

The Predicament and Solution of Digital Music: A Comparative Study between Audio and Visual Contents

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Abstract

Multimedia covers both audio and visual contents; however, the teaching and research of the two contents are not balanced in practice. This paper attempts to evaluate the problem by the case study in Taiwan. It employs an empirical/cultural approach to conduct a comparative evaluation between Digital Music and Digital Imaging. It examines the predicament of Digital Music in higher education system in Taiwan, the interdisciplinary nature of Digital Music, the applications of MIDI technology, the human factors in curriculum designs and also proposes solution for future development.

Keywords: *Digital Music Content, Comparative Study, Human Factors in Curriculum Design, Midi Technology, International Case Study*

1. Introduction

This case study attempts to trace the development of Digital Music in higher education system in Taiwan from the 1980s' and its experiences may reveal worldwide similarities of this digital content-form.

The specific objectives of this paper are:

1. To identify the Digital Music environment by comparison with Digital Imaging
2. To explain the problems in Digital Music and suggest solutions by a point view of international practices.
3. To examine key issues that affect developments in Digital Music in the future

2. Profiling: data analysis and comparison

Multimedia covers both audio and visual contents so that humans can enjoy the media arts with their ears as well as their eyes. Theoretically, the engagement of technology in digital music and Digital Imaging should be balanced and the developments of education in these two fields are expected to be equivalent. However, this is certainly not the case in the real world.

The following analysis attempts to explore a comparison between digital music and Digital Imaging. The author will reveal the higher educational environment by examining universities/ colleges that provide relevant courses, the status of available courses, and the structure of the faculty. The data are from the last five years' records, 2004-2008 [[9]]. The statistics will depict recent and lasting profiles in Taiwan. During the last five years, there were only 4 to 7 universities/ colleges providing courses in Digital Music in Taiwan while there were 60 to 70 universities/ colleges providing courses in Digital Imaging. On average, there were just 9.1% of the higher educational institutes supporting development in Digital Music. (See Table 1).

Table 1. Numbers and percentages of universities/ colleges that provide relevant courses

	2004	2005	2006	2007	2008	Total
Digital Music	4	6	6	7	7	30
	13.3%	20.0%	20.0%	23.3%	23.3%	100.0%
	6.6%	10.0%	9.0%	9.7%	10.0%	9.1%
	1.2%	1.8%	1.8%	2.1%	2.1%	9.1%
Digital Imaging	57	54	61	65	63	300
	19.0%	18.0%	20.3%	21.7%	21.0%	100.0%
	93.4%	90.0%	91.0%	90.3%	90.0%	90.9%
	17.3%	16.4%	18.5%	19.7%	19.1%	90.9%
Total	61	60	67	72	70	330
	18.5%	18.2%	20.3%	21.8%	21.2%	100.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	18.5%	18.2%	20.3%	21.8%	21.2%	100.0%

Furthermore, each university/ college may support more than one department to provide more than one course. There were 4 to 17 courses in Digital Music each year. In the mean time, there were 2,010 to 3,332 courses involved in Digital Imaging every year. Digital Music represented less than 0.5% of the stack of the educational resources provided for these two closely-related fields. The fact is that the gap between educational emphases on the two fields is enormously huge. (See Table 2)

Table 2. Numbers and percentages of available courses

	2004	2005	2006	2007	2008	Total
Digital Music	4	11	11	16	17	59
	6.8%	18.6%	18.6%	27.1%	28.8%	100.0%
	.2%	.5%	.4%	.5%	.7%	.5%
	.0%	.1%	.1%	.1%	.1%	.5%
Digital Imaging	2010	2403	2716	3332	2524	12985
	15.5%	18.5%	20.9%	25.7%	19.4%	100.0%
	99.8%	99.5%	99.6%	99.5%	99.3%	99.5%
	15.4%	18.4%	20.8%	25.5%	19.3%	99.5%
Total	2014	2414	2727	3348	2541	13044
	15.4%	18.5%	20.9%	25.7%	19.5%	100.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	15.4%	18.5%	20.9%	25.7%	19.5%	100.0%

Faculty structure is also a good measure for reflecting the relative strength of the curriculum development in Digital Music and Digital Imaging. In Taiwan, there are two other categories of faculty besides professor, associate professor and assistant professor. One is lecturer who has obtained a Master degree but not a Ph.D. degree. The other is technician who does not have a graduate degree, but has had relevant experience in practice of his/her specific field.

In Digital Music, there was no professor until 2008. There were only 6 faculty who were ranked above assistant professor from 2004-2008. More than half (55.9%) of the faculty were lecturers. Technicians taught 22% of the courses in Digital Music.

The numbers indicates the scarcity of qualified teaching resources in Digital Music. (See Table 3)

Table 3. Faculty structure of Digital Music

	2004	2005	2006	2007	2008	Total
Professor	0	0	0	0	2	2
	.0%	.0%	.0%	.0%	100.0%	100.0%
	.0%	.0%	.0%	.0%	11.8%	3.4%
	.0%	.0%	.0%	.0%	3.4%	3.4%

Assoc. Prof.	1	1	1	0	2	5
	20.0%	20.0%	20.0%	.0%	40.0%	100.0%
	25.0%	9.1%	9.1%	.0%	11.8%	8.5%
Assis. Prof.	1.7%	1.7%	1.7%	.0%	3.4%	8.5%
	0	1	1	2	2	6
	.0%	16.7%	16.7%	33.3%	33.3%	100.0%
Lecturer	.0%	9.1%	9.1%	12.5%	11.8%	10.2%
	.0%	1.7%	1.7%	3.4%	3.4%	10.2%
	2	5	5	12	9	33
Technician	6.1%	15.2%	15.2%	36.4%	27.3%	100.0%
	50.0%	45.5%	45.5%	75.0%	52.9%	55.9%
	3.4%	8.5%	8.5%	20.3%	15.3%	55.9%
Total	1	4	4	2	2	13
	7.7%	30.8%	30.8%	15.4%	15.4%	100.0%
	25.0%	36.4%	36.4%	12.5%	11.8%	22.0%
Total	1.7%	6.8%	6.8%	3.4%	3.4%	22.0%
	4	11	11	16	17	59
	6.8%	18.6%	18.6%	27.1%	28.8%	100.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	6.8%	18.6%	18.6%	27.1%	28.8%	100.0%

Conversely, there were almost 3 fourth (72.2%) of faculty were ranked above assistant professor in Digital Imaging. The percentage of professors was 16.1%, that for associate professors was 29.1% and assistant professors made up 27.0%. Lecturers stood at 26.4%, and technicians were at a mere 1.3%. (See Table 4)

Table 4. Faculty structure of Digital Imaging

	2004	2005	2006	2007	2008	Total
Professor	336	350	400	553	454	2093
	16.1%	16.7%	19.1%	26.4%	21.7%	100.0%
	16.7%	14.6%	14.7%	16.6%	18.0%	16.1%
Assoc. Prof.	2.6%	2.7%	3.1%	4.3%	3.5%	16.1%
	658	757	749	929	689	3782
	17.4%	20.0%	19.8%	24.6%	18.2%	100.0%
Assis. Prof.	32.7%	31.5%	27.6%	27.9%	27.3%	29.1%
	5.1%	5.8%	5.8%	7.2%	5.3%	29.1%
	482	613	764	940	710	3509
Lecturer	13.7%	17.5%	21.8%	26.8%	20.2%	100.0%
	24.0%	25.5%	28.1%	28.2%	28.1%	27.0%
	3.7%	4.7%	5.9%	7.2%	5.5%	27.0%
Technician	511	651	773	872	627	3434
	14.9%	19.0%	22.5%	25.4%	18.3%	100.0%
	25.4%	27.1%	28.5%	26.2%	24.8%	26.4%
Total	3.9%	5.0%	6.0%	6.7%	4.8%	26.4%
	23	32	30	38	44	167
	13.8%	19.2%	18.0%	22.8%	26.3%	100.0%
Total	1.1%	1.3%	1.1%	1.1%	1.7%	1.3%
	.2%	.2%	.2%	.3%	.3%	1.3%
	2010	2403	2716	3332	2524	12985
Total	15.5%	18.5%	20.9%	25.7%	19.4%	100.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	15.5%	18.5%	20.9%	25.7%	19.4%	100.0%

All the figures suggest that Digital Music is not moving on the same track as Digital Imaging. The development of multimedia technology is significantly biased. Nevertheless, it may not be a situation limited to Taiwan; but possibly a worldwide phenomenon.

Analyzing the case in Taiwan may explain the reasons behind the difficulties facing the teaching of Digital Music and also may initiate some enlightenment for future improvement. Thus, let us take a quick glance at the brief history of Digital Music development in higher education system in Taiwan.

3. Brief history: case study and discussion

In 1987, former President Da-Nian Ruan of the National Chiao Tung University initiated a plan to establish an interdisciplinary College of Engineering and Arts in Taiwan. This author was invited by President Ruan to draft a plan for the program in “Computers and Communications”. At that time, “Multimedia” was not a popular term yet. The proposed program covered Desktop Publish (DTP), Image Processing and Music Instrument Digital Interface (MIDI). This might well be the first time that Digital Music became a credited course subject at the college level in Taiwan. However, because of the limitations of the personal computing environment at that time, only the DTP was launched while the other courses were postponed. After the retirement of President Ruan in 1992, the College of Engineering and Arts had still not blossomed into reality.

The author was invited to act as the funding Chair of the Department of Information Management of Shih Hsin University (SHU) in 1999 and presented the previous plan to SHU. The author proposed a thorough “Multimedia Program” including animation, MIDI, networking, and video games for the undergraduate students. Two MIDI courses, one in composition basics and the other in performance, were concurrently launched in 1993 and were directed by the author and an adjunct lecturer. This is very likely the first time that a university in Taiwan provided Digital Music courses [[12]]. Sadly, we decided to shut down the courses after 3 years.

Through a visiting scholar plan, the author was invited to the Saginaw Valley State University (SVSU) at Michigan, USA to teach multimedia courses for graduate students in 2002. The SVSU already had the necessary facilities, but some of them had never been activated. The author assisted SVSU to put the program on track and also found similar problems with Digital Music courses in the United States as in Taiwan. This pushed the author to publish a bilingual teaching/ research website in Digital Contents where Digital Music was also included [[11]].

It was not until 2004 that the author was invited by the Dean of SHU to reopen a Digital Music course. This time, the focus on students for the course shifted to the graduate level. The author also made some major modifications to the former curriculum design.

In 2009, the author was invited by National Taiwan University to establish its Digital Music Lab as a sub-project of the National Research Project of Excellence [[13]]. This project intends to lay down the fundamental capability and trigger the potentials of creativity in Digital Music for NTU. Unfortunately, we are still having difficulty in recruiting participants for the Lab.

After witnessing the long and difficult experiences of Digital Music in higher education, the author identifies the core problems as follow:

1. The extremely interdisciplinary nature of Digital Music.
2. The usability of and cost of investment in Digital Music technology and tools.
3. The human factors in curriculum designs in Digital Music.

3.1. Interdisciplinary Nature

Digital Music is a language that utilizes one’s free imagination while it is also a form of mathematics that requires deliberate planning.

Digital Music is also a form of physics that follows the law of kinetics to quantify musical design, while it is also an art that is never, ever completely constrained by any law.

Digital Music is similar to mind-reading. Sometimes, one must meditate on it while it also results in hand-on action. The hands, the fingers, the ears, the tongue, the breath, the sense of the skin, the vibration of the blood, and the holistic body-and-soul must all be involved to express it fully.

Digital Music is also computer that you have to give precise instructions to in order to obtain the right answers, while it is an instrument that the musician is always improvising on and changing motions with.

Thus, Digital Music requires interdisciplinary interests, training, and patience. It is very time consuming and needs longitudinal persistence.

The largest obstacle to Digital Music is the conventional education system. All young students, as early as their studying in high school, have been forcibly separated into two or three groups and made to give up many of their interests as human beings. Consequently, many of them begin to believe that they only have half a brain and are not capable of managing any interdisciplinary challenge.

During my three years of teaching for SHU from 1993, few students were able to complete their homework. One of two main reasons was that they did not have enough confidence to learn so many new things.

After intense observation, it became obvious that some MIDI players did not read scores and some traditional musicians were very nervous about computers. They did not have the opportunity to reach balanced learning in this relatively new technology/art through the current education system.

3.2. Usability/Investment of technology and tools

The second main reason why we had withdrawn Digital Music course in 1995 was the poor usability of technology and tools in the early days. The connection of MIDI equipment used to be totally different from that of regular computers and we had to share them in the same computer lab. A great deal of time was wasted in connecting and disconnecting facilities during class.

In the professional industry, the Mac system is usually the standard production environment. But considering the cost factor in Taiwan, the universities always choose the PC system. Thus, the input (such as keyboard), sequencers and output (sound modules) were barely acceptable in the early days. Nowadays, there are fantastic improvements whether in Mac or PC systems. The novel electronic MIDI input instruments now function much more flexibly than a traditional keyboard. You are able to blow on, to pull and to beat them as real instruments. The various high-sample rate wave sound modules can produce subtle sounds that are more profound than live playing.

However, all these peripherals and software are very expensive and their life cycles are very short. The administration of any university would be reluctant to deploy full Digital Music facilities since the number of qualified students is limited. This has resulted in a vicious cycle that we do not have enough students to gain better facilities, while we have less chance to attract more students with potential.

3.3. Human Factors in Curriculum Designs

With two decades of try-and-error and continuous cross-examination with the experiences of esteemed international institutes including Digital Music Research Network (DMRN) [[4]], Queen Mary, University of London [[7]], Virginia Tech Department of Music [[10]], Berklee College of Music [[3]], Mary Pappert School of Music [[6]], Teesside University [[8]], and Acadia University [[1]], the author has learned that the curriculum design of Digital Music needs to meet the following requirements of human factors:

1. Self-proficiency: a student must be able to complete a Digital Music project within one year; even he/she knew nothing about music before.
2. Structure of learning: the learning units must be well organized by key processes and with priority; the materials of exercise must initially be designed to be simple and interesting, and that will bring fast positive feedback to students.
3. Usability of User Interface: user interface of the input should be easy to use; specific teaching skills must be developed to shorten the years of practice needed to learn how to play instruments.
4. Cost-efficiency: the investment of facilities must be under the average while the output of the Digital Music's projects must meet the professional quality. Thus the design of the hardware, software and peripherals should be very careful.

There are two major user interfaces for composing Digital Music. The first is keyboard and/or other electronic instruments. The second is electronic music sheets or scores software. The author will recommend a hybrid combination of these two interfaces.

There are many instruments in a music chapter that is similar to there are many characters in a play. Alike the leading actors are different from the supporting actors; the different instruments are also playing different roles in each sentence. Therefore, it will be a good idea to use electronic music sheets to compose the whole chapter then to play electronic instruments for specific parts where need dedicated expression.

Furthermore, there is emerging user interface that could be categorized as “Click-and-Drop” by “Copy-and-Paste” of loops (music episode templates). Due to the progress of Digital Music software, users are able to piece up loops and to complete a project.

With this user interface, so-called composers may skip all knowledge of music aesthetics, aspects of music, scores read/write, music grammar, and instrument arrangement. It becomes, more or less, a certain type of computer game. According to the experiences of the universities that adapt this design, students are able to complete a Digital Music project within only one semester, and it is easier to gather students to enroll this course.

However, this type of music works may produce a strong “mood”, but barely express a unique “theme”. Most of them are not able to initiate specific motivation and create melody in their own right.

In reflection of the above discussions, the author contributes the following modules to curriculum design in Digital Music. There are two parts, four modules and each part lasts for one semester.

Part 1: Basics and Arrangement

Module: Basics

- Aesthetics of Digital Music
- Aspects of Music
- Aspects of MIDI
- Digital Score

Module: Arrangement

- Form Design
- Harmony and Chord Analysis
 - Chord Motion Design
 - Counterpoint Design
- Rhythm Analysis and Design
- Instrument Arrangement
- Extra Episode Design

Part 2: Post Production

Module: MIDI Production

- Sequencer
- General MIDI Instrument
- Virtual Instrument

Module: Digital Audio Production

- Tracks Management
- Mixing and Automation
- Equalization
- Special Effect Featuring
- Mastering

4. Future Research

We may want to investigate more insights into Digital Music by introducing a university course such as “Cultural Economics” that consists of an economic analysis of the creative and performing arts proposed by the Association for Cultural Economics International (ACEI) [[2]]. Due to the constraint of time, we have not employed many of research subjects in our curriculum yet. If we have an opportunity to design a more comprehensive program in Digital Music in the future, we may extend our objectives to the following research approach:

Instructional technology approach

A general syllabus in Digital Music
Teaching materials, tools and methods
Development of web-based interactive learning community

Information technology approach

Chinese virtual instruments
Virtual playing skills for Chinese instruments
Specific topic in digital score
Specific topic in mix

Behavioral sciences approach

Relations of music, emotion, psychology and behavior
Contemporary culture and information society (Such as Digital Youth Research [[5]])
Music and digital aesthetics
Research methodology in Digital Music

References

- [1] Acadia University, School of Music,
http://music.acadiau.ca/aboutus_courses.php
- [2] The Association for Cultural Economics International,
<http://www.culturaleconomics.org/index.html>
- [3] Berklee College of Music, <http://www.berklee.edu/about/>
- [4] Digital Music Research Network, <http://www.elec.qmul.ac.uk/dmrn/index.html>
- [5] Digital Youth Research, <http://digitalyouth.ischool.berkeley.edu/about>
- [6] Mary Pappert School of Music, <http://www.music.duq.edu/grdDesc.html>
- [7] Queen Mary, University of London, Centre for Digital Music,
<http://www.elec.qmul.ac.uk/digitalmusic/>
- [8] Teesside University, Music and Digital Media,
[http://www.tees.ac.uk/Undergraduate_courses/Art_&_Design_Performing_Arts_&_Music/BA_\(Hons\)_Music_and_Digital_Media.cfm](http://www.tees.ac.uk/Undergraduate_courses/Art_&_Design_Performing_Arts_&_Music/BA_(Hons)_Music_and_Digital_Media.cfm)
- [9] University Course Web, <http://ucourse.tvc.ntnu.edu.tw/>
- [10] Virginia Tech Department of Music, <http://www.music.vt.edu/>
- [11] Wu, Sean Tung-Xiung, Digital Content and Web-based Content: Design, Technology, Management, <http://tx.liberal.ntu.edu.tw/ColorStone/index.htm>
- [12] Wu, Sean Tung-Xiung, Digital Music Zone,
<http://tx.liberal.ntu.edu.tw/ColorStone/Docs/Audio-!subjects.htm>
- [13] Wu, Sean Tung-Xiung, NTU Digital Music Lab,
<http://tx.liberal.ntu.edu.tw/ColorStone/Publication/DMusicLab/index-MidiLab.htm>