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Enhancing Music Industry Curriculum with Digital Technologies: A Case Study

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Abstract: Recent years have seen an increase in interest with regard to offering music industry undergraduate programs at institutes of higher learning. Such programs typically cover a mix of courses in both music and business areas. An emerging trend in the music industry is the rising application of digital technologies in all business aspects. This makes it necessary to enhance the curriculum with opportunities that familiarize students with various digital technologies and the possibilities they offer, so graduates are well-prepared for their future careers. This paper presents a case study conducted at the State University of New York—Fredonia. It revealed a need to enhance the school's Music Industry program, in terms of course content, with information and communication technologies. A proposal of novel courses to enhance music industry student acquisition of technology competencies resulted from the study. Additionally, opportunities for the possible enrichment of existing courses with material on digital technologies applications are provided. This work is aimed not only at music industry educators but also at instructors in other disciplines willing to make their students aware of the latest technological trends.

Keywords: music industry; digital technologies; undergraduate education

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1. Introduction

Music industry (sometimes referred to as music business) is a relatively new discipline offered by higher education institutions at baccalaureate level. Students majoring in this program come from different backgrounds, with a wide variety of intentions in terms of how they will employ their degree. For example, among these students will be found musicians, music producers, those seeking to run a venue, prospective artist managers, live sound engineers, event promoters, publicists, copywriters, journalists, booking agents, social media managers, and those seeking to own or work for a record label.

Music industry is a relatively rare program, offered to date by only a few higher education institutions. For example, at one of the largest university systems in the United States—the State University of New York (SUNY)—only two campuses of 64 offer it at the baccalaureate level—SUNY Fredonia and SUNY Oneonta.

In the digital era, educators face specific challenges. The job market requires graduates to possess contemporary technological skills to be applied in professional activities. Hence, the curriculum needs to be constantly updated to keep up with technological developments. One approach is to rely on studies of the trends in the programs and their findings about recommended competencies and courses. This analysis could be applied to popular disciplines like mathematics, life sciences, journalism, and others, which are offered at a large number of universities and for which many studies have been conducted (see, e.g., [1–3]). Sometimes, professional organizations develop detailed documents with curricular recommendations (cf. [4,5]). However, this is not the case with music industry, and we assumed a different approach. For this case study, a survey among the music

industry students at SUNY Fredonia was conducted. The study revealed that students perceived a need to acquire knowledge and skills in digital technologies.

This paper considers changes to music industry education in the digital era and evaluates the current level of technology use within the music industry curriculum as a result of a survey on student perception. Since analysis of the collected data revealed a need to enhance the curriculum with computing and information technology competences, we propose and discuss novel courses that would facilitate students' acquisition of digital knowledge and skills. We additionally provide comments on the possible enrichment of existing courses with material on digital technologies applications. The information in this study is aimed not only at music industry educators but also at instructors in other disciplines willing to make their students aware of the latest technological trends. Thus, this paper could be useful for faculty and administrators in music industry from different perspectives:

- From a curricular point of view, it provides information on topics to be included and applicable courses in which to embed the topics.
- From the standpoint of administration, it contributes ideas about the skills instructors should have, which could be used in job descriptions or interviews, as well as for providing professional development opportunities to current instructors.
- From an IT perspective, it describes the necessary software and hardware to be provided for this program.

The article is structured as follows: in the next section, changes to the music industry in the digital era are considered, followed by the current level of technology use included in a collegiate music industry curriculum. Then, the conducted study is described, the research questions and comments on the results are given, and the limitations of the analysis are clarified. Next, the types of digital technologies—marketing and publicity, music recording, composition and performance, data analytics, decision-making and machine learning, and event and facility management—and the courses in which they could be studied are explained. Finally, a conclusion follows with a discussion of plans for future work.

2. Theoretical Framework

2.1. Music Industry Changes in the Digital Era

The human brain is wired to enjoy the patterns of melodies and rhythms, so a musical beat is something individuals will always seek [6]. In the past, record labels would search the musical landscape to discover new talent. Now, it is more likely that an artist will be discovered by the public through music-sharing platforms such as YouTube, SoundCloud, or even from postings by friends on Facebook or Twitter [7]. In other words, through the use of digital technologies, the music industry is changing from a model dependent on record labels to a model brimming with entrepreneurial opportunities.

Digital streaming services, such as Spotify, Tidal, and Apple Music, are becoming the norm for music listening. As internet and cellular data speeds have increased, more and more people are buying subscriptions for music streaming instead of digitally or physically purchasing music [8]. Spotify now permits independent artists to directly upload music to its streaming service. Recent studies have shown that as the music streaming industry grows, resultant revenue is beginning to offset the displacement of download revenue and has also resulted in a decrease in music piracy [9]. Studies have also shown that unknown artists who release and promote their music independently benefit from the exposure provided by streaming, which reaches a wider audience than they would otherwise reach on their own, further allowing them to capitalize on live performance income [7].

As a result, musicians have the freedom to experiment with alternative and original marketing methods, such as free distribution of their music, while relying on alternate avenues to generate revenue such as merchandise and live performances [10]. The development of digital technologies has not only significantly changed the ways music is enjoyed; it has changed everything from the way music is produced to how musical events are organized, artists are promoted, and marketing and ticket sales are accomplished. It is

in this overall context that music industry students must be exposed to rapidly developing digital technologies.

2.2. Purpose of the Study

To investigate the needs of music industry students with regard to knowledge and skills in digital technologies, and to enhance the curriculum respectively, a survey was developed and administered. More specifically, the purpose of the study was to ascertain what proficiencies in digital technology students have received from the music industry curriculum, what competencies they perceive as important for the music industry and what experiences contributed to their level of perceived skills and knowledge. We hypothesize that a disconnect may exist between which skills/knowledge are perceived as important and the perceived competency in those skills/knowledge obtained from curriculum-based experiences.

The research questions to guide the study are:

(1) What particular courses have students experienced that are designated to provide digital skills/knowledge that may relate to the music industry?
(2) What are students' perceived levels of digital skills/knowledge with regard to common digital competencies in the music industry?
(3) What digital skills/knowledge do students perceive as being most important to the music industry?
(4) For those digital skills/knowledge in which students feel competent, where do they perceive the source of that competency?

2.3. Curriculum of the Music Industry Program at SUNY Fredonia

In the sequel, a short description of the state-of-the art of the Music Industry program at SUNY Fredonia is provided [11], which may largely be considered as a typical program in this discipline. The explanations below help understand the approach to the study as well as the discussion in Section 5 on the proposed curriculum enhancement with digital technology.

As with all the undergraduate programs at the university, the Music Industry program requires the completion of 120 credits; of these 120 credits, only 54 are allowed to be in the specific discipline—in this case, MUSB prefixed courses. The regular duration of study for the curriculum course is four years. The courses are grouped into three main categories (see Figure 1):

(1) General Education,
(2) Supporting courses and
(3) Specific major courses (core courses).

In addition, the students may take elective courses from other disciplines to fulfil the 120-credit requirement. They may also declare a minor, which requires taking 18 to 24 specific credits within the selected minor program. There may be an overlap between the categories. For example, one course could be a general education course and a supporting course at the same time. General education courses are required for all undergraduate students at the university regardless of major. They are grouped into nine categories—Oral Communication, Written Communication, Quantitative Reasoning, Foreign Language, Natural Science, Social Science, Arts, Humanities, and History. The students can choose from a variety of courses in each of these categories. No category related to technology exists, but two computer science courses that fall into the category of Quantitative Reasoning are available. One of these courses is an introduction to Excel (Microcomputer Software), which includes useful knowledge for music industry students, while the other course teaches students how to program in programming language and thus is inappropriate for our students.

GENERAL EDUCATION (30 credit hours)

Category	Category
Oral Communication	Foreign Language
Written Communication	Natural Science
Quantitative Reasoning	Social Science
Arts	History 1
Humanities	History 2

SUPPORTING COURSES IN THE MAJOR (27 credit hours)

Course	Course
COMM 102 Mass Media and Society	ACCT 201 Principles of Financial Accounting
CSIT 107 Web Programming I	ACCT 202 Principles of Managerial Accounting
CSIT 104 Intro. to Microcomputer Software OR CSIT 151 Intro. to Information Systems	ECON 205 Principles of Microeconomics
	ECON 210 Principles of Macroeconomics
ECON 200 Fundamentals of Statistics OR BUAD 200 Fundamentals of Statistics	ENGL 100 English Composition

SPECIFIC MAJOR COURSE REQUIREMENTS (57 credits)

Course	Course
MUS 101 Beginning Music Theory I	MUSB 435 Contemporary Issues in Music and the Marketplace
MUS 104 Applied Music	
MUS 021-048 Special Ensemble	MUSB 465 Music Industry Internship
MUS 115 Music Appreciation	MUSB 470 Concert Touring & Sound
MUSB 100 Pathway to Success	MUS 233 Music of the World
MUSB 101 MI Career Foundations	MUSB 351 Digital Marketing for Music Industry
MUSB 201 The Business of Music	MUSB 425 Music Marketing & Promotion
MUSB 230 History of the MI	MUSB 320 Music Contracts
MUSB 301 Music Copyrights	One MUSB elective
MUSB 304 Business of the Beatles	One MUS elective
MUSB 420 Student Record Label	Other electives to 120 credits

Figure 1. Structure of Music Industry program at SUNY Fredonia.

The supporting courses are from other disciplines, which are mandatory for our students. In evaluating the prospective technology courses offered by other departments, two courses were identified that might be beneficial for our students. One course is the above-mentioned course on Microcomputer Software. (This course could be replaced by a course on information systems if the student transfers from another discipline or another school and has already taken this course). Another course that we require is a course on web programming. Unfortunately, this course is offered to computer science students and covers HTML, CSS, and Java Script. Rather than offering this course as it is currently designed, it could be more appropriate to offer a course that would teach students the principles of web design, human-computer interface, search engine optimization and other related topics.

Thus, no technology-related courses specifically adapted for music industry majors historically existed until recently. In 2018, recognizing student needs, a new core course—Digital Marketing for Music Industry—was introduced, which is geared specifically towards the needs of our students. It covers practical work on topics from web design to social, mobile and email marketing; to search engine optimization; to video recording and image processing. After its success in the Spring and Fall semesters of 2019, it was decided to conduct a thorough systematic study and identify technology-related competencies that our students should possess. At first glance, it may seem that, ideally, a new course should be offered for each competence. However, in practice, this is impossible for various reasons:

(1) The undergraduate degree is limited to 120 credits so students can finish their studies in four years. This restriction limits the number of additional courses they may take.

(2) Only 54 credits can be taken within the discipline, posing another limitation.
(3) Offering several new courses would require hiring a number of new instructors, which is problematic for an institution of higher education and will be even more so in the near future due to the financial crisis.

Hence, as it is impractical to launch a large number of new courses, a hybrid approach is proposed, developing a couple of new courses and enhancing some of the existing courses in such a manner that all identified competences are covered. The process by which these perceived competencies are identified and prioritized follows.

3. Methods

3.1. Survey

For the study, an online survey was constructed that captured student perceptions regarding digital technology competencies within music industry. (The survey and the method of delivery and analysis were approved by the Human Subjects Research Committee of the State University of New York at Fredonia). It was administered electronically in an anonymous, voluntary, and confidential way. It consisted of six inquiries. The first inquiry was to ascertain the student level with regard to collegiate standing, such as freshman, sophomore, junior or senior. The other inquiries sought to understand student perceptions related to gaining of digital skills/knowledge.

Thus, the second inquiry allowed respondents to select the courses they had experienced that were designated by the university as providing digital technology competencies. These courses are offered to students in all disciplines and are general in nature. In the survey, the students were presented with a list of all possible courses where technology was central to the curriculum and could then select all that applied.

The third query allowed the respondents to evaluate their knowledge with regard to a list of common digital music industry competencies, such as video recording/editing, website creation, etc. Related to this third query was the opportunity for the student participants to expand on their answers by providing insight into where they perceived they gained the skills/knowledge in the areas they felt themselves to be proficient or expert.

The fifth query used the same list of common digital music industry competencies as the second query but allowed students to provide judgment in terms of assessing the importance of each competency.

Related to this fifth query, the sixth query asked the students to identify what they perceived to be the top five from the list of common digital music industry competencies.

3.2. Data Collection

The survey was administered at a mid-size liberal arts college to students majoring in music industry in spring 2020. The survey was administered by the instructor of the courses via a link emailed through the course management system. The students were provided with informed consent. They were advised the goal of the study; its voluntary, anonymous, and confidential nature; and the ability to quit the survey at any time.

3.3. Participants

The participants were music industry majors enrolled in two music industry courses. The total population of these two courses was 50 students. Thirty-six (n = 36) students participated. Approximately 36% of the responding students were seniors (36.1%), 30.6% were juniors, 19.4% were sophomores, and 13.9% were freshman.

The participants were traditional students. As a result, the age range was 19–22 years.

3.4. Data Analysis

The collected data were qualitative in nature, specifically categorical and ordinal. The results described in the next section were obtained by means of Excel and Minitab.

4. Results

The results of the research questions described in Section 2.2 can be found below.

4.1. What Particular Courses Have Students Experienced That Are Designated as Providing Digital Skills/Knowledge That May Relate to the Music Industry?

The students were presented with a slate of digital and technology-centric courses prescribed by the music industry curriculum. This included courses in web programming, Excel and Access, Podcast, Video Recording, and Digital Recording. The students were asked to select the courses taken thus far in their academic work. The results by academic status cohort (year at college) with respect to the number of courses taken are illustrated in Figure 2.

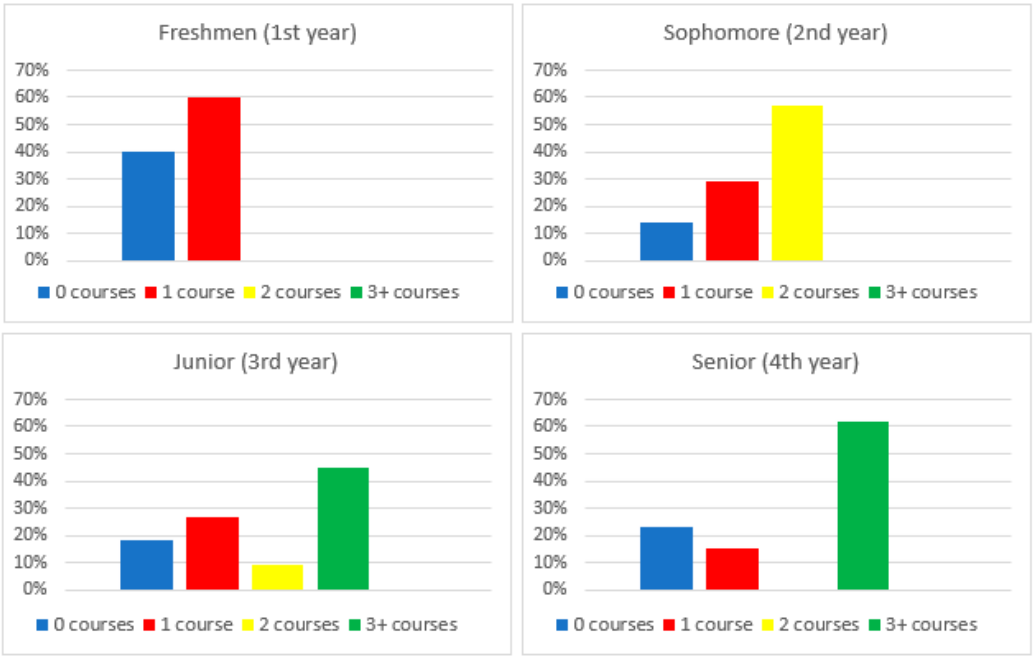

Figure 2. Number of courses on digital technology students have taken by academic year of their studies. The height corresponds to the percentage of students in their particular cohort (freshman, sophomore, junior, senior) that have taken zero, one, two, or three or more courses, respectively.

It is not surprising that over the years students take more technology-related courses. However, in each cohort some students indicate that they did not take any designated technology-related courses. Although this finding is not surprising for freshmen and sophomores who are still in the early stages of the curriculum, 21% of the juniors and seniors indicated a lack of such coursework. This finding may suggest that these courses made a limited impression on the students with regard to application to the music industry.

4.2. What Are Students' Perceived Levels of Digital Skills/Knowledge with Regard to Common Digital Competencies in the Music Industry? What Digital Skills/Knowledge Do Students Perceive as Being Most Important to Music Industry?

In this subsection, responses to research questions (2) and (3) are given. The students were asked to evaluate their perceived level of digital skills/knowledge with regard to common digital competencies in the music industry as well as their perceived importance of those skills/knowledge. These competencies are shown in Table 1.

Table 1. Common digital competencies in music industry, about which the students were polled.

Common Digital Competencies in Music Industry
website development
podcast or blog development
search engine optimization
systems for identifying hash tags
audio editing
video editing
graphical editing
sales management systems
data analytics for music recommendation
event and facility management systems

Levels were presented in terms of textual ordinal statements, which were later converted to numeric levels for ease of analysis. The correspondence between the textual statements and numerical values for skills/knowledge is shown in Table 2.

Table 2. Correspondence between the textual statements and numerical values for skills/knowledge.

Textual Statement	Numerical Value
no knowledge	1
little knowledge at conceptual level	2
good knowledge; worked with software extensively	3
expert; I can teach others	4

The correspondence between the textual statements for perceived importance and their numerical values is defined in Table 3.

Table 3. Correspondence between the textual statements and numerical values for perceived importance.

Textual Statement	Numerical Value
not important	1
somewhat important	2
important	3
very important	4

Note: Students were also able to indicate "I don't know" regarding this inquiry. In that event, those results were disregarded for analysis.

The recoded numerical values were analyzed for modes for each of the digital competencies, resulting in a mode pair for each aspect: perceived skills/knowledge and perceived importance. A matrix was constructed to identify the relationship between them. Each digital competency was mapped into the matrix, utilizing the mode pair. The matrix is color-coded to illustrate "gap" areas that may exist between the curriculum and its perceived importance.

For example, if a competency is perceived as important or very important, the curriculum is covering that competency well since students indicate they perceive themselves as having good or expert knowledge; these cells are color-coded as green. If the competency is perceived as important or very important but the students perceive themselves as lacking in skills/knowledge, then these cells are colored in red, signaling a high priority. If a competency is perceived as somewhat important, those cells are highlighted in yellow, as these areas require attention but are not of highest priority. If a competency is perceived as not important, the cells are shaded. The respondents' results are shown in the matrix in Figure 3.

Perceived Knowledge and Skills / Perceived Importance	No knowledge (1)	Little knowledge (2)	Good knowledge (3)	Expert knowledge (4)
Very Important (4)	Video Editing Sales Management	Audio Editing Event and Facility Management		
Important (3)	Hashtag Management Graphical Editing	Data Analytics		
Somewhat important (2)		Website Development Podcast/Blog Development Search Engine Optimization		
Not important (1)				

Figure 3. Perceived skills/knowledge and perceived importance matrix.

From this matrix, it appears that curriculum enhancement can be carried out to support the movement of seven competencies from the red area to the green area:

- Video editing;
- Audio editing;
- Graphical editing;
- Sales management;
- Hashtag management;
- Event and facility management systems;
- Data analytics for music recommendations.

Additional studies included two ANOVA analyses utilizing established modalities for each competency in terms of the academic standing of cohorts within each area: perceived skills/knowledge and importance. With respect to skills and knowledge, no statistically significant difference was found between the cohorts. However, in terms of perceived importance, seniors differentiated from the other cohorts in that they perceived digital skills to generally be somewhat important, while the remaining three cohorts determined them to be of greater importance. Thus, it is feasible that the competencies highlighted in yellow in Figure 3 could be better placed in the red zone, as removal of the senior cohort from the sample raises their importance.

Lastly, analysis of the perceived top five competencies was performed. The identified ones were:

(1) Website development;
(2) Event and facility management systems;

(3) Video editing;
(4) Audio editing;
(5) Sales management systems.

4.3. For the Digital Skills/Knowledge in Which Students Feel Competent, Where Did They Perceive the Source of that Competency?

As Table 4 shows, most of the respondents indicated that they have little or no knowledge in digital technology applications. None of them reported good or expert knowledge in all the fields.

Table 4. Percentage of students that feel that they have little or no knowledge in the respective area.

Common Technological Competencies in Music Industry	Percentage of the Students with Little or No Knowledge
website development	67%
podcast or blog development	61%
search engine optimization	75%
systems for identifying hash tags	81%
audio editing	64%
video editing	72%
graphical editing	67%
sales management systems	83%
data analytics for music recommendation	89%
event and facility management systems	83%

When students felt competent in a field, we were interested to learn where they perceived the source of their competency. The respondents offered a variety of sources; however, a key theme appeared within the data. About 52% indicated they became competent in various areas on their own, while approximately 30% indicated computer technology courses and approximately 18% indicated other coursework. It should be noted that all music industry majors take an internship, and this may be the source of acquiring technical skills. Some students take a minor in another discipline and this might be the source of computer technology courses or other coursework.

4.4. Concluding Notes about the Research Hypothesis

It was hypothesized that in the Music Industry program, a disconnect may exist between what technological skills/knowledge are perceived as important in the professional arena and the perceived competency in those skills/knowledge from curriculum-based experiences. Data analysis, with regard to the research questions, supports this hypothesis.

The analysis suggests there is a need to further embed digital competencies within the curriculum to support students' skillsets and knowledge, as evidenced by the importance and skills/knowledge matrix (Figure 3). Additionally, a large percentage of students who perceive themselves to be competent within certain areas indicate that the competency came from experiences other than those found in the curriculum.

4.5. Limitations of the Method

The study has some limitations. In terms of design, the digital competencies in music industry were identified for the respondents. It is possible that proficiency in other digital applications could be suggested by professionals. As a result, focus groups with working professionals to establish the most valued digital competencies would assist in providing a more robust offering for survey analysis. Nonetheless, as most of our instructors are also working music industry professionals, it is believed that the main areas are addressed.

A second limitation is the breadth of the study. It was administered at only one university; a larger sample size could be obtained if the survey were administered at several institutions. In this way, the study could benefit from expanding the set of respondents and representing a broader demographic, which in turn would lead to a better

understanding of demographic differences. As a precursor to a more extensive study, the curriculum in many similar programs was carefully investigated, and no indications of wide coverage of technological competencies were identified. Hence, the results obtained appear representative.

Finally, the pace of technological development and the respective changes in all aspects of life are growing faster and faster. These changes must be contemporaneously met; thus, it is critical to continuously survey the students and professionals in the field to stay abreast of new digital competencies, which the students have to acquire.

5. Proposed Curricular Enhancement

In this section, new courses or the enriching of existing courses with elements that will fill the gaps in the technological preparation of music industry students are proposed. The competencies in Table 1 are split into four broader areas: Marketing and Publicity; Music Recording, Composition and Performance; Data Analytics, Decision Making and Machine Learning; and Event and Facility Management. Finally, a music industry curriculum in the framework of other related disciplines and interdisciplinary projects is considered.

5.1. Marketing and Publicity

Marketing and publicity are very important parts of the music industry. These activities are executed mostly through digital technologies. Thus, students have to be acquainted with tools and methods for digital marketing, advertisement and promotion. More specifically, the following elements should be included in the curriculum.

5.1.1. Developing of Web Sites, Blogs, Podcasts, and Vlogs

Here, the emphasis in coursework should be on the ability to express oneself effectively in the digital world. Hence, instead of focusing on the technical aspects covered on courses in the computer science field, the core themes should be human–computer interaction, the aesthetic of the websites and vlogs, and the way the content is presented in blogs and podcasts. It is appropriate to cover the principles of human–computer interaction. At the center of the course must be business models that will bring revenue, content development, design, artistry, and creative ideas for original and engaging visuals using psychological approaches. Students should also learn how to choose appropriate keywords using Google Keyword Planner (ads.google.com/home/tools/keyword-planner) or trending hashtags using the tools Twitonomy (twitonomy.com) or Hashtagify.me (hashtagify.me), as well as optimizing their websites for the search engines, creating organic content, and others.

Students must also learn how to shoot and edit a quality video and how to record music. There are many systems for video editing that could be used. First, video sharing platforms such as YouTube usually have some simple video editors. Platforms may also provide free content, such as background music. For more advanced video-editing, some free software such as the currently available Blender (blender.org) or DaVinci Resolve (www.blackmagicdesign.com/products/davinciresolve) could be recommended. Both run on the major desktop operating systems Windows, Mac, and Linux. They allow for creation of animation, visual effects, audio mixing, syncing, and video editing.

5.1.2. Managing Marketing Campaigns and Enhancing Social Media Marketing

From traditional marketing campaigns, to e-mail marketing, to social media marketing, students must learn how to design brochures, edit pictures, and appropriately utilize color combinations and fonts. The free alternative to the popular software Photoshop (www.adobe.com/Photoshop), GIMP (the GNU Image Manipulation Program, www.gimp.org), has similar functions and a similar interface to Photoshop and runs on all major operating systems. However, it is open source and constantly enhanced by the community, making it a good recommendation for this purpose.

5.1.3. Preparing Sales Management Dashboards

Music industry undergraduate programs usually include one or two mandatory courses in accounting. These courses, however, are general, and while some software use—such as MS Excel—is encouraged, more specialized tools for music industry are rarely provided. On the other hand, the music industry discipline deals with sales, and sales dashboards are essential for monitoring and reporting. While Excel allows the use of dashboards, this topic is not usually covered in Excel university courses. Thus, after taking a general course in accounting and a general course in MS Excel and Access, students should also be acquainted with sales dashboards to enhance their ability to choose between various metrics, connect with the data source, and visualize data in real time.

5.1.4. Curricular Recommendations

It is difficult for music industry faculty to offer all technology-related courses. Some of the courses that music industry students take may be general courses on Excel, Web Programming, or Accounting, as offered by Computer Science, Communication, or Business faculty during the freshman and sophomore years. After those courses, the above-mentioned specialized technology-enhanced topics should be covered by music industry faculty through courses such as Digital Marketing for Music Industry, Promotions for Music Industry, Concert Sales, Music Industry Podcasting, and Music Industry Video Production, with instructors who should have specialized knowledge bridging technology and music industry concerns.

5.2. Music Recording, Composition and Performance

Music professionals employ several software systems for music synthesis, sampling and mixing. Some of them have graphic interfaces for simplified music editing. Others display virtual instruments on which one can play music using a keyboard. A third very advanced group is used for the automatic composition of music and even for professional concerts with animated characters singing music. Some systems that could be used are listed and briefly described below.

Audacity (www.audacityteam.org) is the most popular system for audio editing. It comes with a set of built-in functions and is easy to use. The system is free-of-charge and runs on all major operating systems, which makes it appropriate for classroom use. Although it may not have the capacity for professional audio production, it is appropriate for students.

The system AudioSauna (www.audiosauna.com) is a virtual music studio with a built-in synthesizer, which does not need to be installed on the user's computer, as it runs in the browser. It conveniently provides a graphical user interface, and its use is very intuitive. The company AIVA Technologies (www.aiva.ai) goes a step further, providing software that automatically composes music using methods of artificial intelligence. Compositions could be from a selected genre or could be "influenced" by an existing score in the sense that it would have a similar emotional impact.

Finally, Vocaloid (www.vocaloid.com/en) is a professional voice synthesizer software system with a number of attached packages, some of which are for creating singing characters. It is very popular in Japan and is used for commercial concerts. While probably not appropriate for the classroom, a demonstration of the product should be undertaken so that the students have ideas about the directions of technology used in music industry.

Curricular Recommendations

Ideally a dedicated course on Technology in Music Composition would be offered; however, the challenge is that the scope is very specific and lies between music and technology. It would be difficult to secure instructors proficient in all types of software systems. Moreover, computer technology currently develops at such a fast pace that the instructor would have to constantly update the material.

Hence, a course which deals more generally with trends in the music industry while covering technology in part has to be planned. An upper-level seminar course entitled Contemporary Issues in Music and the Marketplace was developed at Fredonia. Within its framework, technological trends and the related legal and ethical issues are considered. Another possible avenue for getting students exposed to the technology systems in composition is a course on Live Sound, where they may have projects requiring the use of software systems.

5.3. Data Analytics, Decision Making and Machine Learning

With the development of information and communication technologies, it became feasible to gather large volumes of data in every field. When applying various methods for analysis of these data, it is possible to extract meaningful insights and spot trends, and thus make predictions about future behavior and facilitate decision making [12]. In the music industry, data analysis helps with finding new rising stars, predicting the streaming preferences of each individual consumer, optimizing the profit of ticket sales, and minimizing expenses.

Several software tools exist to help with data analysis for professionals, but most of them require programming and knowledge of statistics so are not appropriate for music industry students. Hence, general data analysis software intended for users who have no technical background is recommended. The system Knime (knime.org) is a free, open source platform for data analytics, reporting and visualization. It provides an intuitive graphical interface through which the user indicates the operations that have to be performed on the data, selecting from a menu and placing nodes on the screen; the nodes correspond to data processing functions. Knime provides very powerful software, allowing the methods of machine learning and data mining to be employed.

Curricular Recommendations

A course on Statistical Methods for Music Industry, which would cover practical problems for music industry with the use of some of the above software, would be ideal. Again, the challenge is that the instructor must be proficient in both the music industry and statistics, and it is difficult to find faculty fitting such a profile. It is feasible, however, to offer courses to all business majors that emphasize material on the practical side rather than the theoretical side, as statistics courses are traditionally taught to students in the sciences.

In a similar way, it would be appropriate to offer a course on Software Tools tailored to the needs of business students in such a way that they learn how to represent data and the methods they can use to analyze them. At the upper-level, courses on Digital Marketing, Contemporary Issues, and Touring may have seminars on some of the topics of data analysis or projects requiring the application of some of the systems described above.

5.4. Event and Facility Management

Event and facility management require not only the human-related managerial skills, such as excellent communication, decision-making, problem-solving, delegation, and time management, but also first-rate technical skills [13]. Hence, it is critical to prepare students for these kinds of activities. Different software systems that facilitate scheduling and management of concerts, festivals, concert halls, and sales, including tracking revenue and expenses, could be used in this process. A typical system possesses some or all of the following features:

- Performance planning;
- Artist management;
- Ticket sales;
- Contract management;
- Credential management;
- Staff scheduling;

- Transportation management;
- Vendor management;
- Volunteer management;
- Customer relationship management;
- Mass e-mailing;
- Program, artist and concert hall schedules development, and others.

Eventbrite (www.eventbrite.com) is the most popular ticketing platform. As a website that gets millions of hits, it also promotes events and allows users to search for them. To some extent, music industry students are aware how to work with it, at least as customers. It also has a free version, where the events posted are free. Hence, it could be used for classroom experience.

Curricular Recommendations

Unlike the other technical competencies and computer systems that were discussed previously, it is not necessary to have a separate course that teaches this kind of skill. Software often changes, and the best approach is to have some practical experience with event and facility management, as well as to learn what features the systems offer and how to use them.

An idea about how to work with such systems could be to include experience in courses like Concert Touring and Student Record Label. As these scheduling systems are designed to handle larger events, it would be appropriate to use them in a group project for the organization of a real-life music industry event.

5.5. Music Industry, Technology, and Other Disciplines

As discussed above, music industry emerged as an interdisciplinary field involving educators with various backgrounds. On the other hand, the multiplicity of music-industry-related topics discussed in the previous sections—the technological aspects in particular—could inspire students from other disciplines to become interested in music industry. In fact, projects bringing together students with different backgrounds allow for the formation of multidisciplinary teams for collaborative work [14,15], encouraging students to view their existing knowledge from a different perspective and easily connect new information with the background they already have [16].

Possible avenues are listed below:

- Students in computer science could be asked to develop software for playing music. This way, they would learn about music theory, notation and composition, and the software could be used by music industry students for various applications.
- Students in music could be involved in the organization of musical events and use the respective technology for planning and promotion.
- Students in accounting could research the tax reliefs startup music companies could use and provide respective spreadsheets.
- Students in communications could use publishing or web development software to create promotional materials for music events.

The authors have extensive experience in interdisciplinary projects involving technology and music industry, which could be used in more specific applications. For example, in one previous work [17], the employment of music therapy for controlled transition between different emotional states was studied. This requires efforts and expertise in music therapy, music industry, psychology, and artificial intelligence and is an excellent example of an interdisciplinary project.

Music industry nowadays goes well beyond the physical world surrounding us. The intangible worlds created by virtual reality applications, for example, have spatial sound capabilities and support advanced music integration—indispensable features in education and training. With respect to virtual reality, the authors have experimented with virtual tours incorporating spatial sound and music and providing immersive experiences through stereo viewing of 360-degree panoramas [18]. Such experiences could be further augmented

by employing various tangible interface components. In one case, the authors have used an input component implemented as a physical cylinder with a printed panoramic view of the explored scene. A CLUSPI-based point-and-click interface [19] was employed for direct input of the yaw and pitch angles of the stereo's panoramic view and for controlling a motion chair linked to the system. Users were thus provided with a highly immersive experience both for visual and spatial audio.

Children are nowadays raised with sound- and music-enabled toys and educational games provided by the music industry. In earlier works, the authors have studied the different aspects of spatial sound generation for mobile devices and toys [19]. Spatial sound and music support is also important for tabletop computers. As these devices employ large horizontally placed presentation surfaces with touch capabilities, they require proper positioning of virtual sound sources, including music sources, as needed on the screen. The authors have conducted extensive research in this field attempting to determine the limits of human perception with respect to virtual and real physical sound sources [20–22]. Another aspect of audio feedback is how it interacts with our other sensory channels. The authors have conducted some research and experiments in this area [23], examining the effects of sound and music on haptic fidelity perception.

It is believed, therefore, that similar projects involving music-industry-related technologies could be integrated in the curriculum of various disciplines and spark interest among students.

6. Conclusions

Initially, digital technologies were viewed as an adversary of the music industry, and there were many disputes over copyright and illegal downloads. In the last few years, however, this trend changed, and now streaming services are widely used by professional musicians to spread their music. Hence, digital technologies play an important role in music industry professional preparation, and students must stay up to date with them.

The research hypothesis was that the students in music industry do not acquire all the necessary technological competencies during their studies. A survey was conducted, which supported this hypothesis while answering a number of research questions regarding the perceived preparation of the students and the knowledge and skills they have to develop.

There is no single system universally integrating all the elements that are necessary for a music industry professional. Therefore, it is recommended that software addressing specific needs is introduced into the appropriate course. This introduction will provide the curriculum-specific instruction and real-life experience that will best prepare music industry graduates for the myriad of possible professions.

The paper could be of interest to music industry educators, as well as to other instructors who might be interested in interdisciplinary projects. It could also be useful for university administrators and IT personnel for planning purposes.

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