It was first believed that the sensory human, who is someone who has a tendency toward the senses, has a personality that is more outgoing. It would be more natural for the individual to be inclined toward things that are external. It was believed that the intuitive person had a more internally focused personality and was probably more introverted than the other person. The originator and developer of the Myers-Briggs Type Indicator (MBTI), Isabel Briggs Myers, stated that the intuitive person "preferred abstract ideas to concrete facts, potentialities over 14 actualities, future over the present, and holistic over sequential decision making" (Myers & Myers, 2010). The Institute of Personality Assessment and Research at the University of California, Berkeley, which is frequently referred to in the literature as IPAR, developed a number of methods in the 1950s to investigate and get an understanding of the various aspects of personality. IPAR's early adoption of the Myers-Briggs Type Indicator (MBTI) for use in psychological evaluation was strongly affected by the revelations of the MBTI's insights regarding its intuition scale (Lussier, 2016). Despite the fact that IPAR researchers were able to differentiate between creativity and intuition, they were able to demonstrate a certain degree of linkage between the two domains (Bycroft, 2012). Harrison Gough Gough (1981) was one of the researchers at IPAR who investigated the use of the Myers-Briggs Type Indicator (MBTI) in the testing that was carried out at the Institute. In the presentation that he gave at the Fourth Bienniel MBTI Conference, which took place at Stanford University, he stated that the predilection or predisposition toward the intuitive form of perception, also known as the introverted personality type, was extremely uncommon and was discovered in around twenty-five percent of the general population. In addition to this, he mentioned that ninety percent of creative individuals had preferences or dispositions toward intuitive perception. The research classified creative persons as those who showed a fondness for the very forms of perception that defined intuition. Creative people appeared to demonstrate this fondness. Finally, he indicated that people demonstrating a preference for intuitive perception “favor fantasy and the abstract to factuality and the concrete, like imaginative more than sober-minded people, value possibilities more than probabilities, and prefer theories to facts” (as cited in Lussier 2016, p. 712).

2.24 Significance of the Study

The researcher believe that the results of the study would be beneficial to the following:

Students. By participating in this course, students will have the opportunity to acquire the professional theoretical knowledge and operational abilities necessary to become proficient in music composition through the use of digital platforms.

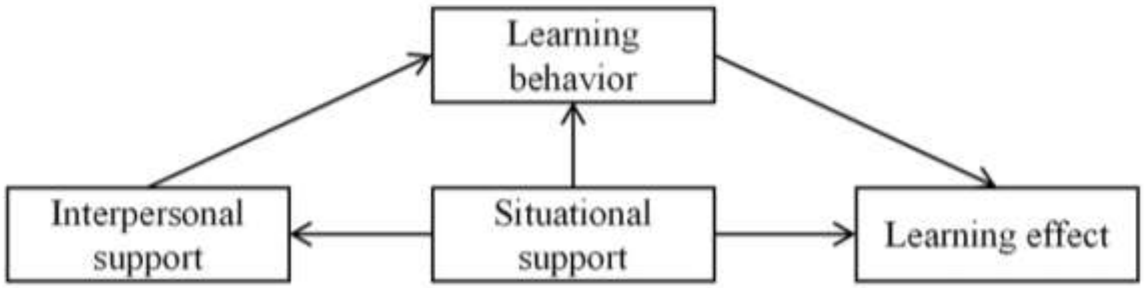
Teachers. This work has the potential to provide music educators with a means of reducing the difficulties that are associated with online instruction in music courses. Additionally, it has the potential to enhance the curriculum that is provided by the school for the music program, which also has the potential to result in more effective teachers and an online learning environment.

Administrators. This can serve as a foundation for the administration of the school to boost their investments in the redesign of software and the reconstruction of professional hardware facilities as they pertain to music programs. This has the potential to gradually enhance the number of students enrolled in the schools and colleges as well as their popularity.

Future Researcher. The findings of the study can serve as a point of reference for researchers in the future who wish to do mixed-method research in order to get a deeper comprehension of the findings of this study and to make a substantial contribution to the existing body of knowledge.

2.25 Theoretical Framework

The route analysis model of building aspects of music effective classroom environment and learning effect will serve as the foundation for the research that will be conducted (Wang, 2021). In the research conducted by Wang (2021), it is presumed that there is a consistent relationship between the three dimensions of the teaching process and the learning impact. Additionally, the relationship between the three dimensions and the learning effect is considered to be consistent. In addition, Wang (2021) asserts that the utilization of computer music production technology in the field of music education has the potential to change the concepts, definitions, and compositions of information that are difficult to comprehend in the classroom into auditory effects that can be felt and touched. On the other hand, it has the potential to pique the interest and excitement of students in the subject of music education, which can lead to an improvement in the overall quality of instruction and the achievement of the intended outcomes. College music instructors can make effective use of online scoring software to create the necessary resources for their students, and they can also use computer technology in the teaching of music courses.



2.26 Conceptual Framework

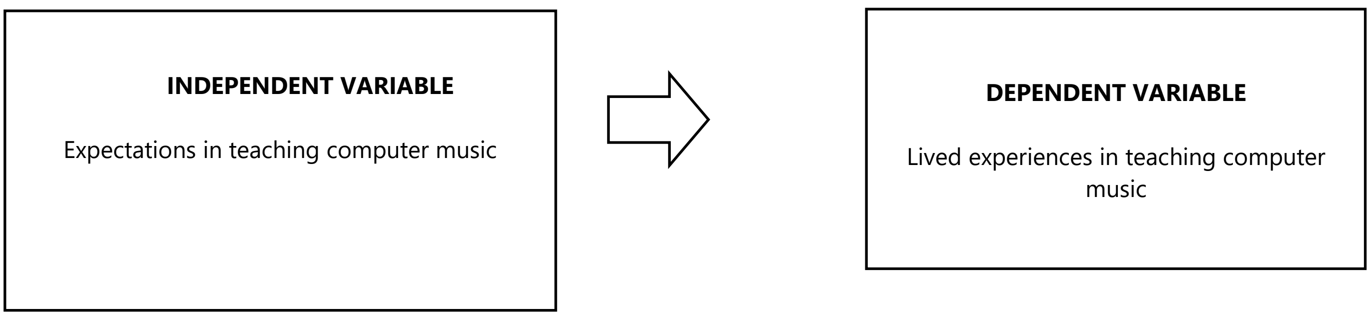


Figure 1. Conceptual Framework of the Study

The goal of this framework is to highlight how the independent variable expectations of teachers regarding the teaching of computer music will be associated with their actual experiences during their time spent in the virtual classroom.

2.27 Statement of the Problem
This study intends to determine the expectations of teachers as well as the experiences that they have had while teaching computer music composition in a selection of colleges and universities located in the province of Hubei in China.

To be more specific, the research endeavored to provide answers to the following questions:

1. How do the teachers assess their expectations in teaching computer music composition in school with respect to:
    1.1 Interpersonal Support;
    1.2 Situation Support; and
    1.3 Learning Effect?
2. How do the teachers describe their lived experiences in teaching computer music composition in school?
3. Is there a significant difference between the teachers' expectations and lived experiences in teaching computer music composition based on the identified dimensions?
4. What recommendations can be drawn from the study to improve the current computer music composition program offered by the school?

2.28 Definition of Terms
Computer music. It is a type of electronic music that is created by synthesizing or modifying music with electronic sound technologies. Tape music, synth music, and computer music were the three levels of growth that it went through. MIDI music production technology, digital audio technology, computer composition, and a wide variety of additional materials are all included in the category of computer music content.

Interpersonal supports. The term refers to the activities or tactics that are provided by peers and school officials in order to enhance the general interpersonal skills of teachers, with the goal of increasing the amount of social interaction that teachers have with students and other classroom members.

Learning effect. This is a term that describes the process by which students' productivity is increased by the use of music education, which ultimately leads to improved academic performance.

Music literacy. It is a reference to the all-encompassing and high-quality education used for studying music. A compulsory course, it is also a fundamental subject in music, and it is a professional field that operates independently. The full theoretical foundation of spectrum reading, solfeggio, hearing, rhythm, harmony, writing, music enjoyment, and music history are all included inside it.

Music production. It refers to the use of computer and music production software as the main creative tools, with electronic synthesizer, sound source or software sound source as creative resources, combined with the traditional composition theory knowledge and modern music theory to sound instrument, sound source or software sound source as creative resources, combined with the traditional composition theory knowledge and the music theory of modern music to music creation, and finally produce a "sound" form of music creation.

Situational support. The term "management action" refers to the actions taken by management to ensure that teachers offering music courses continue to receive their salaries and other essentials.

Teaching computer music. In the context of teaching music courses, specifically in the area of music composition, it refers to musical applications achieved through the utilization of digital computers.

2.29 Scope and the Limitations of the Study

The participants in the study will be professors working in the Music department at several colleges and universities in Hubei, China. The study will be conducted in the vicinity of these institutions. While the sample size of the study is still being decided, the total number of teachers working in the Music department of the school or institution will be taken into consideration. The Research Project is scheduled to be carried out throughout the Calendar Year 2022-2023.

3. Methods and Techniques of the Study

In order to gather the perception of a particular respondent in order to detect a structured pattern, this study will be based on a descriptive correlational research design. A numerical score rating will be issued to each respondent. According to Health Research Funding (2018), quantitative research enables researchers to be objective, collect data quickly, and analyze the data in a statistical format, which can provide a comprehensive perspective of the investigations being conducted. Additionally, correlation will be utilized in addition to the descriptive quantitative design in order to gain a deeper comprehension of the ways in which the variables are related to one another. The independent variable will be the expectations of teachers regarding the teaching of computer music, while the dependent variable will be the actual experiences that teachers have had with teaching computer music. In light of this, I-Chant A. Chiang, Rajiv S. Jhangiani, and Paul C. Price (2013) state that correlation research is a non-experimental study approach in which two variables are measured and evaluated based on the feature of their statistical relationship in terms of both strength and range.

3.1 Respondents of the Study

The respondents for this study will be teachers working in the music departments at the selected schools and universities in Huibei, China. The study will put its primary emphasis on these institutions. It is expected that the respondents will be educators who have both expectations and experiences in teaching computer music within the Music department.

3.2 Data Processing and Statistical Treatment

For the purpose of describing the teachers' expectations and experiences in teaching computer music composition in selected colleges and universities in Hubei, China, the data that will be gathered in this research will be analyzed through descriptive analysis using the Statistical Package for Social Sciences (SPSS) version 25. This research will be conducted in China. When it comes to teaching computer music composition within the music department, the purpose of this study is to determine the relationship between the expectations of teachers and the experiences they have actually had. In order to take into account the distribution of the data and to determine which statistical formula will be applied, the data may be subjected to normality testing. The results of the normal data distribution will be analyzed with the help of Pearson-r, and the results of the non-normal data distribution will be computed with Spearman-rho. This testing method is guided by the statistician.

3.3 Presentation, Analysis, And Interpretation of Data

This chapter provides interpretations and analysis of the data that was collected for the study. The following data are presented in the order and sequence of the questions that were addressed in Chapter 1 for the purpose of ensuring that the discussion is both clear and consistent: (1) What criteria do teachers use to evaluate their expectations when it comes to interpersonal support, situational support, and learning effect when it comes to teaching computer music composition in traditional classroom settings? (2) In what ways do the educators characterize the instructional experiences they have had while instructing students in the art of computer music composition? When it comes to teaching computer music composition, depending on the dimensions that have been discovered, is there a major discrepancy between the expectations of teachers and the experiences that they have actually had? (4) What suggestions can be derived from the research in order to enhance the quality of the computer music composition program that is currently being provided by the institution?

1. How do the teachers assess their expectations in teaching computer music composition in school with respect to:

Table 1
Teachers' Assessment on Teaching Computer Music Composition in School

Indicators	Weighted Mean	Verbal Interpretation	Rank
A. Interpersonal Support			
1. Teaching computer music composition has concrete guidance.	2.32	Disagree	2
2. Teaching computer music composition makes it easier for students to associate and comprehend different phonograms.	2.40	Disagree	1
3. Teaching computer music composition increases the proportion of music theory knowledge.	2.25	Disagree	3
Average	**2.32**	**Disagree**	**1**
B. Situation Support			
1. Teaching computer music composition enriches the content of music knowledge.	3.04	Agree	2
2. Teaching computer music composition broaden the scope of music curriculum knowledge.	2.92	Agree	4
3. Teaching computer music composition improve the teaching efficiency of music theory courses, instrumental music singing courses and computer practical application courses when applied to traditional music teaching.	2.99	Agree	3
4. Teaching computer music composition improve the function of computer-assisted instruction by guiding students to master the method of music creation to achieve the optimization of teaching and learning.	3.14	Agree	1
Average	**3.02**	**Agree**	**3**
C. Learning Effect			
1. Teaching computer music composition enrich and improve the shortcomings and defects in traditional music teaching	2.82	Agree	3
2. Teaching computer music composition effectively improves the teaching quality.	3.02	Agree	1
3. Teaching computer music composition no longer needs the traditional professional equipment piled up in mountains.	2.99	Agree	2
Average	**2.94**	**Agree**	**2**
Overall Weighted Mean	**2.76**	**Agree**	

A numerical representation of the instructors' evaluations of the effectiveness of teaching computer music composition in schools is presented in Table 1. The evaluations are broken down into three categories: interpersonal support, situation support, and learning effect. When it comes to the table, the three constituents received a weighted mean score of 2.76, which indicates that they are in agreement with the statement.

1.1 Interpersonal Support;

A quantitative analysis of the instructors' opinions regarding the teaching of computer music composition in schools with regard to the provision of interpersonal assistance is presented in this part. Students are able to more easily associate and comprehend a variety of phonograms when they are taught computer music creation, which ranks first and has the greatest weighted mean of 2.40 and is translated as "Disagree." The next step is to teach computer music composition in a way that provides concrete direction on rank two, with a weighted mean of 2.32 and an interpretation of "Disagree." The final point is that teaching computer music composition increases the proportion of music theory knowledge despite having the lowest weighted mean of 2.25 and a verbal interpretation of "Disagree." In general, the instructors' evaluation of the effectiveness of teaching computer music composition in schools with regard to interpersonal assistance corresponds to a weighted mean of 2.32 and a verbal interpretation of "Disagree."

1.2 Situation Support; and

This section provides a quantitative analysis of the instructors' evaluations of the teaching of computer music composition in schools with regard to the assistance provided by the circumstances. Having the highest weighted mean of 3.14 and being translated as "Agree," teaching computer music composition improves the function of computer-assisted instruction by directing students to grasp the method of music production in order to accomplish the optimization of teaching and learning. This is the first position on the list. After that, teaching computer music composition, which enriches the content of music knowledge, came in at number two with a weighted mean of 3.04 and an interpretation of "Agree." Having a weighted mean of 2.99 and being translated as "Agree," teaching computer music composition improves the teaching efficiency of music theory courses, instrumental music singing courses, and computer practical application courses when applied to traditional music education. This is the third position on the list. Last but not least, with a weighted mean of 2.92 and a verbal interpretation of "Agree," teaching computer music creation broadens the scope of information that is covered in the music curriculum. A weighted mean of 3.02 and a verbal interpretation of "Agree" relate to the overall evaluation that the instructors gave on the teaching of computer music composition in schools with regard to the support of the situation.

1.3 Learning Effect?

This section provides a quantitative analysis of the teachers' evaluations of the effectiveness of teaching computer music composition in schools with regard to pupil learning. Having the highest weighted mean of 3.02 and being interpreted as "Agree," teaching computer music composition is a method that effectively increases the quality of instruction. On the second spot, with a weighted mean of 2.99 and an interpretation of "Agree," is the teaching of computer music creation, which no longer requires the customary professional equipment that is stacked up in the mountains. Last but not least, with a weighted mean of 2.82 and a verbal interpretation of "Agree," teaching computer music composition enriches and improves the deficiencies and flaws that are present in traditional music instruction. In general, the instructors' evaluation of the effectiveness of teaching computer music composition in schools corresponds to a weighted mean of 2.94 and a verbal interpretation of "Agree." This conclusion was reached after considering the learning effect of the instruction.

2. How do the teachers describe their lived experiences in teaching computer music composition in school?

Table 2

Teachers' Description With Their Lived Experiences in Teaching Computer Music Composition

Indicators	Weighted Mean	Verbal Interpretation	Rank
1. Students' enthusiasm for participating in learning is aroused.	2.31	Disagree	8
2. Students are able to experience the charm of music in intuitive and vivid cases.	2.56	Agree	6
3. Students are able to master music theory knowledge in a more expressive teaching environment.	2.94	Agree	3
4. Students are able to master computer music production technology and show certain music theory knowledge to create and produce music.	2.40	Disagree	7
5. The price of computers is declining and the performance is improving, and more updated and powerful music software is being introduced.	2.25	Disagree	9
6. There are times that teachers still apply traditional teaching modes and methods, such as blackboard writing only to present professional teaching knowledge and music scores, which can't make students really feel specific sound effects	2.92	Agree	4
7. Computer music technology in harmony music teaching transform the knowledge composition, principles and definitions that are difficult to understand	2.92	Agree	4

in teaching into audible effects that can be touched and felt.			
8. Computer music arouse students' enthusiasm and interest in music learning that improves the quality of harmony teaching and achieve the desired results.	2.99	Agree	2
9. Multimedia courseware is already prepared by head teachers before class, showing the key points and difficulties involved in theoretical courses, which can directly reach the teaching purpose and optimize the classroom structure.	2.17	Disagree	10
10. In class, teachers only need to click the software lightly, and students can see the music score and hear the music effect.	3.19	Agree	1
Average	**2.67**	**Agree**	

Table 2 presents the numerical data that provides an overview of the experiences that the teachers have had while teaching computer music creation. "Agree" is the verbal interpretation of the first rank, which has a weighted mean of 3.19 and is the first rank in the list. The teachers only need to lightly click the program in order for the pupils to be able to see the music score and hear the music effect while they are in education. The next topic on the list is computer music, which has a weighted mean of 2.99 and a verbal interpretation of "Agree." It is ranked second because it seems to inspire students' passion and interest in music. Students are able to grasp music theory information in an environment that is more expressive, as indicated by the third rank, which has a weighted mean of 2.94 and is interpreted as "Agree." On the fourth spot, There are times when teachers continue to use traditional modes and methods of instruction, such as writing on the chalkboard, just for the purpose of presenting professional teaching expertise and music scores. This approach is not capable of making pupils truly experience certain sound effects and emotions. A weighted mean of 2.92 and a verbal interpretation of "Agree" are the results of the application of computer music technology in harmony music instruction. This technology transforms the knowledge composition, principles, and definitions that are difficult to explain in teaching into aural effects that can be touched and felt. Students are able to experience the allure of music in circumstances that are both intuitive and vivid, with a weighted mean of 2.56 and a verbal interpretation of "Agree." This places them in sixth place. Students are able to understand computer music production technology and demonstrate certain music theory knowledge in order to create and produce music, which places them on the seventh rank with a weighted mean of 2.40 and a verbal interpretation of "Disagree." The excitement that students have for taking part in the learning process is bolstered. represents the eighth position, with a weighted mean of 2.31 and a meaning that can be translated as "Disagree." With a weighted mean of 2.25 and translated as "Disagree," the ninth position is occupied by the fact that the price of computers is decreasing and the performance is improving. Additionally, more advanced and powerful music software is being introduced. With the highest weighted mean of 2.17 and a verbal interpretation of "Disagree," multimedia courseware is already prepared by head teachers before class. It demonstrates the most important points and challenges that are involved in theoretical courses, and it has the potential to directly reach the teaching purpose and optimize the classroom structure. All things considered, the student's level of satisfaction with the music class is equivalent to a general weighted mean of 2.67, which can be understood as "Agree."

3. Is there a significant difference between the teachers' expectations and lived experiences in teaching computer music composition based on the identified dimensions?

Table 3
Significant Difference Between the Teachers' Expectations and Lived Experiences in Teaching Computer Music Composition

Analysis of Variance (ANOVA)						
Source of Variation	**Sum of Square**	**Degree of Freedom**	**Mean of Square**	**Computed F**	**P-value**	**F crit**
Treatment	0.94	2	0.47	54.65	0.00	4.74
Errors	0.06	7	0.01			
Total	**1.00**	**9**				

In Table 3, the analysis of variance was performed to determine whether or not there was a significant difference between the teachers' expectations and their actual experiences in teaching computer music composition. The results showed that the null hypothesis was rejected because the computed F value of 54.65 was higher than the critical value of 4.74, with the degree of freedom ranging from 2 to 7 and a level of significance of 5%. It is for this reason that there is a substantial gap between the expectations of teachers and the actual experiences they have had when it comes to teaching computer music composition.

4. What recommendations can be drawn from the study to improve the current computer music composition program offered by the school?

Due to the fact that the expectations of teachers are very different from the experiences they have actually had in the field of teaching computer music composition, there is a pressing need to enhance the computer music composition program that is now being provided by the learning institution.

4. Summary of the Findings, Conclusions, and Recommendations

During the course of the research project titled "Lived Experiences of Teachers in Teaching Computer Music Composition in Selected Colleges and Universities in Hubei, China," this chapter provides a summary of the findings and the conclusion that was reached as a result of the research activities. As an additional benefit, it offers suggestions that can be pursued by the administrators of the schools and the teachers.

4.1 Summary of Findings

1. Teachers' Assessment of Their Expectations in Teaching Computer Music Composition in School

Teaching computer music creation makes it simpler for students to associate and comprehend a variety of phonograms. This is the case with regard to interpersonal support, which is ranked first and has the greatest weighted mean of 2.40, which can be translated as "Disagree." The next step is to teach computer music composition in a way that provides concrete direction on rank two, with a weighted mean of 2.32 and an interpretation of "Disagree." The final point is that teaching computer music composition increases the proportion of music theory knowledge despite having the lowest weighted mean of 2.25 and a verbal interpretation of "Disagree." In general, the instructors' evaluation of the effectiveness of teaching computer music composition in schools with regard to interpersonal assistance corresponds to a weighted mean of 2.32 and a verbal interpretation of "Disagree."

Teaching computer music composition improves the function of computer-assisted instruction by guiding students to master the method of music creation in order to achieve the optimization of teaching and learning. This is in accordance with the situation support, which ranks first and has the highest weighted mean of 3.14 and is interpreted as "Agree." After that, teaching computer music composition, which enriches the content of music knowledge, came in at number two with a weighted mean of 3.04 and an interpretation of "Agree." Having a weighted mean of 2.99 and being translated as "Agree," teaching computer music composition improves the teaching efficiency of music theory courses, instrumental music singing courses, and computer practical application courses when applied to traditional music education. This is the third position on the list. Last but not least, with a weighted mean of 2.92 and a verbal interpretation of "Agree," teaching computer music creation broadens the scope of information that is covered in the music curriculum. A weighted mean of 3.02 and a verbal interpretation of "Agree" relate to the overall evaluation that the instructors gave on the teaching of computer music composition in schools with regard to the support of the situation.

Teaching computer music creation is an excellent way to increase the quality of instruction, as evidenced by the fact that it ranks first in terms of learning effect, with the highest weighted mean of 3.02 and its interpretation being "Agree." On the second spot, with a weighted mean of 2.99 and an interpretation of "Agree," is the teaching of computer music creation, which no longer requires the customary professional equipment that is stacked up in the mountains. Last but not least, with a weighted mean of 2.82 and a verbal interpretation of "Agree," teaching computer music composition enriches and improves the deficiencies and flaws that are present in traditional music instruction. In general, the instructors' evaluation of the effectiveness of teaching computer music composition in schools corresponds to a weighted mean of 2.94 and a verbal interpretation of "Agree." This conclusion was reached after considering the learning effect of the instruction.

2. Teachers' Description With Their Lived Experiences in Teaching Computer Music Composition

The program is ranked first with a weighted mean of 3.19 and a verbal interpretation of "Agree." In the classroom, teachers only need to softly click the software, and pupils are able to view the music score and hear the music effect. The next topic on the list is computer music, which has a weighted mean of 2.99 and a verbal interpretation of "Agree." It is ranked second because it seems to inspire students' passion and interest in music. Students are able to grasp music theory information in an environment that is more expressive, as indicated by the third rank, which has a weighted mean of 2.94 and is interpreted as "Agree." On the fourth spot, There are times when teachers continue to use traditional modes and methods of instruction, such as writing on the chalkboard, just for the purpose of presenting professional teaching expertise and music scores. This approach is not capable of making pupils truly experience certain sound effects and emotions. A weighted mean of 2.92 and a verbal interpretation of "Agree" are the results of the application of computer music technology in harmony music instruction. This technology transforms the knowledge composition, principles, and definitions that are difficult to explain in teaching into aural effects that can be touched and felt. Students are able to experience the allure of music in circumstances that are both intuitive and vivid, with a weighted mean of 2.56 and a verbal interpretation of "Agree." This places them in sixth place. Students are able to understand computer music production technology and demonstrate certain music theory knowledge in order to create and produce music, which places them on the seventh rank with a weighted mean of 2.40 and a verbal interpretation of "Disagree." The excitement that students have for taking part in the learning process is bolstered. represents the eighth position, with a weighted mean of 2.31 and a meaning that can be translated as "Disagree." With a weighted mean of 2.25 and translated as "Disagree," the ninth position is occupied by the fact that the price of computers is decreasing and the performance is improving. Additionally, more advanced and powerful music software is being introduced. With the highest weighted mean of 2.17 and a verbal interpretation of "Disagree," multimedia courseware is already prepared by head teachers before class. It demonstrates the most important points and challenges that are involved in theoretical courses, and it has the potential to directly reach the teaching purpose and optimize the classroom structure. All things considered, the students' level of satisfaction with the music class is equivalent to a general weighted mean of 2.67, which can be understood as "Agree."

3. **Significant Difference Between the Teachers' Expectations and Lived Experiences in Teaching Computer Music Composition**

The outcome of the analysis of variance showed that the null hypothesis was rejected since the computed F value of 54.65 is higher than the critical value of 4.74, with the degree of freedom being between 2 and 7 and the level of significance being 5%. It is for this reason that there is a substantial gap between the expectations of teachers and the actual experiences they have had when it comes to teaching computer music composition.

4. Recommendations Drawn from the Study to Improve the Current Computer Music Composition Program Offered by the School

It is necessary to enhance the existing computer composition program in order to make it more useful for both the instructors and the students, as indicated by the findings of the investigation. The program ought to be organized in such a way that in addition to program-specific goals, it should also be designed to develop student comprehension of a common set of goals (through common core courses). Both the general core goals and the specific goals that are included in the improvement proposal for the program have to be able to accommodate the anticipated growth of the students in the area of music composition.

4.2 Conclusions

1. The majority of respondents were not in agreement with the statements that teaching students how to compose music using a computer makes it simpler for them to associate and comprehend various phonograms, that teaching students how to compose music using a computer provides concrete guidance, and that teaching students how to compose music using a computer increases the proportion of students who are knowledgeable about music theory.

2. The majority of those who participated in the survey were of the opinion that students are not capable of mastering computer music production technology and need to demonstrate specific knowledge of music theory in order to develop and produce music. There was a significant amount of disagreement among educators regarding the notion that students have become more enthusiastic about participating in learning and that head teachers have already prepared multimedia courseware prior to the start of class. This courseware demonstrates the key points and difficulties involved in theoretical courses, which can directly reach the teaching purpose and optimize the organizational structure of the classroom.

3. Because the null hypothesis was not accepted, it can be concluded that there is a substantial disparity between the expectations of teachers and the actual experiences they have had when it comes to teaching computer music composition.

4. It is necessary to enhance the existing computer composition program in order to make it more useful for both the instructors and the students.

4.3 Recommendations

1. In order for learners to have an easier time associating and comprehending the various phonograms, teachers should be creative when it comes to teaching computer music composing. It is also important for teachers to provide their students with concrete direction in the area of teaching computer music composition. This can be accomplished by increasing the proportion of music theory knowledge that is covered in the music course.

2. In order to show students how to compose and produce music, teachers should assist them through the process of learning computer music production technology. This technology demonstrates specific knowledge of music theory. Multimedia courseware that has previously been developed should be prepared by head teachers before the class begins. This courseware should demonstrate the most important points and challenges that are included in theoretical courses. This can directly reach the teaching purpose and maximize the structure of the classroom.

3. Among the objectives that should be included in the enhancement of the computer composition program that the institution provides are the following:

- In the field of music, a full awareness of the relationships between sociocultural and historical perspectives, theoretical analysis, and performing practice is essential.

• A grasp of music in the historical and cultural context in which it exists, to the extent that it enables them to promote the evolution of their musicianship and enables them to have a greater understanding of the music that they produce, hear, and play.
In the Western musical tradition, a solid understanding of the fundamental concepts underlying the structure, design, and language of music is required.
• A level of technical expertise and vocabulary that allows one to approach music from any era, style, or genre.
• The ability to create a mental image of the sound of written music and to transform music that has been heard into what is written down.
• The ability to sight-read music of a wide variety of forms and genres, as well as musical technical expertise and artistic integrity.
• Knowledge of technology applicable to and in line with their field of specialization.
• Knowledge of music literature that is pertinent to and connected to their area of expertise in the field of work.
• Music students will gain knowledge of learning and teaching as well as music learning and teaching to the extent that they are able to engage in music teaching in their area of concentration, provided that this understanding is relevant to the focus of the particular degree program.

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