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Technology in Music Education
La technologie dans l'éducation musicale

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Résumé de l'article

Cette étude a examiné l'utilisation de logiciels de musique comme outil pédagogique pour la diffusion de contenu spécifique dans un cours d'éducation musicale offert aux étudiants du programme de certificat et de baccalauréat en éducation dans une université des Caraïbes. Le cours existant utilise une approche traditionnelle, et donc, l'étude est importante, car les résultats propulseraient un changement vers l'enseignement transformationnel. Vingt-quatre étudiants universitaires ont été sélectionnés pour l'étude qui a adopté une approche mixte. Pendant un semestre, les participants ont utilisé un logiciel de musique gratuit et open source pour apprendre des indications de mesure simples. Les étudiants ont réalisé un travail et rempli un questionnaire. Quatre-vingt-dix pour cent des étudiants ont pu composer huit mesures de musique selon une indication de mesure simple à l'aide du logiciel. La plupart des participants ont indiqué qu'ils se sentaient à l'aise et motivés en utilisant le logiciel, qu'ils comprenaient les concepts enseignés et qu'ils suggéraient de continuer à l'utiliser. La majorité des participants ont également déclaré qu'ils avaient besoin de plus de formation. Certains participants ont même déclaré qu'ils adopteraient cette méthodologie dans leur stage d'enseignement. Sur la base des résultats, les recommandations comprennent l'adoption de cet outil et d'autres outils d'enseignement technologiques au sein du programme de musique, une évaluation du stage d'enseignement et une composante de formation progressive pour les étudiants et le personnel.

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Technology in Music Education

La technologie dans l'éducation musicale

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Abstract

This study examined the use of music software as a pedagogical tool for the delivery of specific content in a music education course offered to Certificate and Bachelor of Education Program students at a Caribbean university. The existing course uses a traditional approach, and thus, the study is significant as the results would propel a shift toward transformational teaching. Twenty-four university students were chosen for the study which adopted a mixed methods approach. Over one semester, participants used a free, open-source music software program to learn simple time signatures. Students produced an assignment as well as completed a questionnaire. Ninety percent of students were able to compose eight bars of music according to a simple time signature using the software. Most participants intimated they felt comfortable and motivated using the software, they understood concepts taught, and they suggested its continued use. The majority of participants also stated that they required more training. Some participants even said that they would adopt this methodology on their teaching practicum. Based on the results, recommendations include the adoption of this and other technological teaching tools within the music program, a teaching practicum assessment, and a progressive training component for both students and staff.

Keywords: music education; technology; software; Caribbean

Résumé

Cette étude a examiné l'utilisation de logiciels de musique comme outil pédagogique pour la diffusion de contenu spécifique dans un cours d'éducation musicale offert aux étudiants du programme de certificat et de baccalauréat en éducation dans une université des Caraïbes. Le cours existant utilise une approche traditionnelle, et donc, l'étude est importante, car les résultats propulseraient un changement vers l'enseignement transformationnel. Vingt-quatre étudiants universitaires ont été sélectionnés pour l'étude qui a adopté une approche mixte. Pendant un semestre, les participants ont

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Mots-clés : éducation musicale ; technologie ; logiciels ; Caraïbes

Introduction

The content of the general music education course offered at the Caribbean university can be described as an interactive exploration of a wide range of knowledge and skills in music required for the early childhood care and education and primary school settings. The purpose of the program is to explore resources and methods for using music as an intrinsic part of the education system. Thus far, the music course at the university has used a more traditional approach where students are exposed to lectures, discussions, and the playing of select instruments. Students use traditional modes of note taking and assessment and are accustomed to a bricks and mortar classroom. In education, however, there are different types of technological tools to support the creation of music through the use of technology. For example, there are different types of music notation software that can provide support to the pedagogical process.

The existing course also includes listening and appraisal of local, regional, and international music, making the distinction between training and teaching through music and special music education. The use of technology is limited to Canvas which is the learning management system (LMS) at the university. Students mostly access their reading materials and assignments from the LMS, but other than this, the use of technology as a methodological tool is not featured in the course. As faculty members of the university, we have noticed that there is a thrust to make the LMS more accessible to both students and lecturers. The university unit responsible for the LMS offers support by way of professional development sessions and support personnel, however, this has not yet caused any major shifts in the methodologies employed in this area.

Purpose

The purpose of this study was to explore the use of technology as a contemporary strategy in the existing music program at the university. Specific music content was chosen and relevant software used to deliver the content over a specified period of time. This was done with student teachers of the Certificate and Bachelor of Education programs. These programs were developed to train persons to

become teachers at either the early childhood or primary school level. The use of this software in music is a new methodology being introduced as part of the teaching of music content.

Significance

It is anticipated that use of the software can reveal definitive statements on the ease of integration, impact of use, and motivational factors displayed by both educator and students alike. Technology has been changing the way musicians produce and compose music and has also created more opportunities to enhance the teaching/learning process (Freedman, 2017). Marrying music and technology is a novel idea at this institution, and this research may propel changes in the program as we continuously seek tools for better teaching and learning as educators.

This research is also in keeping with the United Nations 2030 Sustainable Development Goal of quality education (UN DESA, 2023). As a publicly funded university, we must set the pace and tone for the introduction of innovative, novel ways of delivering content whilst engaging our clients. It is hoped that this research is one small step in that direction. On a larger scale, because the university is charged with the responsibility of teacher training to fulfil the needs of the nation's teaching service, this research is significant as it has the ability to impact the teaching methodology in future classrooms at both the early childhood and primary education level.

The international advent of COVID-19 has added another layer to the significance of this study. From spring 2020 to 2021, schools and other institutions of learning, from early childhood to university levels, have been adopting a blended learning approach to deliver content to students. It has become even more critical that budding teachers be equipped, especially at the level of the training institutions, to deliver content in the digital environment. This shift in learning and teaching is unprecedented, and research such as this is one small step toward achieving the goal of fully online teaching and learning and getting pre-service teachers accustomed to using technological tools.

Statement of the Problem

Since the inception of the music education program at the university, technology as part of the teaching/learning methodology has not been considered or adopted. This research introduces pre-service teachers in the primary and early childhood care and education specialization to the use of technology to learn specific music content. This opportunity may assist in marrying the traditional with the contemporary in teaching music content. In this highly technologically advancing age, the use of software to deliver musical content is relevant and may be valuable in achieving course goals.

Literature Review

Contemporary research advocates the critical significance of the use of music in early childhood classrooms. Music is a practice, and music education is the teaching and learning of music. Grounded in the theoretical underpinnings of constructivism, music has the unique ability to strengthen children's

cognitive, linguistic, physical, social, and emotional skills. Psychologist Howard Gardner has intimated that musical intelligence in young children has equal standing and should be given as much attention as the other intelligences (Gordon & Browne, 2017).

As far back as the 1950s, investigations have revealed the importance of music in early childhood development. Children express music in different ways than adults do as they use their senses from an early age to mimic the sounds they absorb in the environment. Critical to note also is the period from birth to the age of 6: this early childhood span is the window of opportunity for a child's musical development. It has been proven that very young children receive the tones of music and unintentionally differentiate in frequency, melody, and stimuli (Gordon, 2012). Important to note as well are the varied types of technological tools which exist now that support the creation of music. Focus can be placed on different types of music notation software available to educators, such as Finale and Sibelius, which propagate the integration of technology into education (Lam, 2023).

The Early Years

According to researchers, it is absolutely necessary that the early years of childhood are honed in order to facilitate learning so that children can unscramble the tones of music and build up a mental organisation system to memorise music (Feierabend, 2021). Children of this age develop musical skills through imitating and memorising rhythms and tones of songs through activities such as clapping to a beat and singing in tune. Developing musical skills is influenced by positive and negative factors. The school setting, in particular, must offer sufficient intentional, carefully articulated stimulation and exposure to music (Turner, 2008).

One may now ponder, "How can teachers of children effectively expose them to these skills?" In this technological world, it stands to reason that technology be used as a tool in music education. Further questions arise with respect to the teachers of young children. Are teachers trained to use these technological tools? Are training institutions integrating these methodologies within their programs? This research paper attempts to focus on the use of music software as part of a music course at a Caribbean university in order to gain insight into these questions. The use of music software will provide the opportunity to learn music theory through the making of music which may influence motivational factors. When teachers are motivated to teach, the benefits redound to the children in their care (Uludag & Satir, 2023).

Music Education Tools and Technology

Waddell and Williamon (2019) postulated that the overall evolution of music education tools and technology is indicative of a few major trends:

- Music technology has evolved in such a way that it has pushed music toward becoming shareable on a larger scale. This can be evidenced in music and education tools like Soundtrap or Google Classroom as well as broader multimedia social platforms like YouTube.

- Music education tools that offer additional practice to supplement classroom learning with specific skills are now available. These tools have paved the way for more self-paced learning and allow teachers to focus on other key skills.

- There are now newer media platforms, such as virtual reality and augmented reality, that showcase potential for enhancing learning both in and outside the classroom. This is done by enhancing collaboration or offering immersive ways of engaging visual learners. The usage of these in music education is currently limited, however, it is noteworthy, and major breakthroughs could spur innovations in the way teachers use media as a learning tool.

- Artificial intelligence applications may also act as a supplement to teaching and learning. One of the common areas is in aural skills training apps; digital assistants can provide assignments or offer feedback to students at lightning speed. Current usage is also limited but may offer opportunities for innovation as the technology matures.

Digital technology has become so interwoven with today's culture and society that it is difficult to imagine our everyday lives without it. So too, integrating these types of tools into music education may have invaluable effects, especially at the university level. This notion of the use of technology in music education programs is echoed by Parasiz (2018) who said that technology use in the field of music education has given a new perspective to the understanding of education. When the tools in music education are combined artfully with technology, this is powerful enough to provide an expanded education for music students and better equip them to enter the music world of the 21st century. In music education, thanks to technology applications, students are motivated and generally become more interested.

This, however, does not come without challenges. Gall (2013) examined the main inhibitors to trainee music teachers' use of technology within music classrooms. She discovered that a lack of computers and other equipment issues, and a lack of music staff sufficiently competent, confident, and/or interested in providing effective support were among the main challenges with respect to implementation. It must be noted that the role of the teacher has changed as traditional education methods, techniques, and applications have evolved, through research, to a more student-centered approach that requires techniques and applications conversant with the 21st century. Mouza and Lavigne (2012) also posited that teachers are no longer required to be the sole source of information but instead they guide students to access information and manage the learning process using digital tools. Educators at the university level must embrace this, as it has become an inevitable requirement that a teacher interested in guiding a student must be versed with technological developments in the field, as well as master and use the technology in the classroom and integrate it with pedagogical practice.

Objectives of the Study

The objectives of the study are:

1. To explore the use of music software as a novel strategy for delivering specific music content to pre-service teachers in a general music education course in the education department of this university.

2. To examine how pre-service teachers' performance and motivation are impacted by the use of music software.

3. To make practical recommendations based on the findings of the study regarding the implementation of music software in the general music education course at this university.

Research Questions

The following research questions have been identified for exploration:

1. Can music software be integrated in the general education program?

2. Do students comprehend music concepts and skills using the music software?

3. How is performance impacted with the use of music software?

4. Is the use of music software motivating for music education students?

Methodology

This study is mixed methods research and adopts a phenomenological approach. Vagle (2018) insinuated that this is a powerful research strategy that focuses on the study of an individual's lived experiences. It focuses on one basic common narrative experienced by a group of individuals. In this particular instance, the phenomenon being experienced is the use of technology in a program that did not contain this methodological strategy before. Some of the major advantages proposed by Vagle (2018) with this approach are:

- The production of rich data culled from individuals' experiences provides a context for a unique approach.

- A deep understanding emerges from individuals' experiences.

- Results contribute to new theories.

- Researchers can quickly adjust to new issues and ideas as they emerge.

Tashakkori and Teddlie (2010) indicated that a true mixed methods design includes a purposeful integration of qualitative and quantitative methods. This research adopts this integration which occurred at various stages of the research process. We further suggest that triangulation design involves a concurrent collection of quantitative and qualitative data with preferably equal priority being given to both sets of data. Drawing from this perspective, this research paper involved concurrent but

separate collection and analysis of qualitative and quantitative data. The data were merged or integrated in the analysis phase to draw conclusions. This approach allowed us to understand the statement of the problem in a holistic manner mitigating the disadvantages of a solely quantitative or qualitative study.

Participants

The participants included 24 (22 female and 2 male) students enrolled in the general music education course at the university. Fifteen participants were enrolled in the Bachelor of Education – Primary Education specialization, and nine participants were in Early Childhood Care and Education. They were all being trained to enter the teaching service in their specialization.

Data Collection

Questionnaire

Participants were asked to complete a questionnaire during a regular class session in the final week of the semester. This instrument was pilot tested prior to use to ensure reliability and consistency. Participation was voluntary. One of the researchers explained the purpose of the study. Participants willing to take part indicated their consent on a relevant form and filled out the questionnaire. To ensure anonymity, the participants did not indicate their names on the survey.

The questionnaire contained 10 items which assisted in answering the three research questions related to the integration of technology in the music course, comprehension of music skills, and student's motivation. The data collected from the questionnaire were entered and categorized using Microsoft Excel (2019, Microsoft 365) software. IBM SPSS Statistics (SPSS 08-1998) was used to analyze the data. Cronbach's alpha was computed using a data set of four items. The alpha coefficient for the items was 0.71 which suggests that the items have an acceptable internal consistency and, therefore, reliability.

Assignment

A music assignment was given during a regular face-to-face class session that required the use of music software in completing a task. The software chosen by the music teacher is called Sibelius; a music notation software that allows for composing, arranging, publishing, and teaching music writing and scoring. The study utilized the free trial version. The class was exposed to the music software over the duration of the course and were then administered a final assessment. One of the researchers explained the assignment in detail. The participants were required to compose eight bars of music in either 2/4-, 3/4-, or 4/4-time signatures. They were taught, over a 3-week period, how to compose bars of music in those time signatures, and they observed examples of composing in each of the time signatures using the software. For instance, the 4/4-time signature means four beats in each bar, which are note values used for writing music notation.

The assignment required participants to use the following seven note values in their eight bars of music:

- Semibreve or Whole Note = 4 beats

- Minim or Half Note = 2 beats

- Crochet or Quarter Note = 1 beat

- Quaver or Eighth Note = ½ beat

- Semiquaver or Sixteenth Note = ¼ beat

- Dotted Minim or Dotted Half Note = 3 beats

- Dotted Crochet or Dotted Quarter Note = 1½ beats

A timeframe of 2 weeks was given for completion of the assignment. The results from this assignment assisted in answering the research question related to how performance was impacted by the use of music software.
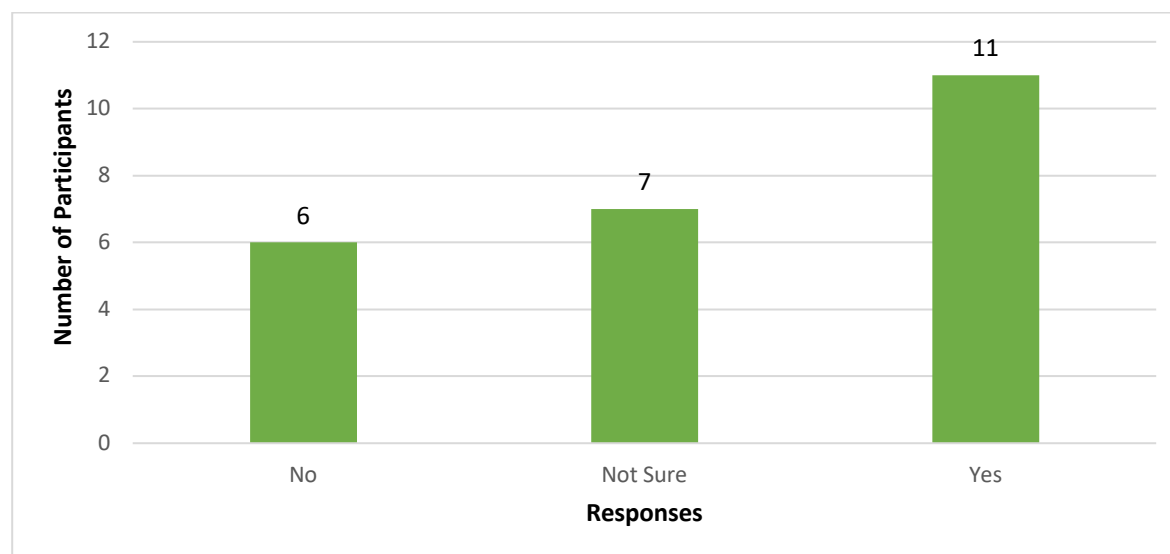
Results

Questionnaire

The participants were questioned about the overall rating of the general music education course. The majority gave the course a "very good" rating, 29% rated the course as "excellent," and 21% rated the course as "good." When questioned on the use of music software to create simple rhythmic bars, the majority of the participants' rating was "fair." Four participants rated the software as "excellent," three stated the music software was "very good," while four rated the software as "good." Only one participant rated the music software as "poor."

Participants were then asked if the use of the music software enhanced their understanding of the concept being taught. Six participants answered in the negative. However, the majority of participants (11) answered in the affirmative. Seven participants indicated they were "not sure" about the software enhancing their understanding of the concept being taught (Figure 1).

When questioned about the choice of a more traditional approach, the majority of participants stated that they preferred more traditional approaches to teaching music. Three of the participants were "not sure," while two stated they were unsure about how they felt. When participants were questioned about the instructor explaining the use of the software clearly, the majority found that the explanation by the instructor was "somewhat clear." Four participants stated that the explanation was "extremely clear" and eight participants indicated that it was "very clear." The least number of participants found that it was "not so clear."

Figure 1

Results of Survey Question on Whether Music Software Enhanced Conceptual Understanding

Note. $N = 24$.

Participants were subsequently questioned about their comfort level using the music software. Half indicated they were either very or somewhat comfortable using the music software (Table 1).

Table 1

Results of Survey Question on Participant's Comfort Level With Music Software

Extremely comfortable		Very comfortable		Somewhat comfortable		Not so comfortable		Not at all comfortable	
n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
4	17	8	33	6	25	4	17	2	8

Note. $N = 24$.

Regarding whether they were motivated to complete the assignment using the software, the majority of participants indicated the "neutral" option whilst there were negligible differences for the "yes" and "no" options. As illustrated in Figure 2, 67% of participants suggested the continued use of technology as part of the music program at the university. However, a significant minority indicated they preferred the traditional approach.

Students undertake a teaching practicum in public schools every year where they are given the opportunity to apply the techniques learnt in training in the field with children at their assigned schools. Half the participants stated they do not feel comfortable using the software in their practicum, while approximately 30% indicated they felt comfortable and 20% said they were not sure.

Figure 2

Results of Survey Question on Continuing to Use Technology in the Music Course
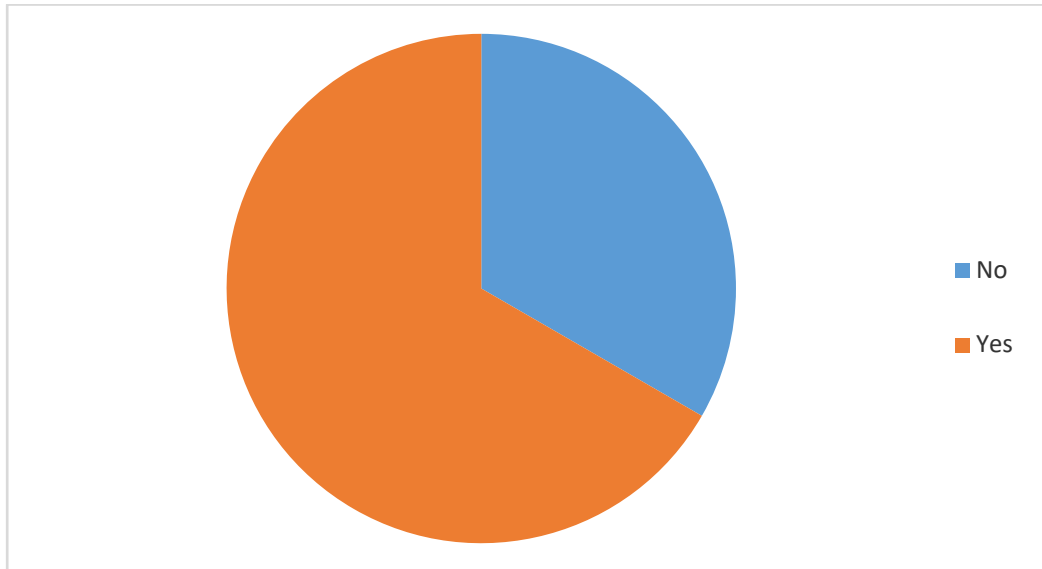
Note. N = 24.

The survey culminated with a question on whether participants felt they required training to use technology in music education. Seventy-five percent of the participants answered in the affirmative and 25% felt they did not require any further training. The results reveal some simple yet compelling data which aided in answering the research questions related to integration, comprehension of music skills, and motivation. These will be explored in the Analysis and Discussion section.

The Assignment

As previously stated, participants were instructed to use the software to compose eight bars of music using specific time signatures. They were taught, step by step, how to use the software, completing examples both individually and in a group setting. All participants understood by answering questions in detail and were given individual attention where necessary. Instructions were given once per week over a 3-week period as part of the general music education course.

Participants completed the eight bars of music in an assigned time signature: 2/4, 3/4, or 4/4. Four participants did not submit their assignment. Twelve participants completed the assignment in the 4/4-time signature, six participants completed it in the 3/4-time signature, and two participants completed the assignment in the 2/4-time signature. The majority of participants used the note values semibreve, minim, crochet, quaver, and semiquaver. A minority of participants used the dotted crochet and dotted minim notes. Most participants were successful using the software in placing the number of beats required in each bar according to the given time signature. However, some participants had minor challenges putting the correct notes in each bar. Overall, the assignment was completed to a 90% accuracy.

Analysis and Discussion

The results yielded persuasive data that assisted in answering the research questions.

Research Question 1: Can Music Software be Integrated in the General Education Program?

Based on results from both the questionnaire and the assignment, the music software can be integrated into the music program. The fact that all participants were able to use the software to complete the assignment to a 90% accuracy suggests success. Also indicative of this is the fact that most participants understood the directions on the use of the software and were able to apply those instructions to complete the assignment. As previously stated, this music software was readily available online and came at no additional cost to the instructor or the university. This augers well for its continued use. Additionally, introduction of the software required no additional training for the instructor and no additional teaching time outside of the allotted 3-hour weekly slot assigned to the course. Overall, the results suggest a high success rate, but one can infer that some persons may have responded better to a different type of music software. This paves the way, in the future, for the music department to explore various types of similar software that offer a variety of methodologies in order to reach a more diverse student population.

Research Question 2: Do Students Comprehend Music Concepts and Skills Using the Music Software?

The successful completion of the assignment suggests that participants did indeed comprehend the music concepts and skills through the use of the music software. Additionally, the majority of students indicated on the questionnaire that the use of the software did indeed enhance their understanding of the concepts and skills taught. They were able to use the music software independently to complete the assignment which otherwise would have had to been taught using traditional modes. This brings the learner to the forefront of the teaching/learning process and re-engineers the role and responsibility of the teacher. Nart (2016) theorized that this type of approach is needed for the 21st century learner, especially in music education, where teachers guide the learning process and no longer control the information.

Research Question 3: How Is Performance Impacted With the Use of Music Software?

In the questionnaire, the majority of participants stated that the use of the music software enhanced their understanding of the concept being taught. This is evidence that their performance was positively impacted. This impact is further evidenced by the fact that the majority of students were able to complete the assignment with the use of the music software to a 90% accuracy. The methodology used, where step-by-step explanation of the content was done, questions were answered in detail, and individual attention given where necessary, reflects very positively on the use of the music software. Based on these findings, music software definitely impacts the performance of participants in a general music education course. Supporting these findings in the literature are Waddell and Williamon (2019)

who focused their research on the use of technology, especially in the music education classroom, and the role it plays in increasing the students' knowledge and skill sets.

Research Question 4: Is the Use of Music Software Motivating for Music Education Students?

Even though the results from the questionnaire revealed the majority of participants were "neutral" with respect to the motivational aspect of the use of the software, the completion of the assignment and the success rate suggest differently. Moreover, the fact that the majority of participants indicated they were "somewhat comfortable" using the software emphasizes that the use of music software is motivating for music education students. The motivation levels may be linked to the comfort levels of participants and the need for more training as they may require more exposure to this tool. As they experience continued success, motivation levels will, no doubt, increase.

Gall (2013) addressed inhibiting factors for the use of technology in music education. The research identified the teacher's role as one of guiding the process which entails the discovery of strategies for increasing the comfort levels of teacher trainees and ultimately increasing motivation. Data analysis has resulted in some definitive statements with respect to the research questions and given rise to recommendations for the university.

Recommendations

Our results have generated four recommendations.

1. Continued use of music software

The use of music software for music education students is an appropriate, introductory, contemporary strategy that can be used at the university level. As a first step of implementation, it should only be used for selected music content in the general music education course. Gradually, across semesters, the use of technological tools can be further added to the instructors' arsenal for teaching more music content.

2. Continued training

The majority of participants indicated a desire for more training. A progressive training program could form part of the general music program. Training can be tiered and involve experts in the field facilitating training for lecturers and, on another level, for students.

3. Introduction of technology in the practicum

The university can consider introducing an assessment in their practicum program that encourages the use of technological strategies in music with children in schools. Each practicum has a rubric that supervisors use for grading their students. On the present rubric, there is no set criteria for the use of technological tools. The administration and coordinators can include such criteria that will measure a teacher trainee's competence with respect to the use of technology in achieving learning outcomes in lessons.

4. Introduction of final assessments in music education that include technology

At present, there are no assignments in music that assess a student's use of technology as part of their training. The music department at the university can collaborate and amend the course outlines to include learning outcomes and assessments that target criteria related to a student's knowledge of the use of technology in music as well as competence with respect to the use of technology in teaching.

Conclusion

The purpose of this study was to explore the use of technology as a contemporary strategy in the existing music program at a Caribbean university. The results revealed that music software is relatively easy to integrate and has the ability to impact positively on student outcomes in music education. The university has its own responsibility with respect to ongoing research, development, and training of its personnel and music course offerings. However, technology has the potential to significantly impact the standards of the program.

As previously mentioned, the COVID-19 pandemic has propelled educators toward this paradigm shift where technology has become an integral aspect of teaching and learning. The traditional modes of transmission that still exist across our educational institutions may need to be revisited and can be supported by the relevant use of technology especially in hands-on areas such as music education. It is with the philosophy that one small step makes a difference that this research can be used as a benchmark by which other institutions and music instructors can bolster the delivery of content in order to enhance existing methodology. It is also anticipated that this study can contribute to further research and development on other innovative uses of technology for both general music education students as well as the wider student population.
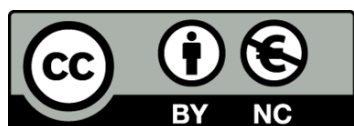
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