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& STEPHEN D. PRIOR

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Exploring the Sustainable Smart Learning Environments in the Digital Education Policies of the EU Third Country Taiwan and the European Union

Yong-Cih Yang

Center for General Education, National Taiwan University of Science and Technology

This study explores how policymakers in EU Third Country Taiwan and the European Union (EU) are addressing the challenges posed by artificial intelligence (AI) in education within the framework of sustainable digital development. The research employs a comparative analysis of educational policies, focusing on enhancing learning opportunities through AI integration and achieving the United Nations Sustainable Development Goal 4 (SDG4), which emphasizes inclusive and equitable education. Document analysis and data juxtaposition were used to evaluate educational reforms in both regions, particularly in terms of promoting a human-centered "Society 5.0" that merges virtual and physical realities. The study finds that while both regions emphasize AI-driven educational innovation, Taiwan focuses on media literacy and lifelong learning, while the EU prioritizes green and digital transitions. These insights are expected to contribute to Taiwan's localization of digital education policies and inform future strategies for AI integration in education.

Keywords – Digital Education, Sustainable Development, Society 5.0, SDG4, EU, Taiwan

Relevance to Design Practice – This study highlights how policymakers in EU Third Country Taiwan and the European Union (EU) are addressing the challenges posed by artificial intelligence (AI) in education within the framework of sustainable digital development.

Background

With the rapid advancement of technology, countries worldwide have formulated new national development visions in the past 15 years. In 2010, Germany championed "Industry 4.0," while in 2015, China unveiled "Made in China 2025." In 2016, the United States emphasized the "restoration of American manufacturing," and Japan proposed a people-centered "Society 5.0" for 2030, focusing on economic and technological development. This marks the fifth transformation of human society, following hunting, agriculture, the industrial age, and the information society, leading to the establishment of a super-intelligent society driven by artificial intelligence (AI), robotics, IoT, and quantum computing technologies (Foxton, 2017; Global Views Monthly, 2019). Within the blueprint of Society 5.0, humans will inhabit in a world where virtual and physical realities merge. Under the foundation of Industry 4.0 in the past, the European Union (EU)

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proposed 'Industry 5.0' in 2021, shifting the paradigm mainly from technology- centric to human-centric, sustainable, and resilient (Directorate-General for Research and Innovation, 2021).

Since 2017, Taiwan, as an EU third country, has promoted the Forward-looking Infrastructure Development Program under the Special Act for Forward-looking Infrastructure, covering eight major areas: "rail construction," "water environment construction," "green energy construction," "digital construction," "urban and rural construction," "friendly childcare spaces to address declining birthrates," "food safety construction," and "talent cultivation to promote employment." (National Development Council, 2020).

Starting from 2020, the Forward-looking 2.0 program continues to strengthen national key infrastructure, promote balanced regional development, and enhance rural construction. It focuses on six core strategic industries, including 5G, digital development, AI, and cybersecurity, while expanding budgets for digital transformation, environmental sustainability, and building a resilient nation. In digital construction, efforts include promoting cybersecurity infrastructure, developing digital cultural and creative industries, enhancing digital infrastructure, facilitating industrial digital transformation, building 5G infrastructure, and reducing the digital divide in rural areas to support the next decade's development (National Development Council, 2020).

The EU Third Country Taiwan, the European Union and Japan emphasize economic and technological development, which should simultaneously address societal challenges, such as enhancing the role and contribution of industries to society. The industrial sector can play a proactive role, providing solutions to societal challenges, including resource preservation, climate change, and societal stability (Directorate-General for Research and Innovation, 2021; Global Views Monthly, 2019; National Development Council, 2020). Meeting various needs in human life, concurrently solving economic development and societal issues, and constructing a society that better meets individual needs with this in mind.

The 2030 Agenda for Sustainable Development, adopted by the United Nations in 2015, provides a common blueprint for peace and prosperity for humanity and the planet, now and into the future. Its core is the 17 Sustainable Development Goals (SDGs), which call on all countries, whether developed or developing, to adopt cooperative actions in global partnerships, to eliminate poverty and stimulate economic growth, while simultaneously addressing climate change and striving to protect our oceans and forests. Among these, Goal 4 aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) (United Nations, 2015). Education is key to achieving the SDGs.

The emergence and development of AI will have a profound impact on education as it can transform the way learning and teaching are conducted, making it more personalized, adaptive, and efficient. In the field of education, artificial intelligence has already begun to generate new teaching methods, such as the use of immersive VR in instruction. Immersive VR refers to the use of head-mounted displays or

headsets, which allow learners to fully immerse themselves in the learning environment through enveloping visuals and sounds. This deep immersion aids focus on learning and its broad field of view helps students improve memory (Ragan, Sowndararajan, Kopper, & Bowman, 2010); close to real-life experiences allow learners to explore and construct knowledge in the virtual environment. These characteristics break the boundaries of traditional digital learning, allowing students to actively explore and learn within the environment set up by educators, thus opening up new possibilities for current education.

Research Objective and Questions

The aim of this research is to understand how policymakers in the EU Third Country Taiwan and EU respond to AI and address its impact on educational policies and the sustainable society during the rapidly changing digital era. To achieve this objective, the following questions need to be addressed:

1. How do policymakers in the EU Third Country Taiwan and the EU enhance educational opportunities in student learning through digital education policies on artificial intelligence?

2. How can policymakers in the EU Third Country Taiwan and the EU achieve SDG Goal 4 to create a human-centric Society 5.0 within the context of AI applications in education?

Literature Review

The Development of Digital Education Policy in the EU Third Country Taiwan

In order to welcome the advent of the 21st century and the global trend of education

reform, Taiwan's Ministry of Education (MOE) must commit to educational reform, aiming to comprehensively enhance the quality of citizens and national competitiveness. The history of Taiwan's policy on promoting STEM education can be traced back to the temporary outline of the Grade 1-9 Curriculum Guidelines announced in 2001. At that time, science and technology were combined into a single field, and this move was used to promote the interdisciplinary integration of mathematics, science, and technology (Lin, 2018). In September 2004, Taiwan fully implemented the Grade 1-9 Curriculum, with the curriculum concept being "competence-oriented". The curriculum included three aspects: "individual and self", "individual and society", and "individual and nature". It integrated all learning fields including Mandarin, dialects, English, Mathematics, social studies, science and technology, arts and humanities, health and physical education, integrative activities. The curriculum was based on student abilities, which served as the basis for educational objectives. The purpose was to enable students to acquire continuous and integrated learning and knowledge (Ministry of Education, 2008). In terms of technology education, it presented a "unification of science and technology".

With the changing society and economy, as well as the rapid progress of technological development, the education system also needs to make corresponding adjustments and reforms. Therefore, starting in 2019, Taiwan began to implement 12-Year Basic Education Curriculum, extending the education system to high school graduation. The core competence of the 12-Year Basic Education Curriculum emphasizes nurturing "lifelong learners" with a human-

centric focus, which is divided into three main dimensions: spontaneity, communication and interaction, and social participation. These three dimensions are further subdivided into nine categories: Specifically, spontaneity entails physical and mental wellness and self-advancement; logical thinking and problem solving; and planning, execution, innovation and adaptation. Communication and interaction entails semiotics and expression; information and technology literacy and media literacy; and artistic appreciation and aesthetic literacy. Finally, social participation entails moral praxis and citizenship; interpersonal relationships and teamwork; and cultural and global understanding. (Ministry of Education, 2021a). The 12-Year Basic Education Curriculum breaks through the original academic knowledge framework, allowing students to develop nine new capabilities, transforming knowledge from just being information to an ability to solve real-world problems. The learning paths of students from elementary school, junior high school, upper secondary school will also pay more attention to fostering personal interests.

Emerging technologies such as smartphones, wearable devices, and various immersive technologies have driven the output of many technologically advanced teaching resources, making students' learning styles even more diverse. Many studies, for example, in humanities and social subjects such as geography and history, immersive VR can transport students to or bring back the scene, giving elementary and middle school students a first-hand experience and personal understanding of the situation at the time (Chen, Wang, Huang & Yang, 2023); or in the application of biological and other scientific

subjects, Zinchenko et al. (2020) found that university students using immersive VR have higher anatomy learning achievement than students using traditional paper-based and 3D interactive models.

Taiwan and EU's digital education policies to reduce the digital divide among students

Taiwan's Ministry of Education primarily focuses on the policy/framework development related to digital education in elementary and middle schools, such as the four-year "White Paper on Information Education for Elementary and Middle Schools" started in 2008, the "Digital Learning Promotion Plan" four-year plan proposed in 2014, the 2016-20 Information Education Blueprint, and the 12-Year Basic Education Curriculum (Ministry of Education, 2008, 2016). These main frameworks have been used to implement the following digital education policies.

The Ministry of Education announced the implementation of the " technology-supported self-regulated learning promotion program for high school " in 2012, planning to use more than 10,000 tablets as vehicles for student learning. Since its launch, 34 to 49 public and private high schools have participated in the plan each academic year. As for middle and elementary school students, there is the long-term "National Middle and Elementary School Action Learning Promotion Plan", demonstrating that mobile learning has become a major trend in information education and digital learning in Taiwan (Liao, Chen &Yang, 2020: 71).

Changes in learning models can enhance student participation in the learning process, improve problem-solving and critical thinking skills, and

thus improve learning outcomes and attitudes. However, students may be overwhelmed by the complex and abundant technological learning resources. Without proper guidance and support, they may not achieve the expected learning outcomes. Since 2014, the Ministry of Education has fully launched the "Digital Learning Promotion Plan". In addition to improving campus network bandwidth and building wireless network environments, constructing educational cloud applications and platform services, it also enables university students to serve as digital learning companions for elementary and middle school students in remote areas (Ministry of Education, n. d. a).

The Ministry of Education in Taiwan, under the Executive Yuan's Forward-looking Infrastructure Development Program, launched the "5G Campus Demonstration Classroom and Learning Devices Program." This initiative utilizes 5G technology to create immersive learning experiences and foster self-directed learning among primary and secondary school students. The program supports 97 schools in integrating VR and the metaverse into teaching and establishes XR Digital Co-learning Centers in 10 counties, providing metaverse teaching resources and virtual studios. These centers will collaborate with 63 additional schools to offer remote live interactive teaching (Department of Information and Technology Education, 2023).

The program includes teacher training, development of teaching strategies, and the setup of VR virtual studios in XR Digital Co-learning Centers. The Ministry of Education aims to provide diverse teaching and learning models, encourage the use of new technologies in classrooms, promote student-centered self-directed and experiential learning, innovate

teaching methods, and reduce the digital learning gap between urban and rural areas. This initiative is expected to significantly enhance the quality and accessibility of education through advanced technology integration (Department of Information and Technology Education, 2023).

Education and training are the best investment for the future of Europe. They play a crucial role in promoting growth, innovation, and creating job opportunities. In the Rome Declaration of March 2017, EU Member States stressed their commitment to providing young people with the 'best education and training'. At the Gothenburg Summit in November 2017, the Commission outlined a vision for a European Education Area (EEA) and announced a dedicated Digital Education Action Plan. The European Commission adopted the Digital Education Action Plan (2018-2020) in 2018, which has three priority: making better use of digital technology for teaching and learning, developing relevant digital competences and skills for the digital transformation, and Improving education through better data analysis and foresight. It includes 11 actions aimed at supporting member states in addressing the challenges and opportunities that digital technologies bring to formal education and training (European Commission, 2018).

Since the outbreak of the COVID-19 pandemic in December 2019, having digital abilities and skills and ensuring the availability of digital infrastructure and equipment has become even more important. Continuous technological change requires lifelong development of abilities and skills for all learners to maintain Europe's economic competitiveness, participate in social life, and ensure equality during the digitization of

education and society (Digital Economy and Society Index, 2023). Among 13-14-year-olds participating in the International Computer and Information Literacy Study (ICILS) in 2018, more than a third did not have the basic level of digital skills proficiency (European Commission, 2019), and a quarter of low-income families were unable to use computers and broadband (Eurostat, 2019). The disparity in internet usage across the EU is influenced by household income.

The initiative "Digital Education Action Plan 2021-2027" (DEAP), approved by the Commission in September 2020, has two priority issues - fostering the development of a high-performing digital education ecosystem and enhancing digital skills and competences for the digital transformation - along with fourteen supporting actions in formal education, including informal and non-formal education based on lifelong learning approaches. With enhanced cooperation and exchange at the EU level, it provides high-quality, inclusive, and accessible digital education and supports member states' education and training systems in adapting to the digital age. The European Parliament in March 2021 urged the use of digital transition funds to enhance the digital capabilities of education systems, emphasizing the need to bridge the digital divide, ensure high-quality digital education based on lifelong learning approaches, and provide financial support for teachers' professional development (European Commission, 2020).

The Digital Education Action Plan is a key driving factor in realizing the European Education Area (EEA) by 2025. It also contributes to the implementation of the European skills agenda, the European social

pillar action plan, and the '2030 digital compass: the European way for the digital decade (European Commission, 2020).

Human-centered Digital Education Policies in the EU Third Country Taiwan and the EU

The 12-Year Basic Education Curriculum in Taiwan incorporates " Information and Technology Literacy and Media Literacy" as one of its core competencies. The curriculum guideline for related fields stipulates the corresponding learning focuses for each educational stage below high school, and formulates the "Promotion Plan for Media Literacy Education in Junior and Secondary Schools". It is also included in the subsidy for local governments to carry out the "Enhanced Teaching Plan" to integrate media literacy education into the curriculum and teaching research. Through subsidizing the establishment of media literacy education base schools in junior and secondary schools, teacher training and regional cooperation to promote media literacy education are carried out by setting up teaching communities and developing curriculum modules. In 2021, the "Curriculum Framework for Media Literacy Education in Junior and Secondary Schools" was deliberated and provided to the National Institute of Education for forwarding to textbook publishing companies as a reference for revising textbooks (Ministry of Education, 2021a, 2023).

In October 2002, the Ministry of Education of Taiwan issued the "White Paper on Media Literacy Education Policy", which was a pioneering initiative in promoting media literacy education policy among Asian countries. Through various measures planned at stages

such as school education, teacher education, and lifelong education, the aim is to cultivate the media literacy knowledge and abilities of the people in our country, and to build a healthier media society that is more comprehensive and enriched with humanistic education. From 2019, the Ministry of Education promoted the 12-year Basic Education Curriculum, and listed "Technology Information and Media Literacy" as one of the nine core competencies, cultivating students and citizens to understand the creative potential of using media and information tools, positive usage methods, and media reading abilities. Furthermore, in 2023, the Ministry of Education's White Paper on Media Literacy Education in the Digital Age, advocated for "Good use of media, good use of technology, promoting participation, and systematic learning" as guiding principles. A comprehensive plan was laid out with three main dimensions - "Deepening School Education, Expanding Lifelong Education, and Enhancing Support Systems", along with seven development strategies and 30 action plans, constructing a policy network that integrates cross-field and public-private collaboration (Ministry of Education, 2023).

Historical Perspectives on Digital Education

Over the past two decades, the integration of digital education policies across various countries has been a focal point of educational reforms. Taiwan's history in this area dates back to the early 2000s, where the government introduced initiatives such as the Grade 1-9 Curriculum Guidelines in 2001, promoting the interdisciplinary integration of science, technology, engineering, and mathematics

(STEM) (Lin, 2018). As digital technologies became more advanced, Taiwan's Ministry of Education (MOE) continued to prioritize these aspects in its educational frameworks. In particular, the 12-Year Basic Education Curriculum, implemented in 2019, emphasized "Technology Information and Media Literacy" as a core competency, aiming to equip students with critical thinking skills and the ability to navigate the digital landscape (Ministry of Education, 2021a). This reflects a broader global trend towards enhancing digital literacy among students as a fundamental component of education in the 21st century.

Similarly, the European Union has been proactive in shaping its digital education agenda. The EU's *Digital Education Action Plan* (2018-2020) laid the groundwork for promoting digital skills and competencies across its member states, recognizing the transformative impact of technologies such as AI, virtual reality (VR), and augmented reality (AR) on learning environments (European Commission, 2018). The plan aimed to make better use of digital technology for teaching and learning, develop relevant digital competencies, and improve education through data analysis and foresight. Notably, the European Commission furthered these efforts by launching the *Digital Education Action Plan (2021-2027)*, which introduced new priorities, including fostering a high-performing digital education ecosystem and enhancing digital skills for lifelong learning (European Commission, 2020). These historical developments reveal a strong alignment between Taiwan and the EU in their approaches to integrating digital education, although their respective emphases—Taiwan's focus on media

literacy and the EU's broader digital skills agenda—highlight different strategic priorities.

Comparative Studies on Digital Literacy and AI in Education

There is a growing body of research examining the role of artificial intelligence (AI) and digital literacy in enhancing educational outcomes. Studies on Taiwan's education system have shown that AI integration in schools can significantly improve students' problem-solving skills and creativity (Liao, Chen, & Yang, 2020). In particular, the use of immersive technologies such as VR has proven to be an effective tool for subjects like geography and history, where students can engage in simulations that enhance their understanding of real-world events (Chen, Wang, Huang, & Yang, 2023). Moreover, Zinchenko et al. (2020) found that immersive VR experiences in science subjects, such as anatomy, improved university students' learning achievements compared to traditional methods. These findings underscore the value of incorporating AI and immersive technologies into the curriculum to create a more engaging and effective learning environment.

On the European front, AI has been recognized as a critical factor in improving student learning outcomes and addressing educational gaps, especially in the context of the COVID-19 pandemic. The *Digital Economy and Society Index* (2023) highlighted the disparities in digital skills across the EU, with a significant portion of low-income households lacking access to essential digital infrastructure. The European Commission's 'Digital Education Action Plan (2021-27)' aims to mitigate these disparities by fostering digital inclusion and promoting high-quality education through AI-enhanced learning environments (European Commission, 2020). Comparative studies have shown that AI not only personalizes learning but also helps educators tailor instruction to meet individual student needs (Giles, 2021). This adaptive nature of AI in education has been crucial in improving digital literacy and fostering lifelong learning in both Taiwan and the EU, contributing to the achievement of SDG4, which aims for inclusive and equitable quality education for all (United Nations, 2015).

Research Method

To conduct this study on sustainable smart learning environments in the context of digital education policies within the EU Third Country Taiwan and the European Union, a comprehensive research methodology was employed. The study utilized the comparative education method as outlined by Bereday (1964), which involves four key stages: description, interpretation, juxtaposition, and comparison. This method has been foundational in comparative education research and remains relevant today. Recent studies have emphasized the importance of this methodology in understanding cross-cultural educational policies and their implications in an increasingly globalized world (Giles, 2021; Newton, 2022; Kim, 2023).

In the description stage, relevant data were meticulously gathered from various sources, including government publications, academic journals, and statistical reports, to document the educational policies and practices in both Taiwan and the EU. These data were then interpreted to uncover the underlying principles and objectives of these policies, particularly in

how they address the challenges of digital transformation and the integration of artificial intelligence (AI) in education. The juxtaposition stage involved placing the policies of Taiwan and the EU side by side to highlight their similarities and differences, providing a clearer understanding of how each region approaches the development of sustainable smart learning environments.

Finally, a comparative analysis was performed to evaluate the effectiveness of these policies in enhancing educational opportunities and fostering a sustainable society. This stage involved not only comparing the outcomes of these policies but also considering their broader impact on achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG4, which aims to ensure inclusive and equitable quality education for all. By integrating insights from multiple data sources and employing rigorous analytical techniques, this study ensures a reliable and valid examination of the policies in question, contributing to the broader discourse on educational reform in the digital era.

This study employed the comparative education method proposed by Bereday (1964), which involves four key stages: description, interpretation, juxtaposition, and comparison, as the main research approach, supplemented by document analysis. The specific process of data collection and analysis is as follows:

In the description stage, relevant data were collected from both domestic and international government websites, journal literature, and other online resources. The types of data gathered included policy documents, research reports, statistical data, and academic articles. Following this, during the interpretation stage,

the collected data were organized, and key concepts, policies, and practices were analyzed in depth to uncover their intrinsic meanings and applications across different educational systems.

In the juxtaposition stage, educational data from various countries and regions were placed side by side to identify similarities and differences. This step focused on comparing and organizing data to build a foundation for the final stage of comparison. The comparison stage involved systematically comparing the characteristics of different educational systems based on the results of the juxtaposition. The comparison focused on the effectiveness of policies, implementation outcomes, and their impact on educational quality.

In terms of data analysis, document analysis was integrated throughout the research process, systematically examining the collected literature to extract valuable information. Methods such as thematic analysis, content analysis, and comparative analysis were employed. Furthermore, data induction played a critical role in organizing and extracting common patterns and trends, ensuring the integration of theory and practice to maintain the research's scientific rigor and practical relevance.

For the analysis of quantitative data, statistical methods, including descriptive statistics, correlation analysis, and regression analysis, were applied. For qualitative data, coding and thematic analysis were used to gain an in-depth understanding of the underlying meanings within the data. This comprehensive approach ensured a thorough understanding of the educational systems under study.

Findings and Discussion

Since 2019, Taiwan's Ministry of Education has included "Technology Information and Media Literacy" as a core competency in its 12-year National Basic Education Curriculum, aiming to bridge the digital divide and improve student learning outcomes through AI. Taiwan's digital education policies emphasize leveraging AI to enhance educational opportunities and address disparities, thus promoting a knowledge society. The curriculum, implemented in 2019, focuses on cultivating "lifelong learners" with a human-centered approach, fostering media literacy, creativity, and the positive use of media and information tools to achieve SDG4 goals. These policies aim to build a foundation for a sustainable digital environment through primary and secondary school initiatives, promoting human autonomy alongside technological advancements.

Similarly, the EU's 2018 Digital Education Action Plan promotes high-quality, inclusive, and accessible digital education and training, highlighting the increased importance of digital skills, especially post-COVID-19. The plan emphasizes achieving enhanced cooperation among key participants to ensure the development of digital skills, crucial for equal opportunities in life, employment, and active citizenship. The EU's approach to SDG4 and the creation of a human-centered Society 5.0 is rooted in supporting green and digital transitions and prioritizing educational policy cooperation. These policies aim to help students and citizens creatively and positively use media and information tools, fostering media literacy to achieve SDG4 goals and create a sustainable digital environment.

To analyze the effectiveness and impact of these policies in fostering a sustainable, human-centric educational environment, this study applies Bereday's comparative education method, which involves four key stages: description, interpretation, juxtaposition, and comparison, supplemented by document analysis. The description stage provides a detailed account of the educational policies and initiatives in Taiwan and the EU, particularly focusing on AI integration and digital education. The interpretation stage explores the underlying goals and outcomes of these policies, such as promoting digital literacy, bridging the digital divide, and achieving SDG4. During the juxtaposition stage, the policies of Taiwan and the EU are placed side by side to identify similarities and differences in their approaches to integrating AI in education and promoting a human-centered Society 5.0. Finally, in the comparison stage, a systematic comparison is made regarding the effectiveness, implementation, and impact of these policies on enhancing educational opportunities and achieving sustainable development goals. This comprehensive analysis provides insights into how both regions are addressing the challenges and opportunities presented by the integration of AI in education, with a focus on creating sustainable and human-centered learning environments.

By applying Bereday's comparative education method, this study systematically examines how Taiwan and the EU have responded to the integration of AI in education and how these responses align with their broader goals of achieving sustainable development and creating human-centered societies. The description stage carefully documents the

specific policies and initiatives that each region has implemented. For instance, Taiwan's incorporation of "Technology Information and Media Literacy" as a core competency in its national curriculum reflects a strategic effort to equip students with the necessary skills to thrive in an increasingly digital world. Similarly, the EU's Digital Education Action Plan is designed to foster a high-performing digital education ecosystem that is both inclusive and accessible, ensuring that all citizens, regardless of their background, can benefit from the opportunities presented by digital technologies.

In the interpretation stage, the study delves deeper into the intentions behind these policies, highlighting their emphasis on bridging the digital divide—a critical issue in both regions. Taiwan's focus on lifelong learning and media literacy demonstrates a commitment to preparing students not only to use technology effectively but also to engage with it critically and creatively. This approach aligns with the broader goal of fostering a knowledge society where citizens are capable of continuous learning and adaptation. On the other hand, the EU's strategy underscores the importance of digital skills in securing equal opportunities for all citizens, particularly in the aftermath of the COVID-19 pandemic, which has accelerated the shift towards digital learning and working environments.

The juxtaposition stage provides a comparative analysis of the two regions' approaches, revealing both similarities and differences. Both Taiwan and the EU prioritize the integration of AI in education as a means to enhance learning outcomes and address existing disparities. However, their strategies differ in focus: while Taiwan emphasizes the development of media literacy and lifelong learning within a human-centered educational framework, the EU places greater emphasis on policy cooperation and the integration of green and digital transitions as part of its broader sustainable development agenda.

Finally, in the comparison stage, the study evaluates the impact of these policies on achieving their intended outcomes. The effectiveness of Taiwan's and the EU's policies is assessed based on their ability to enhance educational opportunities, promote digital literacy, and contribute to the creation of a sustainable, human-centered society. By comparing these outcomes, the study provides valuable insights into how different educational systems can address the challenges of the digital age, particularly in the context of AI integration and the pursuit of sustainable development goals.

Overall, this comprehensive analysis not only highlights the importance of strategic policy development in education but also underscores the critical role of AI and digital technologies in shaping the future of learning. As both Taiwan and the EU continue to navigate the complexities of digital transformation, their experiences offer valuable lessons for other regions seeking to develop sustainable, inclusive, and human-centered educational environments. The application of Bereday's comparative education method proves to be an effective tool in understanding the nuances of these policies and their broader implications, ultimately contributing to the global discourse on educational reform in the digital era.

Concluding Remarks

EU policymakers have placed a clear emphasis on integrating the Green Deal and digital

transition into their education policies. Both the EU and Taiwan, as an EU third country, introduced significant digital education initiatives in 2018 and 2019, respectively, to address global challenges and reduce the digital education gap.

In 2019, Taiwan's Ministry of Education incorporated "Technology Information and Media Literacy" as one of the nine core competencies in its 12-year National Basic Education Curriculum. Similarly, the EU launched the Digital Education Action Plan in 2018 to promote the European Education Area (EEA), aiming to deliver high-quality, inclusive, and accessible digital education. This initiative also fosters collaboration among key stakeholders. The importance of digital skills, particularly for equal opportunities in life, employment, and active citizenship, has been further highlighted by the COVID-19 pandemic. Both Taiwan and the EU are using digital policies to bridge the digital divide and foster knowledge-based societies, with a strong focus on leveraging AI to improve learning outcomes and address educational disparities.

Both the EU and Taiwan have adopted human-centered approaches in their digital education policies. Taiwan's 2019 implementation of the 12-year Basic Education Curriculum focuses on cultivating lifelong learners through a human-centered approach. Similarly, the EU's Digital Education Action Plan, launched in 2018, emphasizes the role of digital and green transitions in education policy. Both Taiwan and the EU focus on creating sustainable, human-centered societies by embedding these principles into primary and secondary education. Despite rapid technological progress, the importance of

human autonomy remains paramount. Both regions aim to equip students and citizens with the skills to use media and information tools creatively and positively, fostering media literacy to achieve SDG4 and build a human-centered Society 5.0.

The idea of establishing an Asia or Asia-Pacific Education Area (AEA) could be modeled on the EU's EEA. The EU promotes European interests in education globally, aligning with the UN's SDGs to enhance equality and protect vulnerable groups. Digital technology plays a crucial role in bridging educational divides and fostering equality. Taiwanese policymakers might consider creating educational zones in collaboration with other EU third countries in Asia or the Asia-Pacific region. Such cooperation would enhance mutual understanding, shared values, and could help Taiwan maintain its economic competitiveness, build public trust, and encourage broader participation in public affairs and social welfare.

This paper examines the digital education policies of both Taiwan and the EU, exploring the long-term effects of AI on education and sustainable societies through the integration of technology and humanities. It underscores the importance of media literacy for personal growth, civic engagement, and achieving the UN's SDGs. Taiwan can benefit from the EU's experience in digital education, particularly through the Digital Education Action Plan, which focuses on improving digital literacy. As an EU third country, Taiwan has opportunities to collaborate with the EU on 5G educational applications and the enhancement of digital literacy. For example, the EU's experience with the Digital Education Action Plan could help

Taiwan streamline its own digital education initiatives. Taiwan's advancements in 5G educational applications could serve as a valuable reference for the EU, while the EU's progress in improving digital literacy could assist Taiwan in refining its educational strategies.

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Junior High School Students' Responses to the Octagonal English Picture Book Creating Activity (OEPBCA)

Ching-Huang Wang[1,*], Wun-Jhen Huang[2], Shu-Han Liao[2], Chia-Lin Wang[3], Ting-Xuan Hsu[2] and Tian-You Wu[2]

[1]*Professor, Applied Foreign Languages, National Formosa University, Taiwan, R.O.C.*

[2]*Graduate, Applied Foreign Languages, National Formosa University, Taiwan, R.O.C.*

[3]*Master's student, Applied Foreign Languages, National Yunlin University of Science and Technology, Taiwan, R.O.C.*

The purpose of the study was to investigate the responses of 23 Taiwanese junior high school students (14 males, 9 females) to an Octagonal English Picture Book Creating Activity (OEPBCA) in an English class. The OEPBCA was designed to enhance students' English acquisition and critical thinking skills. Data collection comprised responses to an anonymous four-section questionnaire (i.e., demographics, questionnaire items, open-ended questions, mind mapping), and the octagonal English picture books created by participating students. The results of the study indicated that (a) All participants (100%) enjoyed the OEPBCA, irrespective of gender, grade, and class-type, (b) The activity most significantly benefited participants in enhancing their knowledge, (c) Approximately 87% of the participants (86.95%) agree that the activity stimulated their English learning motivation, (d) Male participants' attitudes toward the activity did not significantly differ from female ones'; overall, the activity was more beneficial to male participants than female ones, (e) There was no significant difference among the three grade groups in their attitudes toward the activity, except for item 4 and item 10 statements, with the Grade 9 group benefiting less than the other two groups overall, and (f) There was no significant difference among the three class groups in their attitudes toward the activity.

Keywords - Junior High School Students, Octagonal English Picture Book Creating Activity (OEPBCA), Taiwan.

Relevance to Design Practice - OEPBCA can be a useful design tool for design.

Introduction

With the advent of educational diversity, learning language is no longer just teacher-centered (Tsai, 2001). Traditional learning methods, emphasizing recitation and repetition of vocabulary and grammar (Gandimathi & Zarei, 2018), are now considered less suitable for young learners in Taiwan. In the past, traditional teaching

methods, such as the Grammar-Translation Method (GTM) which focused on translating English text into the mother language word by word, made students passively absorb knowledge, and thereby easily forget what they had learned (Eisa, 2020). Furthermore, due to traditional teaching methods, Taiwanese students have had, historically, a tendency to be quiet and passive in class in order to give their teachers a good impression (Irawati, 2014). As such, because of habits indoctrinated by traditional classroom credos such as "silence is golden" and "being quiet is good" (Irawati, 2014, p.1), many Taiwanese learners struggle when called on to think critically.

Yet, nowadays, more and more learner-centered activities, emphasizing autonomy and critical thinking, are designed to encourage students to learn actively in anxiety-free student-centered environments in Taiwanese schools and universities. It has been proved that learner-centered activities can stimulate students' motivation, enhance their concentration, and raise their academic achievements (Su, 2015). Additionally, it has been shown that learner-centered activities can offer students opportunities to increase critical thinking and the four key language skills: listening, speaking, reading and writing (Irawati, 2014).

The issue of critical thinking has been emphasized in many Asian countries recently (Irawati, 2014), and research has shown that traditional teaching methods may not give students the opportunity to think critically and independently (Gandimathi & Zarei, 2018), while learner-centered methods may do so. It is the opinion of this researcher (along with many others) that critical thinking, involving creativity and imagination (Wang et al., 2020, 2021), plays a vital role in foreign language learning, in the four major language acquisition skills (Irawati, 2014; Yang et al., 2014), as well as in grammar and vocabulary. Therefore, it follows that by integrating critical thinking with language learning, students' involvements in class and in-class tasks can make them become active learners, while simultaneously building their confidence in the target language (Gandimathi & Zarei, 2018).

The present research was considered worth investigation because few researchers to date had worked on the impact of an Octagonal English Picture Book Creating Activity (OEPBCA) on Taiwanese junior high school students' English acquisition and critical thinking development. Therefore, the purpose of the present research was to explore the voices of Taiwanese junior high school students through their responses to the OEPBCA. The research question designed to motivate the present study was: What were Taiwanese junior high school students' attitudes toward the OEPBCA in terms of all the participants, taking into account gender, grade, and class-type respectively?

Literature Review

It has been argued extensively that teacher-centered in-class instruction methods force teachers to lecture (Hsu, 2019; Tsai, 2001) and students to listen and memorize, essentially turning teachers into senders and students into receivers (Shih & Tsay, 2019). In the teacher-centered model, there is little interaction between teacher and student. The teacher tends to stress the lecturing of factual information (Namitha, 2018) and the students tend to sit silently in class, take a passive role in teacher's

lectures (Şeker & Kömür, 2008; Tsai, 2001), and may even learn by memorizing while not necessarily understanding (Namitha, 2018). Subsequently, teacher-centered learning may make learners feel bored and demotivated because of a lack of participation in class (Wang et al., 2021). Furthermore, learners may chat, nap, read irrelevant materials, pay little attention to their teachers, and/or use their smart phones to watch YouTube, play online games, and browse social media in class (Wang et al., 2021).

In learner-centered teaching, students as producers take a more active role and teachers become facilitators for learning rather than just lecturers (Namitha, 2018). The learner-centered method encourages students to involve themselves in learning by doing: brainstorming, cooperating with classmates in small groups, and developing critical thinking through interpersonal relationships and communication skills (Hsu, 2019). With group activities, students can brainstorm together to complete their given tasks through mutual help and learning strategies (Şeker & Kömür, 2008). The use of learning strategies can provide students with critical thinking development such as communicative competence (Şeker & Kömür, 2008; Wang et al., 2020, 2021).

The American philosopher John Dewey (1916) considered that the essential goal of education is to make students think critically and independently. In most contemporary classrooms around the world, critical thinking plays an essential role in education, particularly in interactive courses. As Vdovina (2013) stated, "critical thinking requires active and interactive learning" (p. 57). Additionally, teachers can arouse students' critical thinking through course activities and class discussion, and because

critical thinking can be developed, teachers can design activities to make students think critically (Abrami, 2008; Gandimathi & Zarei, 2018) through interpersonal interaction in course activities.

Gandimathi and Zarei (2018) explored the voices of 30 Malaysian ESL postgraduates considering the impact of critical thinking on learning English. The research instruments included semi-structured interviews, an open-ended questionnaire, and essay writing. The researchers found it helpful for students to learn English with critical thinking, and for students to solve learning problems with critical thinking.

The use and creation of picture books in English class can increase students' English language comprehension, vocabulary power (Cullins, 2005), learning motivation (Putu et al., 2020), listening ability (Feitelson et al., 1993), speaking ability, writing ability and grammar knowledge (Lim, 2010; Wang et al., 2021). Adding critical thinking to the process of creating an English picture book can allow students to understand English language more and use it in a more competent way (cited in Gandimathi & Zarei, 2018).

Kochiyama (2016) investigated 18 Japanese English teachers' (M=5, F=13) perceptions of using picture books in a secondary education English class. The research instrument was an anonymous 6-item questionnaire. The results of the study indicated that (a) the use of picture books could benefit learners in English vocabulary power, grammar, and reading, and (b) the themes elicited from the picture books in the English class included concerns, fears, and expectations, among others.

Wang et al. (2021) explored 22 Taiwanese AFL college students' (F: 17; M: 4; Unknown:

1) attitudes toward a Card-Based English e-Picture Book Creating Activity (CEePBCA) in an English class. The main research question was: How did college students respond to the CEePBCA from the perspectives of all the participants, gender and TOEIC score respectively? Data collection included an anonymous online questionnaire and the participants' reflection papers with mind-maps. The results of the study indicated that (a) the CEePBCA benefited the participants in English acquisition and critical thinking development, regardless of gender and English proficiency, (b) the activity benefited all the participants in critical thinking development more than in English acquisition, (c) both female and male participants' perceptions of the activity in English acquisition and critical thinking development were similar, (d) the activity was more beneficial for female and male participants in critical thinking development than in English acquisition, (e) the activity was more beneficial for both TOEIC $\geqq$ 700 participants and TOEIC<700 ones in critical thinking development than in English acquisition, and (f) the activity was a little more beneficial for the TOEIC<700 participants in English acquisition than the TOEIC$\geq$700 students, whereas the activity was more helpful for the latter in developing critical thinking. In the study, English acquisition involves vocabulary power and the four main language acquisition skills (i.e., listening, speaking, reading, and writing), while critical thinking involves imagination, creativity, cooperation, respecting different ideas, friendship, and communication skills.

The abovementioned literature review indicated that learners in an English class can increase their English proficiency and develop their critical thinking via course activities such as the discussion and/or creation of picture books, which was similar to the purpose of the OEPBCA in the current study. However, few research studies focused on the impact of the OEPBCA on junior high school students' English acquisition and critical thinking development. In the OEPBCA, the creation and sharing of octagonal English picture books were aimed to encourage students to boost their English acquisition and develop their critical thinking (i.e., concept classification, imagination, creativity, social skills, and knowledge increase).

Methodology

The current study aimed to look into how junior high school students responded to an Octagonal English Picture Book Creating Activity in an English classroom. This section addresses the participants' demographics, the OEPBCA itself, and data collection for completion of the study.

Participants

The participants recruited for the current study were 23 junior high school students (M= 14, 61%; F=9, 39%) who attended an English class during a summer camp in 2020 (see Table 1). To be more specific, the demographic of the group was as follows: grade 7 (n=8, 35%); grade 8 (n=11, 48%); grade 9 (n=4, 17%). The size of the general group (GG) was 7 students (30%); the gifted-in-language group (LG) – 6 students (26%); the gifted-in-math-science group (MSG) - 8 students (35%).

Table 1. Participants' Demographics (N=23).

Variable	Characteristic	Number	% (rounded)
Gender	M	14	61%
	F	9	39%
Grade	7th	8	35%
	8th	11	48%
	9th	4	17%
Class of	General	7	30%
Junior High	Gifted (Language)	6	26%
School	Gifted (Math-Science)	8	35%
	Gifted (Unknown)	2	9%

The Octagonal English Picture Book Creating Activity (OEPBCA)

The Octagonal Picture Book Creating Activity (OEPBCA) was undertaken in a 4-hour period. Its purpose was to help students increase their English acquisition and critical thinking, especially their creativity and imagination. In the activity, students were encouraged to create concept books (e.g., animals, plants, bridges, vegetables, wines, nature, flowers, colors, buildings, scenic spots, geography, history, music, leaders, educators, and generals), arithmetic, advertisements, poems, riddles, and short stories, among others.

The activity procedure is shown below:

Step 1 (40 minutes): The teacher explained how to create an octagonal paper work and shared three octagonal English picture books created by himself (see Pictures 1-3 in Figure 1) and his former students (see Pictures 4-9 in Figure 1).

Step 2 (15 minutes): The whole class discussed and brainstormed themes.

Step 3 (50 minutes): Students created their octagonal paper works.

Step 4 (50 minutes): Students designed and drew their works and wrote texts.

Step 5 (30 minutes): Students shared their works one by one in small groups and then some of them volunteered to share their works in the whole class.

Step 6 (15 minutes): Students were encouraged to skim and discuss the questionnaire and consent forms under the instruction of the teacher.

Step 7: Students were encouraged to rate the questionnaire and complete consent forms with the signatures of their custodians, especially their parents, at home.

Step 8: The next morning, the teacher collected questionnaires and consent forms.

Picture 1. Riddles	**Picture 2. Question 1**	**Picture 3. Answer to Q1**
Picture 4. Animals	**Picture 5. Question (What is the Animal?)**	**Picture 6. Answer (Hippo)**
Picture 7. Fruits	**Picture 8. Question (What is the Fruit?)**	**Picture 9. Answer (Blueberry)**

Figure 1. The collection of the questions and answers in visual display.

Data Collection

The collected data included an anonymous four-part questionnaire and the junior high school students' octagonal English picture books. They are briefly addressed as follows.

Questionnaire. The design of the 11-item 6-point-Likert-scale questionnaire was based on group brainstorming and references from other journals such as Wang et al.'s (2020). The questionnaire consisted of four parts: participant demographics (Part I), 11 questionnaire items (Part II), three open-ended questions (Part III), and a mind-map (Part IV). The purpose of item 11, "You don't need to circle this item," was to indicate and disqualify any questionnaires rated

without concern. The three open-ended questions in Part III were as follows: (a) Which parts of the teaching activity do you like and why? (b) Which parts of the teaching activity do you dislike and why? (c) Which parts of this activity need to be improved? The reliability of the questionnaire is 0.92 with the use of SPSS20.0, which corresponds to the evidence of reliability with the value of 0.70 or higher (Becker, 2000). At the end of the Octagonal English Picture Book Creating Activity (OEPBCA), the questionnaires and consent forms were distributed to 46 junior high school students in the summer camp. They were encouraged to submit their questionnaires and

consent forms the next day but only 34 students did so. Thus, the returning rate was 74% (34/46, rounded). Moreover, only 23 questionnaires were valid because seven students submitted their questionnaires without their parents' signatures in their consent forms and four rated item 11, "You don't need to circle this item," which made their questionnaires invalid. Thus,

the valid rate was 68% (23/34, rounded).

Students' Works. Most of the students' octagonal picture books tended to be concept books. The themes elicited from the students' works included animals, fruits, colors, national flags, gods, favorite things, people, and foods (see Pictures 10-17 in Figure 2).

Picture 10. Fruits	**Picture 11. Gods**	**Picture 12. People**
Picture 13. Favorite Things	**Picture 14. National Flags**	**Picture 15. Fruits**
Picture 16. Foods	**Picture 17. Colors**	Pictures were taken by the teacher in class.
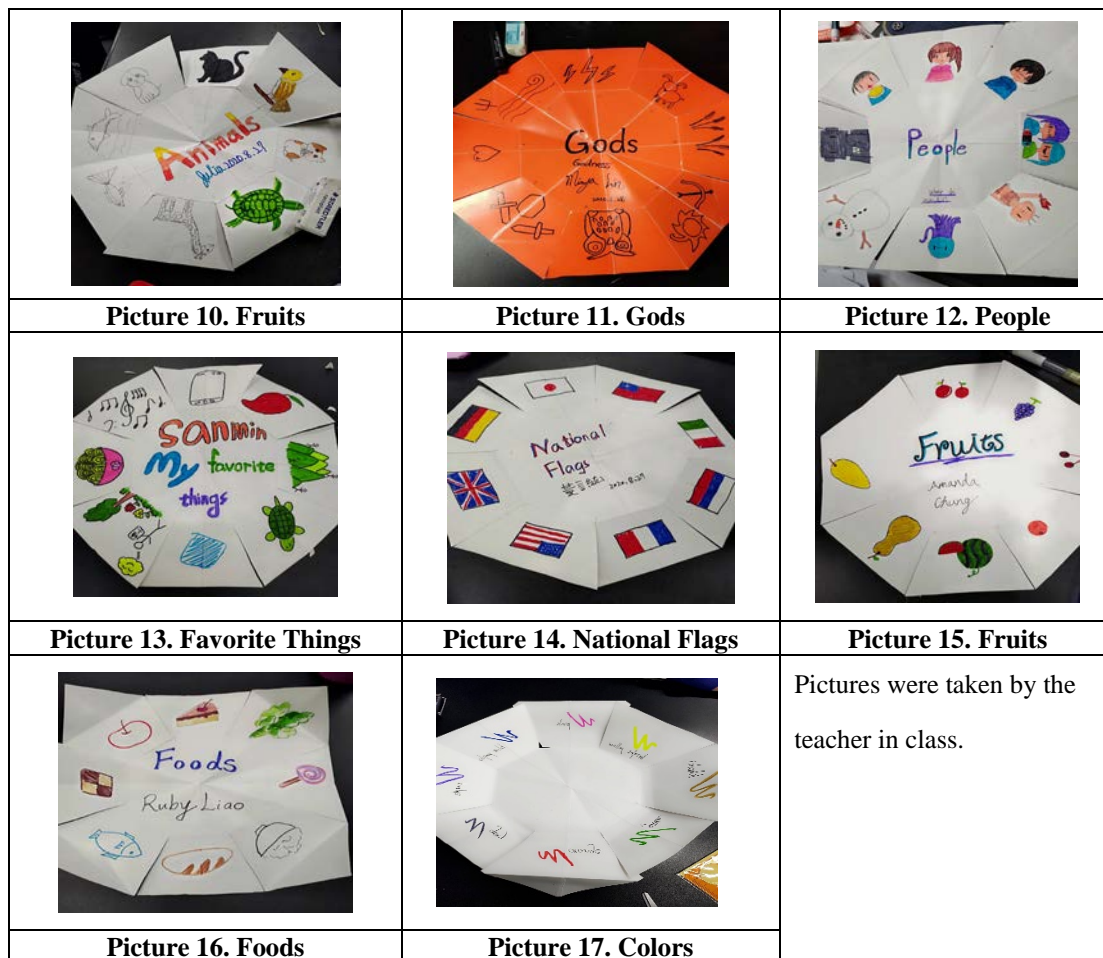
Figure 2. The collection of the students' work.

Findings/Results and Discussion

This section discusses the findings of the current mixed study in terms of quantitative data (i.e., the results of the questionnaire) and qualitative data (i.e., mind maps). In particular, the results of the questionnaire are discussed and analyzed from the perspectives of entire participants, gender, grade, and class-type.

Entire Participants

Table 2 shows that all the participants (100%) liked this teaching activity, OEPBCA (item1, M= 4.91). Also, over 80% of the participants tended to agree that this activity was helpful in (a) increasing their motivation for learning English (item 2: 86.95%, M= 4.39), (b) encouraging them to speak English (item 4:

82.62%, M= 4.17), (c) increasing their English listening ability (item 5: 82.61%, M= 4.39), (d) increasing their ability of (concept) classification (item 6: 82.61%, M= 4.48), (e) increasing their knowledge (item 7: 82.60%, M=4.52), and (f) increasing their social ability

(item 10: 82.61%, M=4.39). However, the results suggest that this activity benefited the participants least in boosting their vocabulary power (item 3: 73.91%, M= 4.26) and their creativity (item 9: 73.91%, M= 4.35).

Table 2. The Results of all the Participants' Responses to the Questionnaire (N=23).

Item		1	2	3	4	5
		I like this teaching activity.	This activity increases my motivation of learning English.	This activity increases my vocabulary power.	This activity encourages me to speak English.	This activity increases my English listening ability.
StA+A+ SoA	n	23	20	17	19	19
	%	100%	86.95%	73.91%	82.62%	82.61%
StD+D+ SoD	n	0	3	6	4	4
	%	0%	13.04%	26.09%	17.39%	17.39%
M		4.91	4.39	4.26	4.17	4.39
Item		6	7	8	9	10
		This activity increases my ability of (concept) classification.	This activity increases my knowledge.	This activity increases my imagination.	This activity develops my creativity.	This activity increases my social ability.
StA+A+ SoA	n	19	19	18	17	19
	%	82.61%	82.60%	78.26%	73.91%	82.61%
StD+D+ SoD	n	4	4	5	6	4
	%	17.39%	17.39%	21.74%	26.09%	17.39%
M		4.48	4.52	4.35	4.35	4.39

Note. StA + A + SoA= Strongly Agree + Agree + Somewhat Agree;
StD +D + SoD = Strongly Disagree + Disagree + Somewhat Disagree
The percentage was rounded up from the second decimal point.

Gender

Table 3 showed that there was no significant relationship between male and female participants' attitudes toward the

OEPBCA. It means that male and female participants' responses to all the 10 questionnaire items/statements were similar.

Table 3. Relationships Between Males and Females in Response to the Activity (N=23).

No.	Item	Gender	N	*M*	*SD*	*Sig
1	I like this teaching activity.	Male	13	5.00	.760	.186
		Female	10	4.70	.483	
2	This activity increases my motivation of learning English.	Male	13	4.86	1.050	.693
		Female	10	4.30	.823	
3	This activity increases my vocabulary power.	Male	13	4.86	1.050	.154
		Female	10	3.90	.994	
4		Male	13	4.43	.947	.508

	This activity encourages me to speak English.	Female	10	4.00	1.247	
5	This activity increases my English listening ability.	Male	13	4.43	1.193	.264
		Female	10	4.10	.876	
6	This activity increases my ability of (concept) classification.	Male	13	4.86	1.092	.161
		Female	10	4.10	1.101	
7	This activity increases my knowledge.	Male	13	4.71	.987	.116
		Female	10	4.10	1.197	
8	This activity increases my imagination.	Male	13	4.57	1.182	.163
		Female	10	3.90	1.449	
9	This activity develops my creativity.	Male	13	4.71	1.198	.409
		Female	10	4.10	1.287	
10	This activity increases my social ability.	Male	13	4.73	.768	.223
		Female	10	4.13	1.197	

*$p<.05$

Overall, however, this activity tended to benefit male participants more than females, based on the average agreement percentages (84.62% vs. 80.00%) and mean values (4.73 vs. 4.13) (see Table 4). To be more specific, Table 4 showed that all male and female participants (100%) liked this teaching activity (item 1). Over 90% of male participants tended to agree that this teaching activity helped them increase their knowledge (item 7: 92.31%, M=4.71) and social ability (item 10: 92.31%, M=4.86); this activity benefited male participants least in developing creativity (item 9: 69.23%), but its mean value reached 4.71. On the other hand, 90% of female participants tended to agree that the teaching activity helped increase their learning motivation (item 2: 90.00%, M=4.30) and encouraged them to speak English (item 4: 90.00%, M=4.00); this activity benefited female participants least in increasing their vocabulary power (item 3: 60.00%, M=3.90).

Table 4. **Results of Male and Female Participants' Responses to the Questionnaire (N=23).**

No.	Item	Rate		Male (13)	Female (10)
1	I like this teaching activity.	StA+A + SoA*	n	13	10
			%	100%	100%
		StD+D +SoD*	n	0	0
			%	0.00%	0.00%
		M		5.00	4.70
2	This activity increases my motivation of learning English.	StA+A + SoA	n	11	9
			%	84.61%	90.00%
		StD+D +SoD	n	2	1
			%	15.38%	10.00%
		M		4.86	4.30
3	This activity increases my vocabulary power.	StA+A + SoA	n	11	6
			%	84.62%	60.00%
		StD+D +SoD	n	2	4
			%	15.38%	40.00%
		M		4.86	3.90
4	This activity encourages me to speak English.	StA+A + SoA	n	10	9
			%	76.92%	90.00%

		StD+D +SoD	n	3	1
			%	23.08%	10.00%
		M		4.43	4.00
5	This activity increases my English listening ability.	StA+A + SoA	n	11	8
			%	84.62%	80.00%
		StD+D +SoD	n	2	2
			%	15.38%	20.00%
		M		4.43	4.10
6	This activity increases my ability of (concept) classification.	StA+A + SoA	n	11	8
			%	84.62%	80.00%
		StD+D +SoD	n	2	2
			%	15.38%	20.00%
		M		4.86	4.10
7	This activity increases my knowledge.	StA+A + SoA	n	12	7
			%	92.31%	70.00%
		StD+D +SoD	n	1	3
			%	7.69%	30.00%
		M		4.71	4.10
8	This activity increases my imagination.	StA+A + SoA	n	10	8
			%	76.92%	80.00%
		StD+D +SoD	n	3	2
			%	23.08%	20.00%
		M		4.57	3.90
9	This activity develops my creativity.	StA+A + SoA	n	9	8
			%	69.23%	80.00%
		StD+D +SoD	n	4	2
			%	30.77%	20.00%
		M		4.71	4.10
10	This activity increases my social ability.	StA+A + SoA	n	12	7
			%	92.31%	70.00%
		StD+D +SoD	n	1	3
			%	7.69%	30.00%
		M		4.86	4.10
Average agreement percentage				84.62%	80.00%
Average mean				4.73	4.13

Note. StA + A + SoA= Strongly Agree + Agree + Somewhat Agree;
StD +D + SoD = Strongly Disagree + Disagree + Somewhat Disagree
The percentage was rounded up from the second decimal point.

Interestingly enough, female students' percentages were higher than males' in item 2 (90.00% vs. 84.61%), item 4 (90.00% vs 76.92%), and item 9 (80.00% vs 69.23%), while female students' mean values were lower than males in item 2 (4.30 vs 4.86), item 4 (4.00 vs 4.43), and item 9 (4.10 vs 4.71) respectively (see Table 4 or 5). The above results were predicated by the fact that more male students rated these three items 6 (strongly agree) and 5 (agree) than females did, as Table 5 shows.

Table 5. Results of Male and Female Participants' Responses Items 2, 4, and 9.

No	Item	Rate		Male (n=13)	Total	Female (n=10)	Total
2	This activity increases my motivation of learning English.	Strongly Agree(6)	n *%	3 23.08%	11 84.61 %	1 10.00%	9 90.00 %
		Agree(5)	n %	2 15.38%		2 20.00%	
		Somewhat agree(4)	n %	6 46.15%		6 60.00%	
		M		4.86		4.30	
4	This activity encourages me to speak English.	Strongly Agree(6)	n %	1 7.69%	10 76.92 %	1 10.00%	9 90.00 %
		Agree(5)	n %	5 38.46%		1 10.00%	
		Somewhat agree(4)	n %	4 30.77%		7 70.00%	
		M		4.43		4.00	
9	This activity develops my creativity.	Strongly Agree(6)	n %	3 23.08%	9 69.23 %	1 10.00%	8 80.00 %
		Agree(5)	n %	5 38.46%		3 30.00%	
		Somewhat agree(4)	n %	1 7.69%		4 40.00%	
		M		4.71		4.10	

Note. The percentage was rounded up from the second decimal point.

Grade

Among the 10 items, only item 4 (p=.007<.05) and item 10 (p=.026<.05) had significant relationships with grade respectively (see Table 6). To be more specific, as for item 4 (This activity encourages me to speak English), the relationship between grade 9 (G9) and grade 7 (G7) (p=.023<.05) and that between G9 and grade 8 (G8) (p=.008<.05) are significant. This means that only the G9 participants' response to item 4 differs from G7 participants' and G8 participants' respectively (see Table 7). On the other hand, this activity encouraged G9 students to speak English (25.00%, M=2.75) much less than G7 participants (100%, M=4.38) and G8 participants (88.89%, M=4.44) respectively (see Table 8). As for item 10 (This activity increases my social ability), the relationship between G9 and G8 (p=.028<.05) is significant (see Table 7). This means that only G9's response to item 10 differs from G8's. On the other hand, this activity increased G9 students' social ability (50.00%, M=3.25) much less than G8 participants (88.89%, M=4.78) (see Table 8).

Table 6. Relationships among Three Grade Groups in their Responses to the Activity (N=23).

No.	Item	Grade	N	M	SD	F	*Sig
1	I like this teaching activity.	Grade 7	8	4.63	.518	1.393	.272
		Grade 8	11	5.11	.632		
		Grade 9	4	5.25	.957		
2	This activity increases my motivation of learning English.	Grade 7	8	4.38	.744	2.937	.076
		Grade 8	11	4.78	1.009		
		Grade 9	4	3.50	.577		
3	This activity increases my vocabulary power.	Grade 7	8	4.13	.835	1.966	.166
		Grade 8	11	4.78	1.120		
		Grade 9	4	3.50	1.000		
4	This activity encourages me to speak English.	Grade 7	8	4.38	.744	6.482	**.007**
		Grade 8	11	4.44	.820		
		Grade 9	4	2.75	1.258		
5	This activity increases my English listening ability.	Grade 7	8	4.13	.835	.462	.636
		Grade 8	11	4.44	1.293		
		Grade 9	4	4.75	.957		
6	This activity increases my ability of (concept) classification.	Grade 7	8	4.38	.916	.209	.813
		Grade 8	11	4.78	1.120		
		Grade 9	4	4.25	1.708		
7	This activity increases my knowledge.	Grade 7	8	4.50	.756	.004	.996
		Grade 8	11	4.78	1.368		
		Grade 9	4	4.50	1.291		
8	This activity increases my imagination.	Grade 7	8	4.13	.991	.159	.854
		Grade 8	11	4.78	1.508		
		Grade 9	4	4.50	1.732		
9	This activity develops my creativity.	Grade 7	8	4.25	1.035	0.73	.930
		Grade 8	11	4.67	1.293		
		Grade 9	4	4.25	1.708		
10	This activity increases my social ability.	Grade 7	8	4.50	.926	4.384	**.026**
		Grade 8	11	4.78	.786		
		Grade 9	4	3.25	.957		

*p<.05

Table 7. Relationships among Three Grade Groups in their Responses to Items 4 and 10.

Grade		Item 4	Item 10
Grade 7	Grade 8 (G8)	.916	.853
(G7)	Grade 9 (G9)	**.023**	.085
Grade 8	Grade 7 (G7)	.916	.853
(G8)	Grade 9 (G9)	**.008**	**.028**
Grade 9	Grade 7 (G7)	**.023**	.085
(G9)	Grade 8 (G8)	**.008**	**.028**

*P<.05

Thus, except for items 4 and 10, the relationships among the three grade groups

(G7, G8, and G9) in their attitudes toward the other questionnaire statements were not significant (see Table 7).

Overall, this activity benefited G7 and G8 groups more than G9, based on the average agreement percentages (90.00%, 85.56%, 65.00% respectively) and mean values (4.34, 4.73, 4.05 respectively) (see Table 8). In particular, all the students (100%) in each grade group liked this teaching activity (item 1). Furthermore, 100% of the students in the G7 group agreed that the activity could increase their motivation for learning English (item 2),

their vocabulary power (item 4), and knowledge (item 7), while 100 % of those in the grade 9 group agreed that this activity could increase their English listening ability (item 5). On the other hand, the results show that this activity benefited the students of the G7 group least in increasing their imagination (item 8: 75.00%, M=4.13), those of the G8 group least in increasing their English listening ability (item 5: 66.66%, M=4.44), and those of the G9 group least in encouraging them to speak English (item 4: 25.00%, M=2.75).

Table 8. **Results of Grade Groups' Responses to Questionnaire (N=21).**

No.	Item	Rate		Grade 7 (G7)	Grade 8 (G8)	Grade 9 (G9)
1	I like this teaching activity.	StA+A + SoA*	n	8	9	4
			%	100%	100%	100%
		StD+D +SoD*	n	0	0	0
			%	0.00%	0.00%	0.00%
		M		4.63	5.11	5.25
2	This activity increases my motivation of learning English.	StA+A + SoA*	n	8	8	2
			%	100%	88.89%	50.00%
		StD+D +SoD*	n	0	1	2
			%	0.00%	11.11%	50.50%
		M		4.38	4.78	3.50
3	This activity increases my vocabulary power.	StA+A + SoA*	n	7	8	1
			%	87.50%	88.89%	25.00%
		StD+D +SoD*	n	1	1	3
			%	12.50%	11.11%	75.00%
		M		4.13	4.78	3.50
4	This activity encourages me to speak English.	StA+A + SoA*	n	8	8	1
			%	100%	88.89%	25.00%
		StD+D +SoD*	n	0	1	3
			%	0.00%	11.11%	75.00%
		M		4.38	4.44	2.75
5	This activity increases my English listening ability.	StA+A + SoA*	n	7	6	4
			%	87.50%	66.66%	100%
		StD+D +SoD*	n	1	3	0
			%	12.50%	33.33%	0.00%
		M		4.13	4.44	4.75
6	This activity increases my ability of (concept) classification.	StA+A + SoA*	n	7	8	3
			%	87.50%	88.89%	75.00%
		StD+D +SoD*	n	1	1	1
			%	12.50%	11.11%	25.00%
		M		4.38	4.78	4.25
7	This activity increases my knowledge.	StA+A + SoA*	n	8	7	3
			%	100%	77.78%	75.00%
		StD+D	n	0	2	1

No.	Item			General	Language	Math-Science
		+SoD*	%	0.00%	22.22%	25.00%
		M		4.50	4.78	4.50
8	This activity increases my imagination.	StA+A + SoA*	n	6	8	3
			%	75.00%	88.89%	75.00%
		StD+D +SoD*	n	2	1	1
			%	25.00%	11.11%	25.00%
		M		4.13	4.78	4.50
9	This activity develops my creativity..	StA+A + SoA*	n	6	7	3
			%	75.00%	77.78%	75.00%
		StD+D +SoD*	n	2	2	1
			%	25.00%	22.22%	25.00%
		M		4.25	4.67	4.25
10	This activity increases my social ability.	StA+A + SoA*	n	7	8	2
			%	87.50%	88.89%	50.00%
		StD+D +SoD*	n	1	1	2
			%	12.50%	11.11%	50.00%
		M		4.50	4.78	3.25
	Average agreement percentage			90.00%	85.56%	65.00%
	Average mean			4.34	4.73	4.05

Note. StA + A + SoA= Strongly Agree + Agree + Somewhat agree;
StD +D + SoD = Strongly Disagree + Disagree + Somewhat Disagree
The percentage was rounded up from the second decimal point.

Class-Type

Table 9 show that there was no significant relationship among the three class groups in their attitudes toward the OEPBCA. This means that the three groups' (General Class, Language Class, and Math-Science Class) responses to all 10 questionnaire statements were similar.

Table 9. Relationships among Three Class-Type Groups in their Responses to the Activity (N=21).

No.	Item	Class	N	M	SD	F	Sig*
1	I like this teaching activity.	General	7	5.00	.816	.816	.458
		Language	6	4.67	.516		
		Math-Science	8	5.13	.641		
2	This activity increases my motivation of learning English.	General	7	4.86	1.215	1.428	.266
		Language	6	4.00	.632		
		Math-Science	8	4.25	.886		
3	This activity increases my vocabulary power.	General	7	4.86	1.069	2.338	.125
		Language	6	3.67	.816		
		Math-Science	8	4.25	1.035		
4	This activity encourages me to speak English.	General	7	4.43	1.134	.775	.476
		Language	6	3.67	1.366		
		Math-Science	8	4.13	.835		
5	This activity increases my English listening ability.	General	7	4.43	1.272	.520	.603
		Language	6	4.00	.632		
		Math-Science	8	4.63	1.302		
6	This activity increases my ability of (concept) classification.	General	7	4.86	1.345	2.914	.080
		Language	6	3.67	.816		
		Math-Science	8	4.88	.835		
7	This activity increases my knowledge.	General	7	4.71	1.113	1.820	.191
		Language	6	4.00	.894		

		Math-Science	8	5.00	.926	
8	This activity increases my imagination.	General	7	4.57	1.397	
		Language	6	3.83	1.169	1.466 .257
		Math-Science	8	4.88	.835	
9	This activity develops my creativity.	General	7	4.71	1.113	
		Language	6	3.83	1.169	1.121 .348
		Math-Science	8	4.63	1.188	
10	This activity increases my social ability.	General	7	4.86	1.069	
		Language	6	3.83	1.169	1.735 .205
		Math-Science	8	4.38	.744	

$p<.05$

Based on the average agreement percentages and average mean values, the Language Class (LC) group (75.00%; M=3.92) displayed a lower positive attitude toward the activity than the General Class (GC) group (84.28%; M= 4.73) and the Math-Science Class (MSC) group (88.75%; M=4.62) (see Table 10). In particular, all the students (100%) in each class group tended to agree that they liked this teaching activity (item 1). Furthermore, 100% of the students in the GC group agreed that the activity could increase their vocabulary power (item 3), while 100 % of those in the MSC group agreed that this activity could increase their ability of (concept) classification (item 6), knowledge (item 7), and imagination (item 8). On the other hand, this activity benefited the GC group least in increasing their English listening ability (item 5: 71.43%, M=4.43), the LC group least in increasing their vocabulary power (item 3: 50.00%, M=3.67), and the MSC group least in encouraging them to speak English (item 4: 75.00%, M= 4.13).

Table 10. Results of Three Class-Type Groups' Responses to Questionnaire.

No	Item	Rate		General (n=7)	Gifted (language) (n=6)	Gifted (math-science) (n=8)
1	I like this teaching activity.	StA+A + SoA*	n	7	6	8
			%	100%	100%	100%
		StD+D +SoD*	n	0	0	0
			%	0.00%	0.00%	0.00%
		M		5.00	4.67	5.13
2	This activity increases my motivation of learning English.	StA+A + SoA*	n	6	5	7
			%	85.71%	83.33%	87.50%
		StD+D +SoD*	n	1	1	1
			%	14.29%	16.67%	12.50%
		M		4.86	4.00	4.25
3	This activity increases my vocabulary power.	StA+A + SoA*	n	7	3	6
			%	100%	50.00%	75.00%
		StD+D +SoD*	n	0	3	2
			%	0.00%	50.00%	25.00%
		M		4.86	3.67	4.25
4	This activity encourages me to speak English.	StA+A + SoA*	n	6	5	6
			%	85.71%	83.33%	75.00%
		StD+D +SoD*	n	1	1	2
			%	14.29%	16.67%	25.00%

		M		4.43	3.67	4.13
5	This activity increases my English listening ability.	StA+A + SoA*	n	5	5	7
			%	71.43%	83.33%	87.50%
		StD+D +SoD*	n	2	1	1
			%	28.57%	16.67%	12.50%
		M		4.43	4.00	4.63
6	This activity increases my ability of (concept) classification.	StA+A + SoA*	n	5	5	8
			%	71.43%	83.33%	100%
		StD+D +SoD*	n	2	1	0
			%	28.57%	16.67%	0.00%
		M		4.86	3.67	4.88
7	This activity increases my knowledge.	StA+A + SoA*	n	6	4	8
			%	85.71%	66.67%	100%
		StD+D +SoD*	n	1	2	0
			%	14.29%	33.33%	0.00%
		M		4.71	4.00	5.00
8	This activity increases my imagination.	StA+A + SoA*	n	5	4	8
			%	71.43%	66.67%	100%
		StD+D +SoD*	n	2	2	0
			%	28.57%	33.33%	0.00%
		M		4.57	3.83	4.88
9	This activity develops my creativity..	StA+A + SoA*	n	6	4	6
			%	85.71%	66.67%	75.00%
		StD+D +SoD*	n	1	2	2
			%	14.29%	33.33%	25.00%
		M		4.71	3.83	4.63
10	This activity increases my social ability.	StA+A + SoA*	n	6	4	7
			%	85.71%	66.67%	87.50%
		StD+D +SoD*	n	1	2	1
			%	14.29%	33.33%	12.50%
		M		4.86	3.83	4.38
Average agreement percentage				84.28%	75.00%	88.75%
Average mean				4.73	3.92	4.62

Note. StA + A + SoA= Strongly Agree + Agree + Somewhat agree;
StD +D + SoD = Strongly Disagree + Disagree + Somewhat Disagree
The percentage was rounded up from the second decimal point.

Mind-Maps

In Part IV of the questionnaire, the students were encouraged to design their mind maps related to the OEPBCA. The quantitative results of the current study were backed up by the participants' mind-maps with English translations as follows:

According to Mind-map 1 in Figure 3, the OEPBCA benefited the student in cooperation (mutual help) and increasing classification ability. In addition, the student said that (a) students should concentrate on their teacher's instruction lest they cut their papers incorrectly; (b) they should think about themes for their works in the creating process; and (c) they should speak clearly and loudly enough for their group members in the process of sharing.
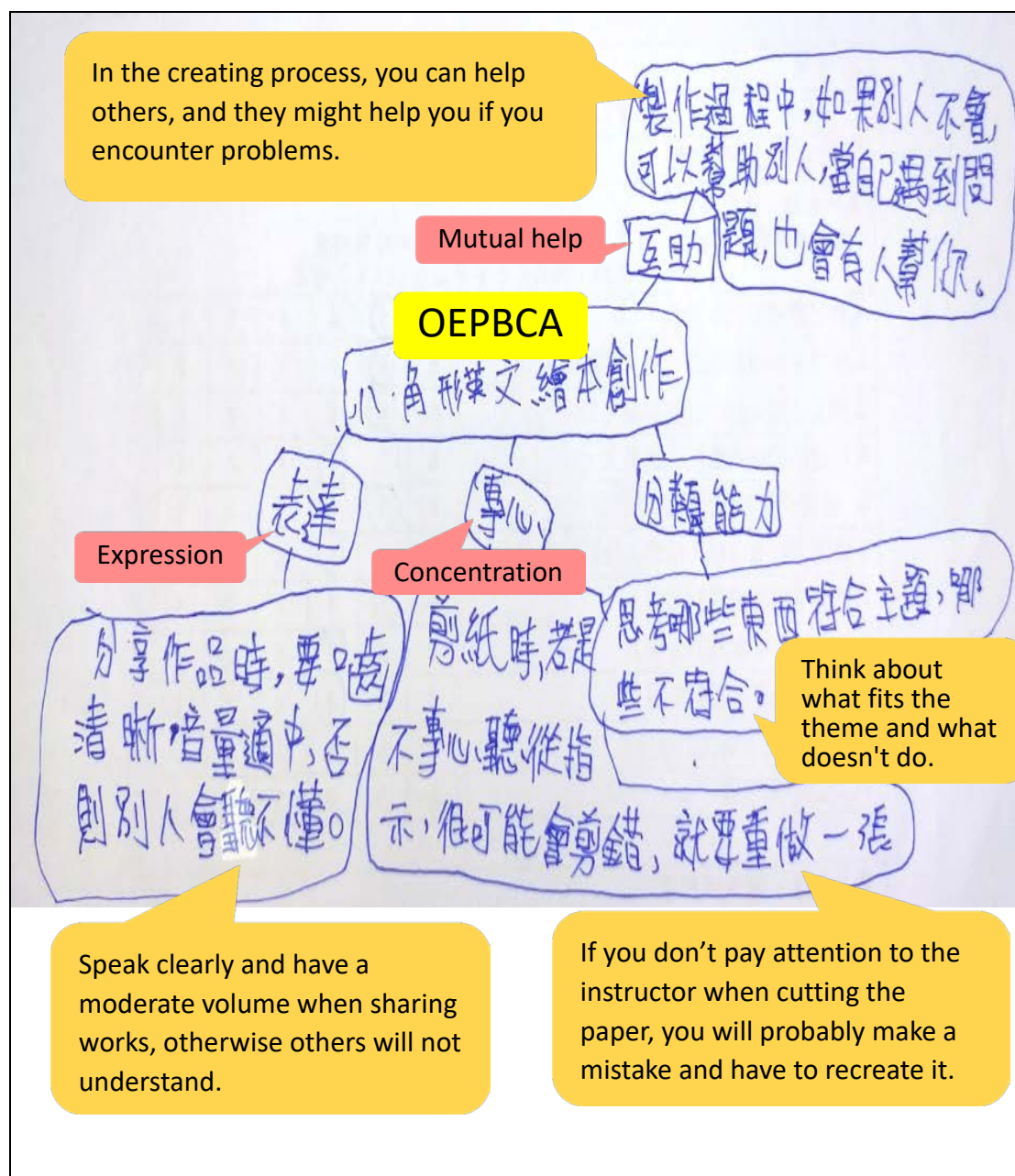
Figure 3. Mind-map 1 by a Female Student of the Language Class (LC).

Mind-map 2 in Figure 4 showed that the OEPBCA could benefit the student in boosting English ability and in enhancing imagination, creativity, and communication skills. Additionally, the student interacted well with other group members in the process of sharing.
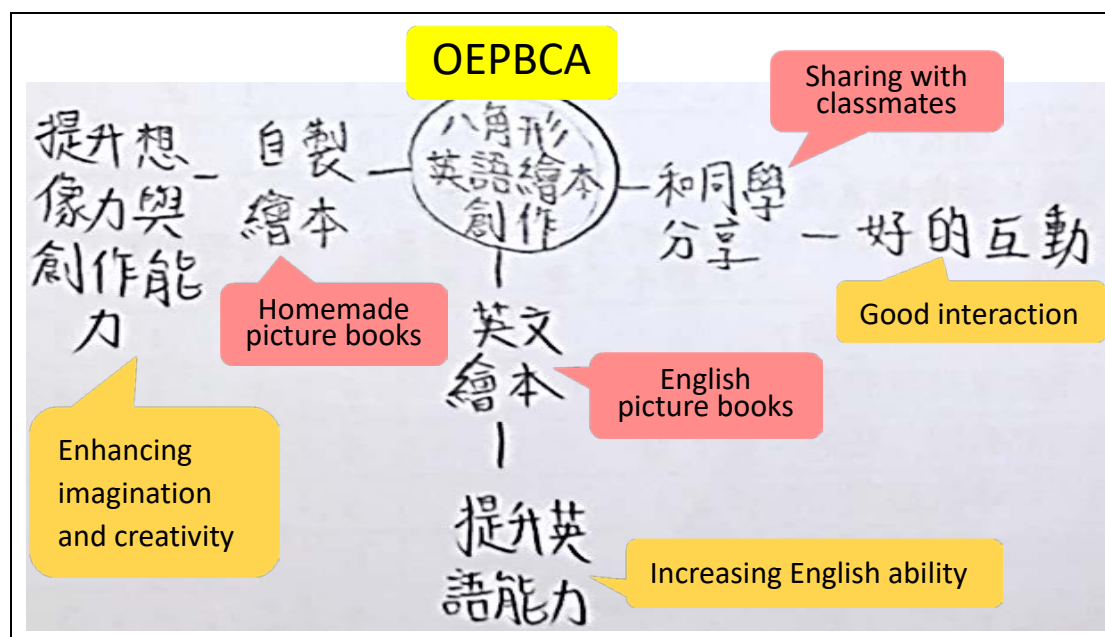
Figure 4. Mind-map 2 by a Female Student of the General Class (GC).

In Mind-map 3, the student considered the class interesting and relaxing. Moreover, she said that it was easy for her to create an octagonal English picture book. However, the student did not like group sharing time because she was not familiar with other group members and thereby felt awkward sharing ideas with relative strangers (see Figure 5).
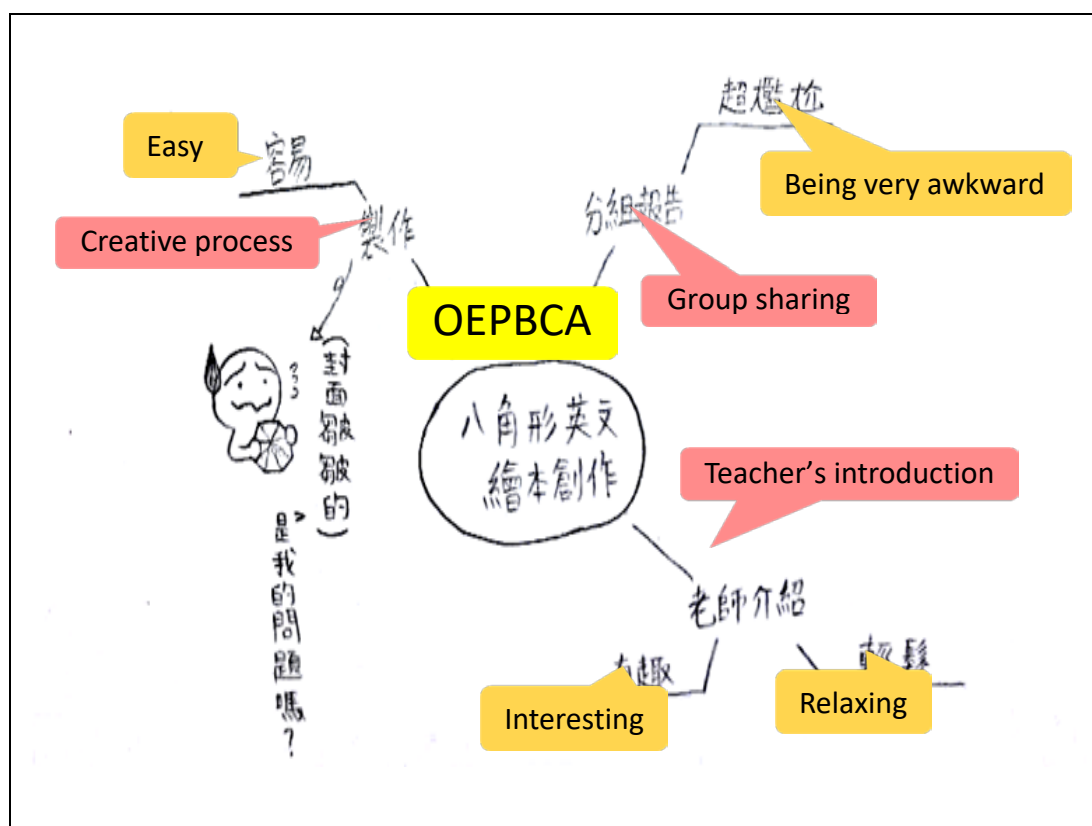
Figure 5. Mind-map 3 by a Female Student of the Language Class (LC).

Mind-map 4 presented that the OEPBCA helped the student in increasing social skill and friendship. Additionally, the activity appeared to boost the student's hands-on ability (see Figure 6).
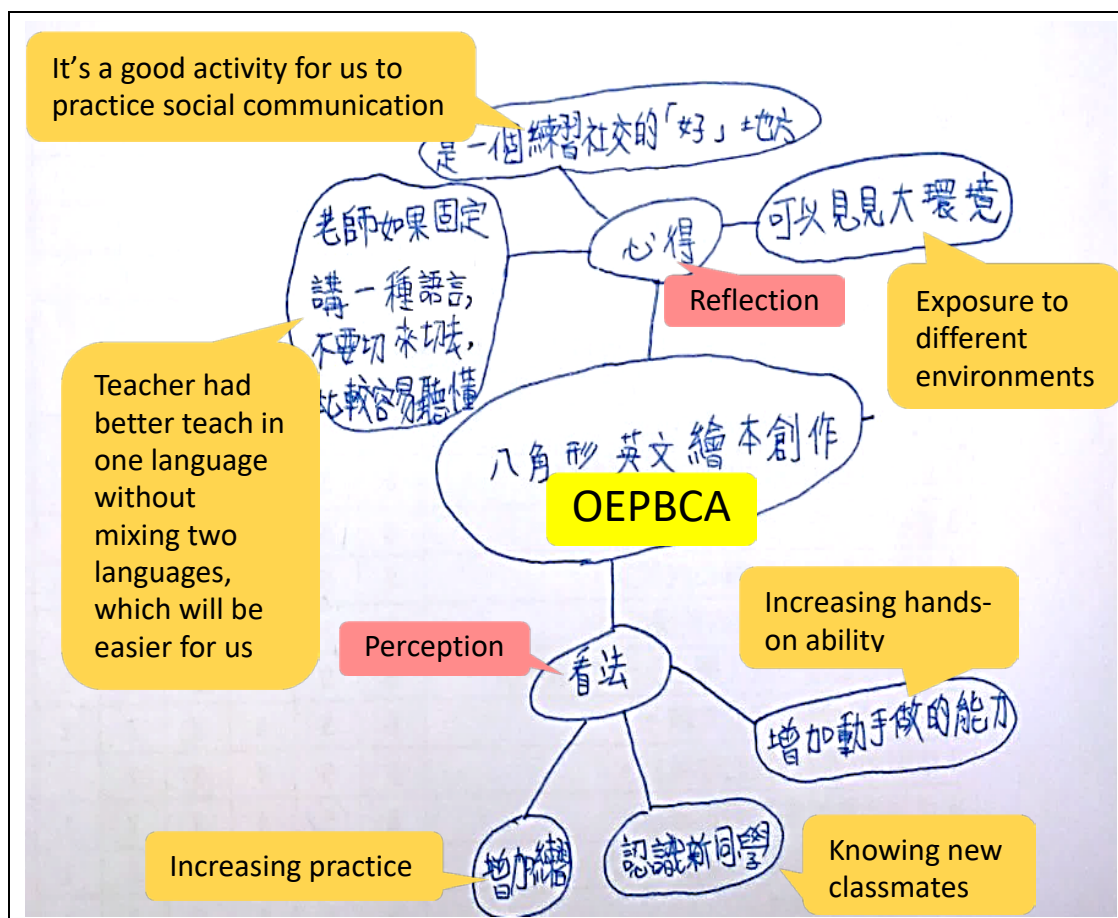
Figure 6. Mind-map 4 by a Male Student of the General Class (GC).

Mind-Map 5 showed that the OEPBCA helped the student increase his speaking and reading abilities as well as vocabulary power. Plus, this activity boosted the student's interest in learning English. Moreover, he employed the framework of ORID (i.e. objective, reflective, interpretive, and decisional) to create his octagonal picture book (see Figure 7).
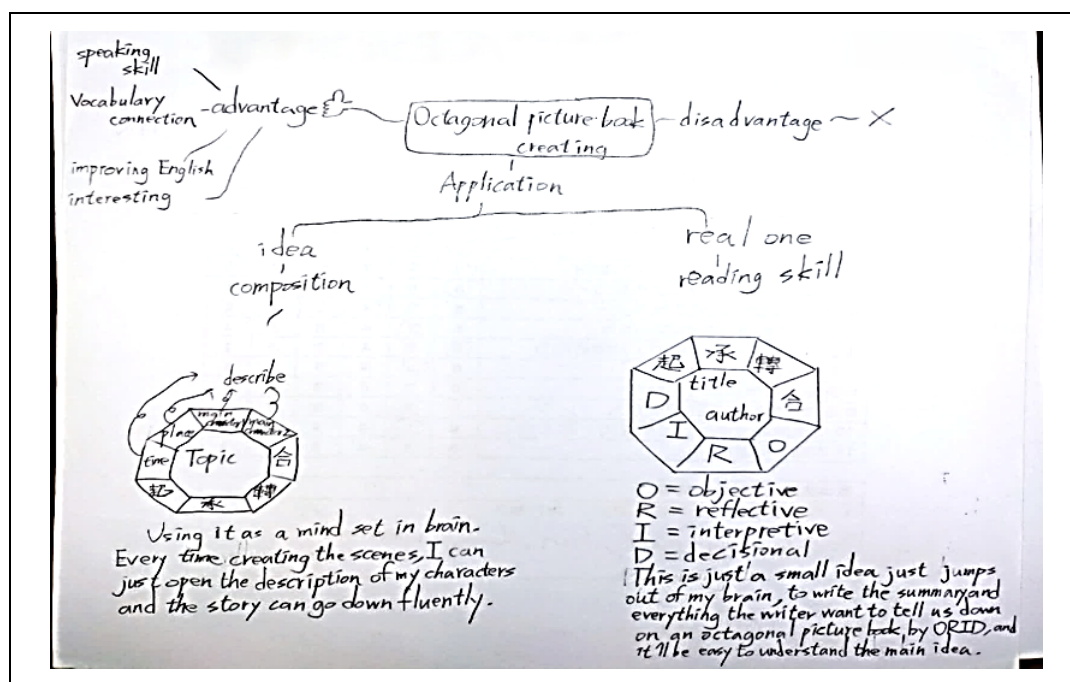
Figure 7. Mind-map 5 by a Male Student of the General Class (GC).

Conclusion

The aim of the current study was to investigate junior high school students' responses to the Octagonal English Picture Book Creating Activity (OEPBCA) in an English classroom. The major findings are shown as follows:

a. The gender and class (General Class, Language Class, and Math-Science Class) factors did not have a significant relationship with the participants' attitudes toward the OEPBCA. Nor did the grade (Grade 7, Grade 8, and Grade 9) except for items 4 (This activity encourages me to speak English) and 10 (This activity increases my social ability).

b. All the junior high school students (100%) showed their preference for the OEPBCA, regardless of gender, grade and class of junior high school.

c. Overall, more male students tended to agree with the effectiveness of the activity than females.

d. Overall, the activity was less beneficial to the G9 group than the other two groups.

e. Overall, the activity was less beneficial to the Language Class group than the other two groups.

This current study was limited to a small sample size in an English class offered for junior high school students in a summer camp, which was held at a suburban technical university in mid-southern Taiwan. Thus, the results of the study cannot be generalized to those who study in any other public and/or private junior high schools. In future studies, more junior high school students, public or private, should be recruited as participants and some other factors, such as English proficiency and attending language cram school, should be taken into account.
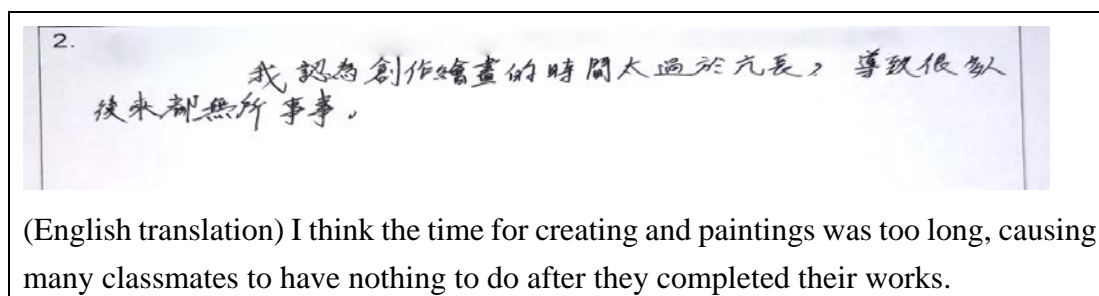
The following are four suggestions for

interested teachers who may employ the activity as part of their teaching practice:

a. The duration of the OEPBCA employed in class can depend on students' English proficiency.

b. The themes the students showed in their octagonal English picture books were not diverse enough. Students can be encouraged to explore more themes.

c. A few students were too shy to share their works with others in a small group during the sharing time, especially when they were not familiar with each other. Students should be encouraged to enjoy sharing via interpersonal interaction, and perhaps time could be allowed for an "icebreaker" or getting to know each other activity.

d. Some students completed their octagonal English picture books earlier than others, then had nothing to do and thereby felt bored (see Figure 8). Hence, such students should be encouraged to create second octagonal English picture books.

(English translation) I think the time for creating and paintings was too long, causing many classmates to have nothing to do after they completed their works.

Figure 8. One Response by a Male Student of the Math-Science Class.

Teachers can be a "valuable source of language input" (Vukelich et al., 2008, p. 56) for students. They can design teaching activities suitable for a specific student group (such as a class of junior high school students) to develop English acquisition and critical thinking skills through learning-by-doing activities. Plus, conventional activities can be changed into creative teaching activities for different courses to keep students motivated (Woodward, 2001).

A critical thinking activity is not a "one-shot treatment" (Irawati, 2014, p. 1) but part of a long-term method of educating and helping students become critical thinkers (Irawati, 2014). Several research studies have indicated that many Asian students have not been educated or encouraged to develop the habit of thinking critically (Irawati, 2014). Thus, like many educators around the world, teachers in Taiwan should implement critical thinking enhancement into different levels of education—from elementary to tertiary (Gandimathi & Zarei, 2018; Irawati, 2014)— in educational settings such as in English as a Foreign Language (EFL) or English as an Additional Language (EAL) classes because "critical thinking in language teaching enhances students' language proficiency" (Senthamarai & Chandran, 2016, p. 62). Developing critical thinking can increase foreign language proficiency and vice versa (Vdovina, 2013), so that English teachers can design their course activities like the OEPBCA to enhance students' critical thinking (e.g., imagination, creativity, and social skills) and

increase their English competency (e.g., vocabulary power, listening ability and speaking ability).

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Sustainable Emotional Sublimation: *Research on the Effects of Watching and Listening to Poetry Videos on Adolescents in Relieving Anxiety, Transferring Negative Emotions, and Reducing Suicidal Ideation*

Yong-Cih Yang[1], Ruei-Shan Lu[2,*], Hao-Chiang Koong Lin[3], Li-Wen Lu[4], Yu-Chen Liang[5], Chih-Chien Chen[6]

[1]*Center for General Education, National Taiwan University of Science and Technology, Taipei, Taiwan, R.O.C*

[2]*Department of Management Information System, Takming University of Science and Technology, Taipei, Taiwan, R.O.C.*

[3]*Department of Information and Learning Technology, National University of Tainan, Taiwan, R.O.C.*

[4]*Department of Information and Learning Technology, National University of Tainan, Taiwan, R.O.C.*

[5]*Department of Information and Learning Technology, National University of Tainan, Taiwan, R.O.C.*

[6]*Tainan City Jhong-shan Junior High School, Information Center, Bureau of Education, Tainan City Government Taiwan R.O.C.*

In an era where sustainability extends beyond environmental concerns to include mental and emotional well-being, innovative approaches are crucial. Sustainable emotional health practices can provide long-term benefits for individuals, especially adolescents. One such practice involves the use of artistic mediums like poetry to foster emotional resilience. This study utilized a self-developed poetry software to investigate the potential of Christian poetry videos in alleviating anxiety, managing negative emotions, and reducing suicidal ideation among 30 teenagers divided into low and high anxiety groups. The quasi-experimental design involved pre-tests using the Beck Anxiety Inventory, Achievement Emotions Questionnaire, Mental Health Inventory for Adolescents, and Beck Scale for Suicide Ideation. Participants were instructed to use the poetry software daily for four weeks, followed by post-tests. Results showed significant differences in AEQ scores related to humiliation in both groups post-study. The high anxiety group demonstrated improvements in physical and mental health indices with poetry software use, while the low anxiety group did not. Additionally, significant differences were observed in BSS scores for the high anxiety group pre and post-study, but not for the low anxiety group.

Keywords - Sustainable emotional sublimation, Adolescents, Music Therapy, Anxiety, Negative emotions, Suicidal ideation, Learning emotions.

Relevance to Design Practice - This study investigates sustainable emotional health design practices and can provide long-term benefits for individuals, especially adolescents.

Introduction

Promoting mental health in a sustainable manner involves creating enduring strategies that provide continuous support for emotional well-being. Sustainability in mental health focuses on developing practices that not only address immediate issues but also equip individuals with long-term coping

mechanisms. By integrating sustainable approaches into mental health practices, we can ensure that the benefits are lasting and profound. Poetry and music have long been recognized for their therapeutic effects, providing a refuge and a means of expression for many. These art forms offer sustainable methods to alleviate stress and foster emotional resilience. In the context of education, where students face relentless academic pressures, sustainable emotional support becomes crucial. The stress from academics, coupled with societal and parental expectations, often leads to significant emotional distress among youths. By focusing on sustainable emotional practices, we can help students navigate these challenges more effectively. Encouraging the use of poetry and music as tools for emotional support can provide students with sustainable ways to manage their mental health. This study aims to explore how poetry videos can serve as a sustainable method to relieve anxiety, transfer negative emotions, and reduce suicidal ideation among adolescents.

Under the constant changes in the education system, Taiwanese youths face heavy pressure from academics and examinations, coupled with parental expectations and interpersonal relationships. This pressure leads to a quarter of Taiwanese youths having a tendency towards depression and anxiety. In severe cases, they may not want to go to school or may refuse to go to school,

and as many as 30% of high school vocational students even develop a low sense of self-worth (Zhao, 2017). Anxiety is a real and serious disorder that can affect a person's thinking, sadness, despair, lack of motivation, or disinterest in life. The purpose of this study is to listen to Christian hymns so that the participants can be immersed in the hymns and music, and to investigate whether watching and listening to hymn videos can achieve the function of soothing the heart, relieving anxiety, shifting negative emotions, and reducing suicidal ideation.

Theoretical Background

Disorder (abbreviated as anxiety disorder) is a serious disorder in which a person feels depressed, sad, hopeless, unmotivated, or disinterested in life for more than two weeks, interfering with daily life and affecting a person's thinking, feeling, behavior, and functioning. Anxiety disorders are the most prevalent and common psychiatric disorders in domestic and international epidemiological surveys (Che, Hsien-Huei, Lu, Meng-Liang, Chen, Hsi-Chung, Chang, Shang-Wen, Lee, Universe, 2006). Anxiety disorders are common mental illnesses among Taiwanese adolescents. Cases with obvious anxiety symptoms rarely seek help because most of them are worried about ridicule from their classmates, resulting in untimely treatment of symptoms and, in more serious cases, suicidal

thoughts. Some studies have pointed out that the prevalence of suicidal ideation among adolescents in Taiwan is not low, and deserves the attention of the relevant sectors (Huang, Yafen, 2008).

In the United States, 26.9% of 155,026 students on 196 campuses in the decade 2007-2017 screened positive for depression, and the percentage of students diagnosed with a mental health condition increased from 21.9% in 2007 to 35.5% in 2016-2017 (Lipson, S. K., Lattie, E. G., & Eisenberg, D., 2019), the same problem exists both domestically and internationally. Research has also pointed out that late Millennials and early Gen Zers are at the height of their anxiety to the point where it is contributing to increased mental health awareness (Amels, 2021).

About 20% of middle school and high school vocational students have significant depression, and schoolwork and exams are the main sources of stress (Tung Foundation, 2011). The physical and mental health of adolescents affects their learning emotions, which in turn affects their motivation to learn. The production of emotions affects brain development and learning effectiveness, as well as creating different physical and mental states, drawing attention to the individual, creating self-worth, and forming self-memory pathways. Emotions generated during the learning process are closely related to personal behavior and learning outcomes, with positive emotions helping to motivate learners, while negative emotions are detrimental to learners' motivation and learning outcomes (Pekrun et al., 2011) (Liu, Yuling, and Shufen, 2015; Pekrun, 2006). In order to assess students' emotions during learning, Pekrun et al. compiled the Achievement Emotions Questionnaire (AEQ), in which eight types of emotions, including pleasure, pride, hope, anger, anxiety, shame, hopelessness, and boredom, which are more frequently seen during learning, were used as the test criteria for the scale, and then the scale was used to assess learning emotions. The scale was used to assess learning emotions. It has been found in the literature that if students develop positive learning emotions during the learning process, they will actively put more effort and perseverance into their coursework, and their learning performance will be better; on the contrary, if individuals experience mostly negative learning emotions during the learning process, their concentration and effort in learning will be reduced, and their learning effectiveness will be poorer (Wang, Quan-Xing, and Yang, Qiao-Jun, 2015; Lee, J.-Q. 2007; Jiazhen Zhang, 2015; Yuling Liu and Shufen Shen, 2015).

Related research on anxiety has found a significant correlation between negative mood adjustment and anxiety and suicidal ideation in adolescents (Yeh, J. T., 2001), with 8.2% of 155,026 students on 196 campuses in the U.S. over a ten-year period from 2007-

2017 experiencing suicidal ideation (Lipson, S. K., Lattie, E. G., & Eisenberg, D. 2019).

According to the Department of Health, Executive Yuan, the number of suicide deaths in 2015 was 3,675, according to the statistics found that an average of 10 people died of suicide every day, of which 49 deaths accounted for the age of 10-19 years old, in the top ten causes of death in Taiwan suicide has been ranked for four consecutive years in the rankings of the ten, and the cause of death of adolescents was ranked the second place. According to the National Health Administration's survey in 2022, 25% of high school students in Taiwan have seriously considered suicide, and the National Center for Suicide Prevention and Control statistics show that the majority of youth suicides are committed by 15-24 year olds, and the suicide death rate of youths is increasing rather than decreasing, which means that youths are exposed to long-term anxiety that affects their physical and mental health, and that negative emotions result in negative emotions, which can lead to anxiety and depression, and even trigger suicidal ideation. Suicidal ideation is the intention or thought of wanting to commit suicide, for children and adolescents, suicidal ideation (suicidal ideation) is a rather common phenomenon, and feelings, family, having a tendency to depression, and suffering from depression are the three main causes of adolescent suicidality (Chia-Yi Wu, Ming-Bin Lee, 2016), conservatively estimating that

about 20-30% of children and adolescents have suicidal ideation (Yung-Ling Hsieh, 2000), but there is no research that points out that suicidal ideation is the main cause of adolescent suicidality. 2000), but there is no research indicating that suicidal ideation is related to suicidal death, the purpose of this study is to explore how to reduce suicidal ideation without the relation to suicidal death.

In the literature on anxiety disorders caused by negative emotions, it is found that music group therapy can help to improve depression symptoms, suicidal behavior, cognitive triad and anxiety in adolescents, effectively improve adolescents' mood, reduce the risk of adolescents' suicidality, and help adolescents to reduce the feeling of stress in their daily life (Lin & Zuoting, 2010).

Music therapy is a natural medicine treatment method that utilizes music as the main focus, supplemented by medical treatment, and produces therapeutic effects mainly through music as a form of art. It is a non-invasive young applied science that starts from the concept of natural medicine. It is a young applied discipline that is based on the concept of natural medicine, non-invasive treatment, and helps patients achieve physical and mental health through the process of musical intervention (Sun Rui Yang, 2012). The main purpose of music therapy is to treat illnesses through the melody, harmony, rhythm, tonality, tempo and intensity of sounds, as well as their melodic and lyrical

combinations, in order to alleviate or eliminate the various behaviors and emotions that cause pain and suffering to the patient, as well as the resultant physical symptoms, thereby achieving the goal of treating the patient's mental and physical health. The purpose of physical symptoms is to restore, maintain, and promote the patient's physical and mental health (Dave Elliott, M.Sc., Remco Polman, Ph.D., Richard McGregor, Ph.D., 2011).

In Taiwan, from 2008 to 2020, music therapy-related master's theses mentioned that the results of music therapy research include: most music therapy practice studies have shown positive results, and the effects of music are positive and significant, both as a direct therapeutic medium and as an adjunct to other therapies (Amels, 2021). A study using the Beck Anxiety Inventory BAI and the Beck Depression Inventory BDI demonstrated significant improvement in patients with generalized anxiety disorder and suggested music therapy as a new approach in clinical psychiatry for the treatment of generalized anxiety disorder (Gutiérrez, E. O. F., & Camarena, V. A. T., 2015).

The research questions were as follows:

(1) Is there any significant difference in the physical and mental health of adolescents when using Psalms?

(2) Is there a significant difference in the AEQ mood when using Psalm software?

(3) Is there a significant difference in suicidal ideation when using Poetry software?

The purpose of this study is to design a self-developed poetry software so that the participants can listen to the poems without searching for the poems by themselves, but the types and number of poems are limited, and the length of the poems is adjusted so that each song lasts for about two minutes. The software includes Bible verses, prayers, and poems. The main purpose of the software is to interact with the test subjects in a multi-media format of music, text, and video, and to understand the effects of using the software on the subjects' physical and mental health, learning emotions, and suicidal ideation.

Research Design

Experiment Design

The first week of this study was conducted in the classroom of the Department of Digital Learning Technology at National Tainan University, while the second through fourth weeks allowed participants to zero in on the poetry software, and the fifth week featured an online post-test.

The research process was divided into two phases: the design of the digital textbook and the design of the quasi-experimental content. The digital teaching materials were based on the ADDIE teaching model, presented in a PPT

created by the homemade poetry software, with an interface that used the Fields Learning Style Inventory as a reference for learning and teaching, with four dimensions and eight types to choose from, and with content that included both prayers and church hymns, and with an interface designed to be easy for participants to use.

The students were first tested on the Beck Anxiety Inventory and categorized into two groups, high and low anxiety. Both groups were pretested on the Adolescent Emotional and Physical Well-Being Scale (AEQ), the AEQ, and the Beck Suicidal Ideation Inventory (BSAI), and then listened to the hymn software for 10 minutes per day, approximately 2 minutes per song, for a total of 10 minutes per day, for a total of 5 hymns. A posttest was administered four weeks later to compare pre- and post-test differences in adolescents' academic mood, physical and mental health, and suicidal ideation.

Research Framework

The subjects of the study were 30 teenagers aged 17 to 24 from a church in Tainan City, 28 of whom had been exposed to poetry and 2 of whom had not; 2 of the 30 teenagers were graduate students, 18 were college students, and 10 were high school students; the number of subjects in this study was limited, and it was not possible to take the 27% of the total number of subjects before and after the study;

thus, the study was directly grouped by anxiety scores for high and low anxiety, and there were a total of 15 people in each of the two groups, and the extrapolations of the results of the study are applicable only to similar contexts and subjects, and it is not suitable for generalizing the results of the study to other research arenas.

Data Collection

BAI Baker Anxiety Inventory

The Baker Anxiety Scale (BAS) was developed based on data from adult psychiatric outpatients and is applicable to psychiatric outpatients aged 17 years or older. Five scholars, including Che Hsien-huei (2006), conducted a reliability study of the Chinese version of the BAS using a sample of psychiatric outpatients and community members, and concluded that the Chinese version of the BAS has good reliability and validity, and is applicable to the screening of patients with clinical anxiety. In the present study, the degree of anxiety was measured by the subjects' self-reports. There were 21 items describing the symptoms of anxiety, and the scale was scored as 0, 1, 2, and 3 for no anxiety at all, mild anxiety, moderate anxiety, and severe anxiety, respectively, and the intensity of the subjects' self-reports was interpreted in terms of the range of the scale's total score, and two groups were divided into the high and low anxiety groups; the total score of 0-7 indicated

that the subjects had very little anxiety, A total score of 0-7 indicates that the participant has little anxiety, 8-15 indicates mild anxiety, 16-25 indicates moderate anxiety, and 26-63 indicates severe anxiety. 15 participants with a total score of 0-7 are in the low anxiety group, 14 participants with a score of 8-15, and 1 participant with a score of 16-25 are in the high anxiety group. (see Table 1)

Table 1. High and Low Anxiety Grouping Scenarios.

Score	Number of People	Anxiety group
0~7 points	15	Low
8~15 points	14	High
16~25 points	1	High
26~63 points	0	

MHIA Youth Physical and Mental Health Inventory

The MHIA assesses the physical and mental health of adolescents, and serves as a reference for screening adolescents in need of care. This scale consists of 40 questions and is applicable to students aged 12 or above and below 20 years old. In this study, there were 22 youths below 20 years old and 8 youths above 20 years old.

The following are the six subscales and the total scale of physical and mental health:

∗ Physical health: Measures the state of physical and mental health.

∗ Cheerfulness and joy: Measures depression and mental health.

∗ Leisure: Measures anxiety and mental health.

∗ Enthusiastic and outgoing: measures the state of interpersonal relationship and mental health.

∗ Self-identity: Measurement of self-identity and mental health.

∗ Positive Optimism: Measures the state of positive psychology and mental health.

The Likert 4-point scale, with side charts, allows for quick conversion between the six subscales and the percentile scores on the General Health Scale, with higher scores indicating better physical and mental health.

AEQ Learning Mood Scale

This scale is based on the Achievement Emotions Questionnaire "AEQ" User's Manual compiled by Pekrun (2005), which has three parts: pre and post-test, and contains eight emotions: pleasure, pride, hope, anger, anxiety, shame, hopelessness, boredom, etc. The pre and post-tests were conducted in the present study, and the intersection of the pre and post-tests contained five emotions: pleasure, anger, anxiety, shame and hopelessness. In this study, the pre-post test was administered, and the intersection of the pre-post test contained five emotions: pleasure, anger, anxiety, shame, and hopelessness. 15 questions were asked in each of the pre-post test and 30 questions were asked in total, and the scores were 5, 4, 3, 2, and 1 for strongly agree, agree, have no opinion, disagree, and strongly disagree, respectively.

BSS Beck Suicidal Ideation Scale (BSS)

This scale is used to detect and measure the severity of suicidal ideation in adults and adolescents. The scale consists of 21 sets of questions that measure suicidal ideation, attitudes, and severity of plans. The first 5 sets of questions are used to screen for attitudes toward life and death, and participants are only required to complete sets 6 through 19 if they are assessed to have active or passive suicidal ideation. Sets 20 and 21 are designed to provide information on the number of previous attempts to commit suicide, and the severity of the previous attempts to commit suicide.

Data Analysis

In this study, "quantitative analysis" was adopted as the research method, and SPSS statistical software was used as the analysis tool. The quantitative data used were the MHIA Adolescent Physical and Mental Health Inventory, the AEQ Learning and Emotional Scale, and the BSS Beck Suicidal Ideation Scale, and the pre-test and post-test scores were analyzed in relation to the t-tests of the independent samples, as well as the comparisons of the discrepancies.

Results of physical and mental health t-test analysis for the high anxiety group

The following is an analysis of the physical and mental health status of the high anxiety group in six dimensions, and the total of the six dimensions converted to the percentage of physical and mental health; the results of "Physical Health", "Cheerfulness and Joy", "Self-identity", and "Positive Relationships" indicated that the use of the Poetry Song software improved physical and mental health, reduced depression, strengthened interpersonal relationships, and improved self-identity, but there was no significant difference. In the analysis of "Leisure", the results

indicated that the use of the Poetry software had alleviated anxiety and improved mental health, and there was a significant difference in the results. The physical and mental health scale indicated that the use of the Poetry

software was effective in improving the physical and mental health of the participants. (see Table 2)

Table 2. Pre- and Post-independent T-test scores of students in the high anxiety group (N=15).

Wellness	Average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Physical Health	2.61	2.85		-1.147	0.261
Cheerfulness and Joy	2.72	2.92		-0.969	0.341
Leisurely	2.02	2.61		-2.355	0.026
Lively and outgoing	2.42	2.64	14	-0.974	0.338
Self-identity	3.01	3.23		-1.363	0.184
Positive and optimistic	2.70	2.98		-2.040	0.051
Percentage	30.40	51.20		-2.316	0.028

Physical and mental health status Analysis of the low anxiety group before and after the study

The following is an analysis of the physical and mental health status of the low anxiety group. There is no significant difference between the pre- and post-tests in terms of the physical and mental health status and the

percentage of physical and mental health of the low anxiety group. This means that the low anxiety group's physical and mental health was not improved to a large extent after using the Poetry Song software. (see Table 3)

Table 3. Pre- and post-test scores of students in the low anxiety group (N=15).

Wellness	Average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Physical Health	3.52	3.43		0.489	0.629
Cheerfulness and Joy	3.18	3.16		0.093	0.926
Leisurely	2.95	3.01	14	-0.249	0.805
Lively and outgoing	3.31	3.10		0.946	0.352

Self-identity	3.27	3.39		-0.644	0.546
Positive and optimistic	3.25	3.26		-0.035	0.972
Percentage	74.73	78.20		-0.401	0.691

Analysis of High-Anxiety Group's Pre- and Post-study Emotions - Five Emotions

The mean score of the post-test "happiness" was higher than that of the pre-test, which indicated that the happiness was improved after using the Poetry software, but there was no significant difference. The mean scores of the Anxiety, Anger, and Hopelessness were both lower than the median of 3, indicating that there was no significant difference in the Anxiety, Anger, and Hopelessness after using the Poetry software. The mean scores of the shame post-test were lower than the mean score of the pre-test, which indicated that there was no significant difference in shame after using Poetry Song software. (see Table 4)

Table 4. Results of t-test analysis of learning mood in the high anxiety group.

Learning Mood	average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Pleased	3.80	4.16		-1.273	0.213
Anxiety	2.62	2.87		-0.683	0.500
Anger	2.53	2.20	14	0.904	0.374
Shame	4.27	2.93		4.689	<0.001
Hopelessness	2.63	2.38		0.917	0.367

Analysis of Low-Anxiety Group's Pre- and Post-Learning Emotions - Five Types of Emotions

As shown in Table 5, there was no significant difference between the pre-test and post-test for the low anxiety group's learning emotions "pleasure, anger, anxiety, and hopelessness" after using the Poetry software. However, when analyzing the low anxiety group's post-test emotion "shame", the mean score of the post-test emotion shame was lower than that of the pre-test, which indicated that the use of the Poetry software reduced the emotion of shame, and that there was a significant difference.

Table 5. Results of t-test analysis of learning mood in the Low anxiety group.

Learning Mood	average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Pleased	3.67	4.18		-1.379	0.179
Anxiety	2.29	2.83		-1.431	0.164
Anger	2.49	2.00	14	1.108	0.277
Shame	3.60	2.31		3.116	0.004
Hopelessness	2.17	2.28		-0.354	0.726

Analysis of suicidal ideation in the high anxiety group before and after the study

In the following analysis of the high anxiety group's post-study suicidal ideation, the results of the pre-test and post-test suicidal ideation analyses were analyzed using the Poetry software, with the pre-test suicidal ideation scores (M = 3.40, SD = 4.954) and post-test suicidal ideation scores (M = 0.53, SD = 2.066) and the t-tests of the independent samples were conducted, as shown in Tables 4-5. 0.048 < 0.05, there was a significant difference between the pre and post-tests. This indicates that there is an effect of reducing suicidal ideation after using the Poetry software. (see Table 6)

Table 6. Results of Suicidal Ideation t-test in the High Anxiety Group.

Suicidal ideation.	Average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Suicidal ideation.	3.40	0.53	14	2.068	0.048

Analysis of suicidal ideation in the low anxiety group before and after the study

In the following analysis of the low anxiety group's suicidal ideation after the study, the results of the pre-test and post-test of suicidal ideation were analyzed by using the Poetry software, and the pre-test score of suicidal ideation (M = 0.40, SD = 0.828) and the post-test score of suicidal ideation (M = 0.33, SD = 0.816) were analyzed by using the Poetry software and the t-test of an independent sample was carried out, which was shown in Tables 4-6. t(14)=0.222, p = 0.826 > 0.05, and there was no significant difference between the pre-test and post-test. 0.826 > 0.05, there was no significant difference between the pre and post-tests. The mean scores of the pre-test and post-test were both less than 1, indicating that the low anxiety group did not have suicidal ideation. (see Table 7)

Table 7. Results of Suicidal Ideation t-test in the Low Anxiety Group.

Suicidal ideation.	Average		Degree of Freedom	t	p
	Pre-testing (*N*=15)	Post-test (*N*=15)			
Suicidal ideation.	0.40	0.33	14	0.222	0.826

Discussions

Effects of Using Poetry Software on Adolescents' Physical & Mental Health

According to the results of the study, the high anxiety group had a mean score of 30.40 for the pre-test and 51.20 for the post-test on the six dimensions of physical and mental health, and the mean scores of the two groups were analyzed, with a significant difference of 0.028, which indicates that the use of the Poetry software can effectively improve the physical and mental health status of the test subjects. The mean scores were analyzed and the significant difference was 0.028.

Among the six dimensions of physical and mental health, although there were no significant differences in the five dimensions of physiological health, cheerfulness and joyfulness, liveliness and extroversion, self-identity, and positive optimism, the scores of the latter dimension were larger than those of the former dimension. The use of Poetry Song software can reduce depression, improve physiological and psychological health and self-identity, strengthen interpersonal

relationships, and effectively improve positive psychology and transfer negative emotions. Especially in the Leisure and Comfort dimension, there was a significant difference between the pre and post-tests, which indicated that the use of Poetry Song software could alleviate anxiety and improve mental health.

The low anxiety group showed no significant difference in the six dimensions of mental and physical health, indicating that the low anxiety group did not need to use the software to improve their mental and physical health, as their mental and physical health was already in a normal state.

Differences in AEQ Learning Emotions Analyzed by Using Poetry Software

From the results of the learning mood analysis, it was found that there were no significant differences in the learning moods of pleasure, anger, anxiety, and hopelessness while there was a significant difference in the learning mood of shame when watching and listening to the Psalms video. In the high anxiety group, the mean score of shame in the pre-test was 4.27, and the mean score of shame in the post-

test was 2.93. The mean scores of the two groups were analyzed, and the significance value was <0.001. It can be deduced that watching and listening to poetry videos can reduce the emotion of shame. The mean score of the post-test of learning emotion happy was higher than that of the pre-test, although there was no significant difference, but there was an increase in the emotion of happy. The mean scores of the pre-test and post-test of the learning emotions anger, anxiety, and hopelessness were all lower than the median of 3, which had no effect on the learning emotions.

Interestingly, there was also a significant difference in shame in the low anxiety group, indicating that students were more concerned about what their peers thought of them when they were studying.

Effectiveness of Poetry Software on Suicidal Ideation

In the high anxiety group, the mean score of suicidal ideation in the pre-test and post-test after using the Psalm software was 3.40, and the mean score of suicidal ideation in the post-test was 0.53. After analyzing the mean scores of the two groups, the mean score of the two groups was 0.048, which is a significant difference, indicating that the use of the Psalm software has an effect on lowering the level of suicidal ideation.

Conclusion and Future Work

From the results analyzed in this study, it can be seen that the use of poetry software can alleviate anxiety and improve mental health, echoing previous research that music can control anxiety and have a positive effect on stress symptoms.

For the five learning emotions in this study, there were significant differences between the high and low anxiety groups in terms of shame, which is a negative emotion. It can be inferred that watching and listening to poetry videos can reduce the emotion of shame and transfer negative emotions to positive emotions.

From the results of this study, it can also be seen that music group therapy is effective in reducing the risk of suicide among adolescents, and it can also help adolescents to reduce their feelings of stress in their daily lives, echoing the research of (Lin, 2010). Based on the results of the study and the scales used, the following recommendations are made for future research.

(1) This study focuses on the youth of a particular church, with a sample size of only 30. It is suggested that in the future, the sample size could be enlarged to focus on youth who have not been exposed to hymns, in order to obtain better statistical data. It is also suggested that more qualitative interviews be conducted with the respondents in the hope that more

people will come into contact with the Church's hymns and the Creator, God, as described in the hymns.

(2) Four scales were used in this study, three of which required payment. On the one hand, the need for qualified personnel to administer the scales increased the complexity of the study, and on the other hand, it is recommended to look for free or author-authorized scales.

(3) If the digital poetry software used in this study could be developed into an app, it would be more convenient for the participants to operate and listen to the poems, and the effectiveness of each item would be improved.

Finally, it is hoped that the systematic framework and methodology provided in this study will lead to more research on this or other related religious issues in the future.

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Integrating the ADDIE Instructional Model and 4D Design Thinking: Teaching Approach for Experiencing Rural Life Beyond the Classroom

Li-Shu Lu

Department and Graduate School of Digital Media Design, National Yunlin University of Science and Technology, Taiwan R.O.C.

This study adopted action research as the foundation for teaching practice research, aiming to integrate the ADDIE instructional model with the 4D design thinking method to develop innovative teaching strategies and practices. The teaching process was observed and analyzed using the foundational Digital Music course in the Department of Digital Media Design at the National Yunlin University of Science and Technology (YunTech) as a case study. The research findings are as follows. First, the project-based teaching framework for field application in the Digital Music course comprises three main units operating in parallel: 1) introduction to sound and soundscapes, field exploration, and sound map construction; 2) music fundamentals and imagery, sound collection, and documentary analysis; 3) software applications and practical implementation, transforming field sound imagery into practice. Second, based on observations of the field-based practice course and analysis of students' learning reflections, this study concludes that foundational courses for first-year students can be effectively designed using field-oriented, problem-based, and thematic project approaches. This approach enables students to simultaneously acquire theoretical knowledge and engage in project-oriented problem-solving processes, thereby enhancing their critical thinking and problem-solving abilities.

Keywords – ADDIE instructional model, 4D design thinking, rural field, teaching process.

Relevance to Design Practice – This article mainly focuses on the teaching planning of the ADDIE teaching model, combined with the design thinking methodology, into the basic course of digital music, and takes the recording, analysis and application of rural local sound landscapes as homework topics to train students to combine field sounds. Use music software to create local image sounds for rural field.

Introduction

Due to current global trends in educational development, the mission of talent cultivation has shifted from producing knowledge workers to fostering creative thinkers. The role of educators has expanded beyond unidirectional knowledge transmission to include guiding knowledge construction, promoting practical application, and acting as co-learning partners. Cross-disciplinary teaching teams now share

responsibility for university social accountability, breaking traditional classroom boundaries by bringing students into real-world settings. This approach employs problem-based learning to integrate knowledge and practical skills through project-oriented practice and training. This evolution signifies that the mission of educators has become more diverse, interdisciplinary, and innovation-driven.

In fostering the capacity for social engagement aligned with university social responsibility, cultivating interdisciplinary thinking and field-based empathy is essential. The importance of cross-disciplinary and practical field concepts can be traced back to Lee's *Becoming 21st Century Talent* (2006), which identified seven essential types of individuals for the 21st century: (1) generalists who integrate knowledge; (2) innovative practitioners; (3) cross-domain collaborators; (4) individuals with high IQ, EQ, and SQ; (5) effective communicators; (6) passionate workers; and (7) optimistic achievers. Taiwan's *Ministry of Education White Paper on Talent Cultivation* (2013) outlined six critical capabilities for talent over the next decade: global mobility, employability, creativity, interdisciplinary expertise, information literacy, and civic engagement (Ministry of Education, 2013). Similarly, Cheng (2016), in *Reimagining University Education: The Shifting Learning Ecosystems in Stanford 2025*, emphasized the "Axis Flip" in learning ecosystems, addressing contemporary competency-based learning by focusing on cross-disciplinary technical and practical skills. This demonstrates that industry demands increasingly emphasize cross-disciplinary collaboration as a core criterion for talent selection.

Furthermore, generational shifts and increased accessibility to information underscore the importance of cultivating diverse, interdisciplinary skills. Universities must also uphold their responsibility for local engagement and social care while adapting to the increasing diversity of student backgrounds and changes in learning trajectories brought about by Taiwan's 108 Curriculum Guidelines reform. These changes necessitate adjustments in teaching design to align with evolving needs. For instance, teaching must center on "core competencies" across three dimensions: "autonomous action," "interactive communication," and "social participation." These competencies aim to nurture students into people-centric "lifelong learners," thereby reshaping the learning experiences and pathways of technical and vocational education students.

The establishment of social participation competencies aligns seamlessly with universities' responsibilities for social engagement, field participation, and societal practice, extending and enhancing these concepts. This study focuses on the Fundamentals of Digital Music course in the Department of Digital Media Design. For students in this discipline, understanding music and sound effects is fundamental to developing audiovisual appreciation and technical skills. These professional concepts and practical skills enable them to compose music for animation, games, short films, or interactive exhibition contexts, fostering their creative abilities in sound design and production.

In summary, this study revisits the principles and guidelines of instructional design to enhance students' design thinking abilities. The ADDIE instructional model is applied to evaluate and refine the current course implementation. Additionally, the study incorporates the 4D

service design methodology into a design practice course focused on soundscape design within real-world contexts. This research proposes innovative teaching strategies through an instructor-as-researcher approach involving planning, implementation, observation, reflection, and continuous refinement. The study addresses the changes introduced by new curriculum policies and aims to establish a teaching model that integrates digital music courses into field practice-based curricula. The approach is student-centered, emphasizing the integration of audiovisual capabilities, the development of professional knowledge, and the cultivation of practical abilities through real-world engagement. The ultimate goal is to nurture socially conscious, passionate, and innovative interdisciplinary talent equipped with practical application skills, thereby enhancing students' employability and fostering entrepreneurial innovation capabilities.

Literature Review

The ADDIE instructional model and design thinking methodology**.** The ADDIE model is a widely adopted and straightforward approach to systematic instructional design. Systematic instructional design refers to an organized and systematic process that supports learners in achieving specific learning objectives through the structured development of learning systems (Lin, 2009). The model consists of five phases—Analysis, Design, Development, Implementation, and Evaluation—collectively referred to as ADDIE based on their initials (Lin, 2009; Chen, 2020), as shown in Table 1. Yu (2011) applied the ADDIE model within the Instructional System Design (ISD) theory framework to develop a digital learning platform for physical education. This platform offered instructional materials in three areas: sports techniques, rules, and injury first aid. It enabled learners to effectively acquire self-directed sports skills while fostering mutual assistance and cooperation (Yu, 2011). The ADDIE model focuses on three core components: what to learn (defining learning objectives), how to learn (applying learning strategies), and how to evaluate (implementing learning assessments to determine whether learners have achieved the desired outcomes).

Table 1. The Five-Step Systematic Instructional Design Model of ADDIE. (Source: Chen, 2020)

Stage	Content
1 Analysis	Learning objectives, instructional content, learners' prior behaviors.
2 Design	Instructional activities, teaching strategies.
3 Development	Instructional materials production, teaching resources.
4 Implementation	Implementing instruction, using media.
5 Evaluation	Formative assessment, summative assessment.

In addition, for the design field and the field practice courses, this study posits that the 4D design thinking method is particularly suitable. This approach is derived from the "Double Diamond" design process (also referred to as the 4Ds) proposed by the British Design Council. The process consists of four phases: (1) Discover phase: The service design team

identifies and prepares methods, gathering relevant and insightful information (first creative divergence); (2) Define phase: Through systematic categorization and analysis, key touchpoints and service gaps are defined (first creative convergence); (3) Develop phase: The service design team engages in brainstorming, strategy planning, and prototype creation and refinement through workshops (second creative divergence); (4) Deliver phase: The service design team validates the design prototype with customers and stakeholders in the value network, developing specific implementation methods

(second creative convergence), as illustrated in Figure 1 (Design Council, 2005). Sung (2014) also proposed a universal service design process known as the IDEA Service Design Process (IDEA SDP), comprising four phases: Explore, Design, Execute, and Evaluate. This study argues that the 4D design method has become a widely adopted approach in design field teaching in recent years. Therefore, it integrates the ADDIE teaching strategy with dual-track design practice thinking to design and apply digital music course materials.
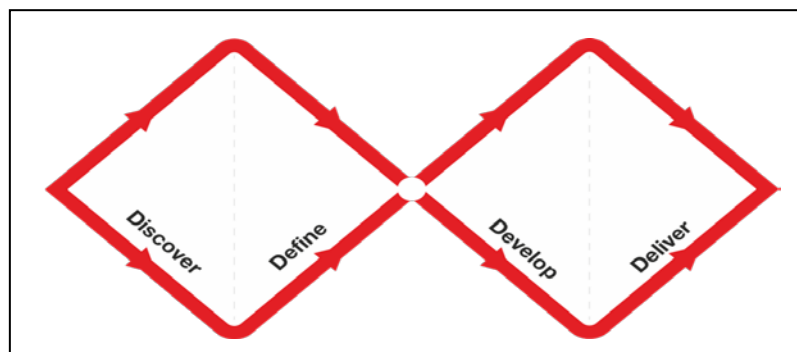

Figure 1. The Double Diamond Design Process (Design Council 2005).

Problem-based and project-based learning model

Field-based teaching models primarily begin with observation and problem needs, with a clear target audience in mind. Therefore, in terms of learning, such models often adopt a problem-based and project-based learning (PBL) approach. At present, interdisciplinary learning fundamentally relies on PBL as its guiding principle. In PBL, students are presented with real-world problems as course content, fostering student-centered learning processes that encourage active exploration and the development of an active learning mindset. PBL originated in the 1960s at McMaster University in Canada, where medical faculty used real

medical problems as course content, prompting students to collaboratively explore solutions in groups (Huang, 2007). Barrows (1996) emphasized that PBL achieves learning objectives through problem-solving, replacing traditional curriculum content with problems. Barrows outlined the following characteristics of PBL teaching: (1) student-centered learning, where students take responsibility for their own learning by identifying what they need to learn, and understanding how to acquire it; (2) small group learning, typically consisting of four to eight members, where students learn to develop teamwork skills through group interaction; (3) teacher as facilitator and guide, helping students to ask meaningful questions to gain a deeper understanding of the problem, encouraging

students to pose key questions to each other; (4) organizing problems to stimulate learning, presenting real-life situations through written text, video, and computer simulations, integrating them across various disciplines and serving as clues for collecting new information; (5) problems as key elements in problem-solving skills, where teaching should focus on real-life problems, such as having students ask patients questions, perform physical exams, or conduct pathology tests to fully understand the nature of the problem; (6) self-directed learning, where students engage in discussion, comparison, analysis, and debate to develop broader perspectives and divergent thinking.

Project-based learning (PBL) originates from the educational philosophy of American thinker John Dewey (Tsao & Chen, 2015). As a constructivist learning approach, it emphasizes student-centered teaching activities. By adopting the concept of "learning by doing," PBL organizes thematic project tasks that encourage students to integrate knowledge from different fields and collaborate to develop practical skills. This process fosters autonomous learning and enhances problem-solving abilities (Chang, 2017). Moursund (1999) described the characteristics of PBL from both student and teacher perspectives: From the student's perspective, PBL promotes collaboration and cooperative learning by producing challenging works, reports, or performances, allowing for continuous improvement and expansion. This approach actively engages students in "learning by doing." From the teacher's perspective, PBL is rooted in constructivism, focusing on real content and purpose. Teachers act as facilitators, setting clear educational goals and establishing concrete evaluation criteria, allowing students to follow specific standards to complete their

projects while also enabling teachers to learn from the process (Hao, 2021). Research on PBL for university students has demonstrated positive outcomes in areas such as communication skills, teamwork, self-growth, creativity, critical thinking, and project management (Chang, 2017). As a result, universities are increasingly promoting PBL to encourage thematic or problem-solving learning. This approach aims to break disciplinary boundaries, foster cross-disciplinary thinking and social participation, and improve practical skills.

The teaching practice course in this study begins with an exploration of field-related problems. Through the application of professional knowledge, skills, and interdisciplinary collaboration, students propose innovative solutions. This course is grounded on PBL and PjBL models, emphasizing the learning process and cognition throughout its implementation. Real-world problems are inherently complex and multidimensional, rarely confined to a single discipline. These challenges are further amplified by evolving educational curriculum policies, diverse student backgrounds, and the necessity for cross-disciplinary thinking. To address these complexities, this study employed action research as its core teaching practice framework. The ADDIE teaching model and 4D design thinking methods are integrated to develop and implement innovative teaching strategies. From the dual perspectives of the instructor and researcher, the course is systematically planned, executed, observed, and reflected upon, aiming to further explore students' challenges and perceptions during their engagement with this course model.

Research Process

This study primarily employs the concept of action research, the ADDIE instructional model, and the 4D design thinking method to plan teaching activities and field practice. Additionally, it further evaluates students' learning perceptions and assessments of field-based teaching through a questionnaire survey. The survey consists of a pre-test conducted before the course and a post-test administered after the course to gain insights into students' learning perceptions and challenges in field-based teaching. The overall research process is illustrated in Figure 2.
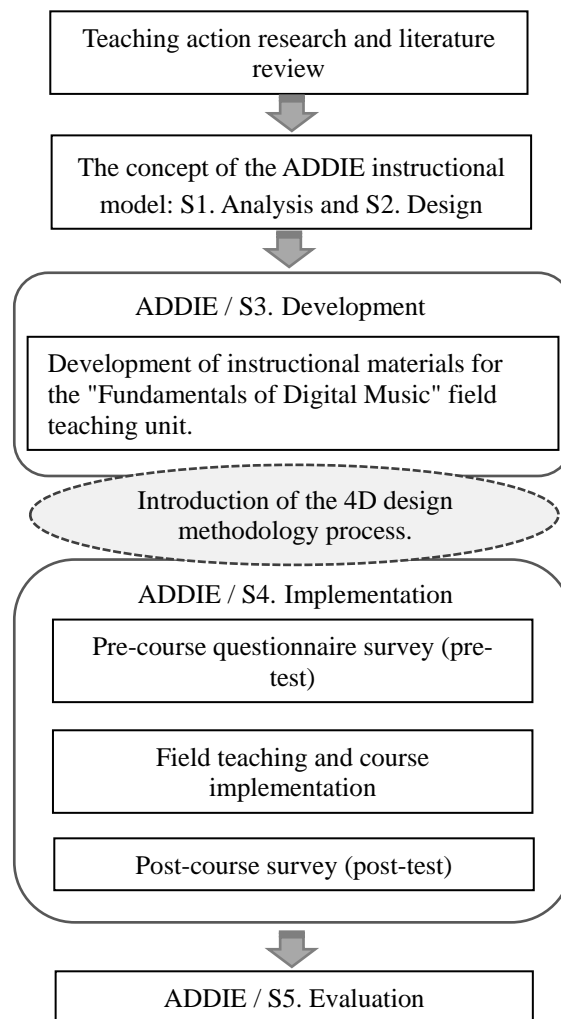
Figure 2. Teaching Research Implementation Flowchart.

Research subjects and field

The course is based on the "Fundamentals of Digital Music" course offered by the Department of Digital Media Design at YunTech in 2023. The participants are primarily students from the Department of Digital Media Design, College of Design, YunTech, with approximately 50 students. The course adopts a group project approach to explore the field of soundscape and image music design. Teaching assistants (TAs) observe individual behaviors and conduct interviews as part of the teaching practice research. The research focuses on creating rural imagery for the Wutu Community in Linnei Township, Yunlin County, and integrates the 4D design thinking method into

the field project. The overall research process follows a project-based and problem-guided approach, consisting of three stages: 1) the Pre-project phase, where the project objectives are explained, allowing students to understand field problems and definitions while constructing design perspectives and fostering creativity; 2) the Design development phase, where students are grouped into teams to brainstorm ideas, apply sound collection, and execute production; 3) the Proposal and reflection phase, where surveys and team reflections are used to gather feedback and suggestions from students regarding the course design, which can be used to revise and adjust the teaching methods in this study.

Course Unit Requirements and Research Plan

The teaching process in this study is primarily based on the ADDIE model for course planning and construction. The third stage of ADDIE, D (Development), and the fourth stage, I (Implementation), focus on curriculum design, field resource integration, and the application of teaching materials within the course. Additionally, the 4D design thinking method is incorporated into project-based field teaching, along with the collection of student feedback and reflections. The course execution teaching units and research concepts are presented in Figure 3.
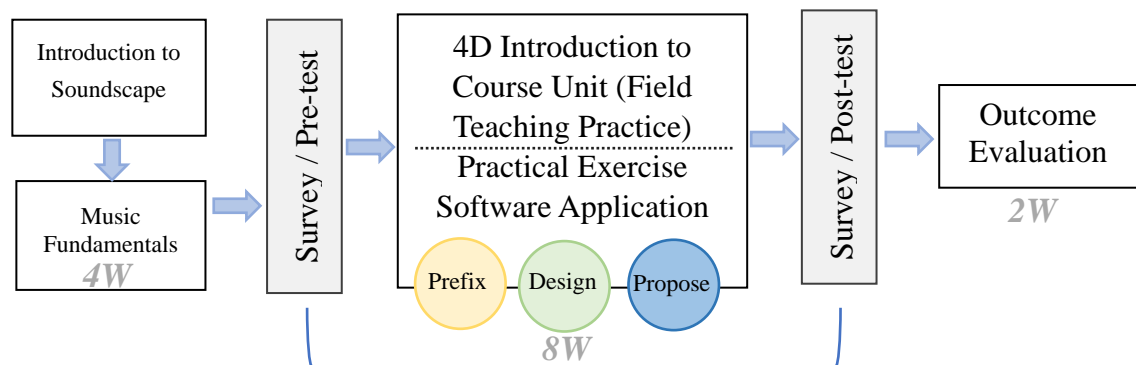

Figure 3. Concept Map of Teaching Units and Research Implementation in Course Execution.

Survey and Data Processing

The survey primarily employed pre- and post-tests, along with student feedback, to further clarify the issues and challenges students encounter during their learning process. Based on these findings, adjustments to the course execution and corresponding countermeasures were proposed. The survey design mainly focuses on three key aspects: students' learning attitudes, cognitive load, and flow experience (Hwang et al., 2013; Pearce et al., 2005). The survey items are categorized as follows: 6 items on learning attitude, 8 items on cognitive load,

and 8 items on flow experience. Each question is rated using a Likert scale, with 1 representing "disagree," 2 representing "neutral," and 3 representing "agree."

Teaching Practice Research Results and Discussion

Teaching Process Planning

The teaching objectives of this course are designed to establish students' foundational concepts of digital music creation by introducing fundamental music theories and

digital music application software. Through the analysis and discussion of cases that combine music and visuals, the course aims to develop a conceptual understanding of integrating music and imagery. Additionally, students will enhance their sensitivity to sound and music through practical audio recording exercises, exploring sound, and analyzing recordings. This process helps cultivate the ability to integrate visual and auditory thinking within the digital media field. To achieve these objectives, the study adopted a PBL and PjBL approach as the guiding framework. These approaches emphasize social engagement and practice, fostering students'

cross-disciplinary thinking and their innovative capacity for social practice. The teaching design is centered on action research as the core of teaching practice, using the ADDIE model as the foundation for overall instructional planning. Furthermore, the 4D design thinking methodology is incorporated as a professional application tool. Guided by PBL and PjBL concepts, the course focuses on socially engaged, field-based problem exploration that encourages students to propose feasible solutions. The teaching process and research framework of this study are illustrated in Figure 4.
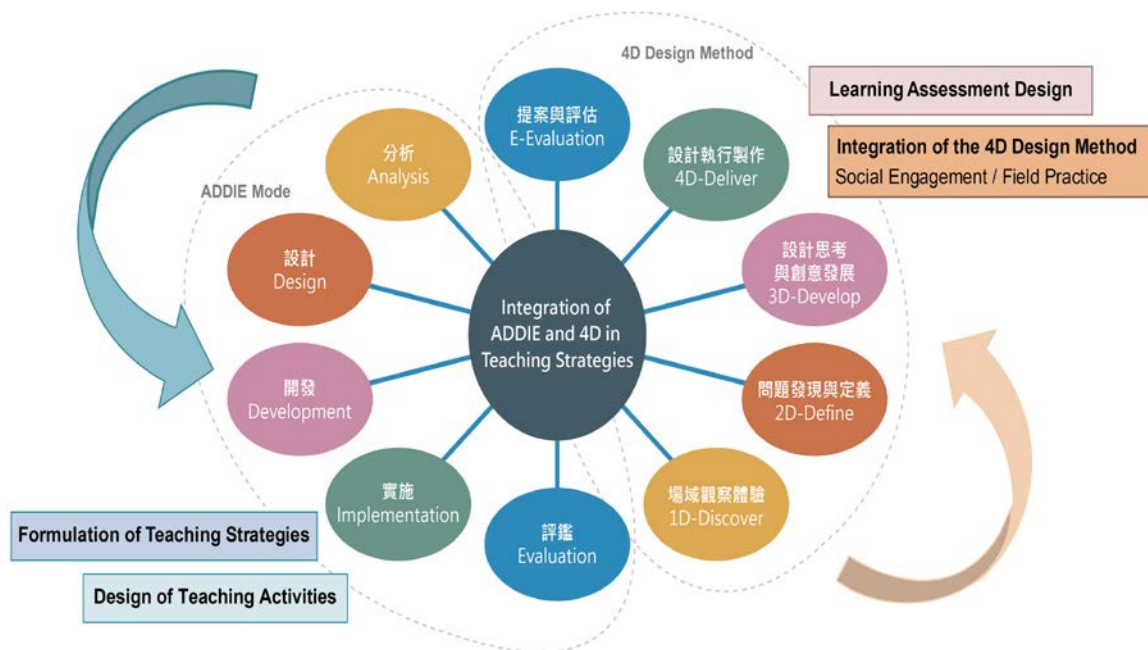

Figure 4. Teaching Process and Research Concept Diagram.

Teaching Material Development and Design

This study integrates the 4D design thinking method into project-based field teaching, with the primary goal of marketing the field's auditory (sound) and visual (scenic) characteristics through field observation and analysis. The assignment progresses as follows: (1) Field Exploration: Through on-site field

exploration, students collect or capture emotionally impactful images of the local area, as well as sound recordings, to facilitate the subsequent design and production of soundscapes; (2) File Management: Students create a project design database using sound and image recording tables; (3) Soundscape Documentation Design and Execution: This includes background music (MIDI, soundpool

material selection), environmental sounds, sound effects (self-recorded), narration/dialogue (group recordings), and other elements. Each group of students is encouraged to apply creativity to address issues in rural fields (1D-Discover), followed by guiding students to gain a deeper understanding and definition of the field issues (2D-Define). After clarifying and defining the problem, students apply their design expertise to seek feasible solutions (3D-Develop) and implement and produce the proposed solutions in groups (4D-Deliver). The related teaching material unit design is as follows:

*Unit 1: Soundscape Concepts and Sound Map Construction (1D)*

First, the instructor will introduce the course objectives and relevant content through lectures and presentations, establishing a foundational knowledge of related theories. The content includes the development context of soundscape concepts and case studies on the application of soundscapes in urban and rural development. The teaching materials for this unit include a soundscape concept lecture based on Wang (2001) and Tilly (1974)'s location triangle framework, which considers people, space, and activities, as well as Schafer's (1977) soundscape triangle, which addresses elements such as source, signal, and keynote. These frameworks provide a basis for exploration and analysis. The goal is to explore and analyze the cultural characteristics of rural villages through field exploration and soundscape listening and reading. The related methods and theories are

based on the field's own historical literature (including cultural, social, and natural landscape features) and observation methods for analyzing the field's environmental images (visual) and sounds (auditory). Additionally, a "resource survey" for field observation will be introduced to help students better understand the field soundscape resource survey and data collection procedures for the next stage.

Unit 2: Soundscape Documentary Analysis of Rural Field (2D)

This unit's teaching material primarily guides students into the field of Wutu Village in Linnei Township, the research site for this course. The investigation is based on the five senses of perception and experience, focusing on the observation, experience, and documentation of the five senses: sight, hearing, smell, taste, and touch. The observations and recordings emphasize the experience and analysis of urban and rural landscapes through visual text (images), leading each student group to participate in field observation. Records are primarily in the form of text and visual images, with additional documentation such as written descriptions, drawings, photography, or video recordings to support the overall experiential documentation. Additionally, the unit focuses on the experience and analysis of auditory texts in urban and rural landscapes, documenting sounds heard in the field, such as natural sounds, human-made sounds, and social sounds, with reference to concepts like those in Figure 5 (Lu, 2018).
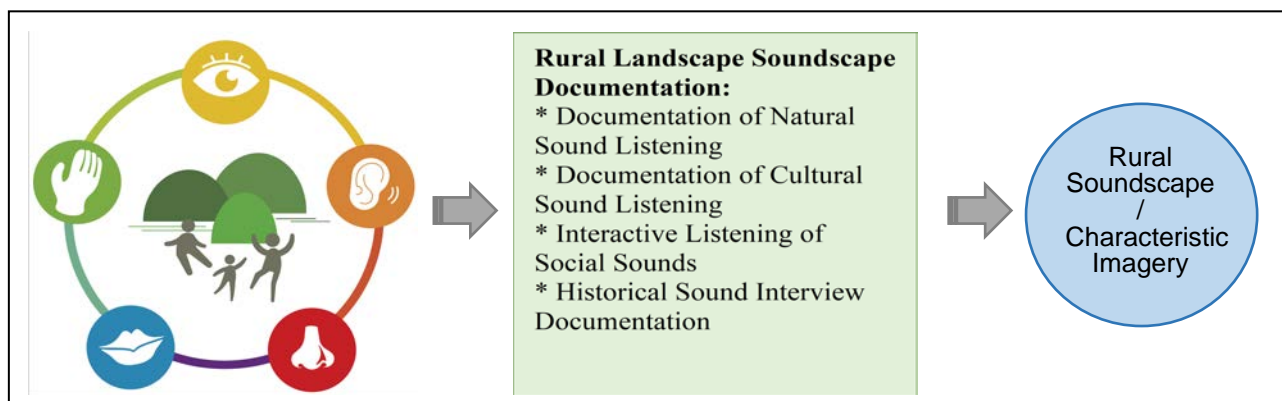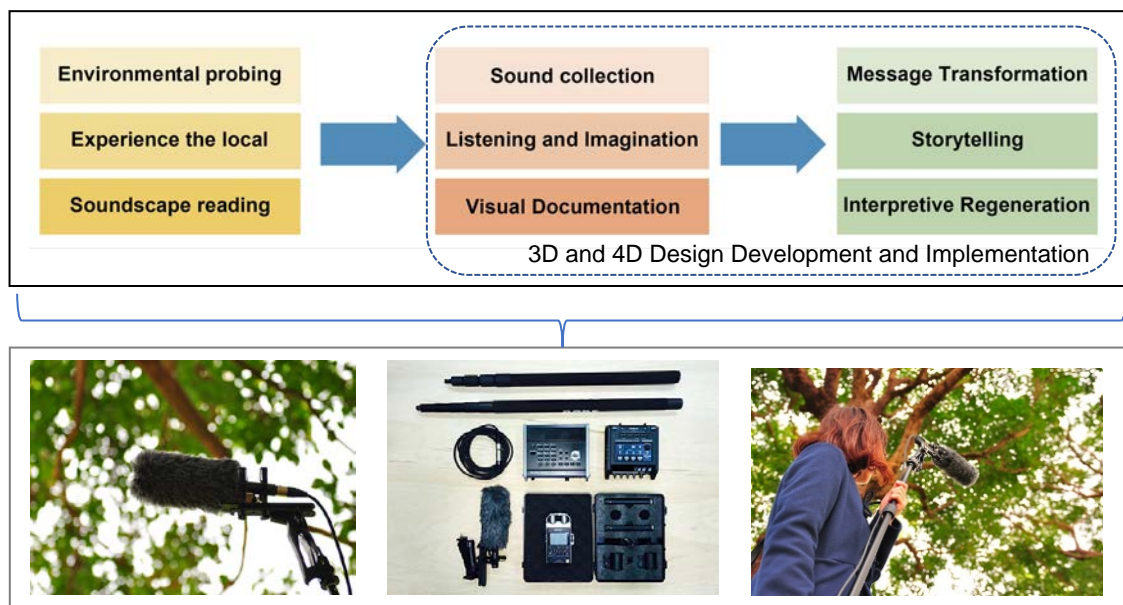
Figure 5. Explanation Diagram of the Rural Soundscape Documentation Process.

Unit 3: Soundscape Collection Methods and Transformative Practice (3D, 4D)

This unit focuses on recording techniques and the operation of video recording equipment to assist students in conducting soundscape listening and collection in the field. Through collaborative instruction with guidance from field experts, students will participate in exercises designed to transform visual and auditory elements. Students will engage in discussions and brainstorming sessions about the unique soundscape characteristics of rural areas, which will culminate in the creation of audio-visual promotional works. The operational reference concept is illustrated in Figure 6 (Lu, 2018).

Figure 6. Explanation Diagram of the Rural Soundscape Documentation Process.

Field Study Process and Practical Outcomes

The field study week corresponds primarily to the third phase of the ADDIE model—Development (D) and the fourth phase—Implementation (I), during which instructional materials are designed, the field study is conducted, and the materials are integrated into the teaching curriculum. The pre-course establishes the foundational concept of

soundscape, followed by an actual field exploration of Wutu Village, Linnei Township, to understand the area's issues and needs. Subsequently, local sound collection and visual documentation are conducted, such as capturing rural landscapes, bird calls, and flowing water sounds. Finally, information transformation and storytelling create local field imagery and audio-visual works. Each group of students integrates the soundscape concept into the local imagery of the rural area, exploring how this concept can promote rural cultural features and audio-visual applications. Some of the outcomes are shown in Table 2.

Table 2. Field Study Implementation Results (Partial Examples/2 Groups of Works).

| 1D - Field Listening and Observation. | 2D - Field Experience and Definition. | 3D - Field Imagery Design. | 4D - Field Soundscape Implementation. |

Field Teaching Questionnaire Analysis

This study primarily utilized pre- and post-surveys, along with students' reflections, to further clarify the issues and challenges encountered during field-based learning. The questionnaire design focused on three main dimensions: learning attitudes, cognitive load, and flow experience.

The questionnaire items were categorized under these dimensions, with responses rated on a 3-point scale: 1 representing "disagree," 2 representing "neutral," and 3 representing "agree." The analysis details are as follows. The study participants consisted of 50 students enrolled in the course. The research questionnaire was conducted in two stages: a pre-test and a post-test. Only students who completed both stages were included in the final sample. A total of 31 students completed the pre-test questionnaire, while 51 students completed the post-test questionnaire. After data collation and analysis, only the 28 students who completed both questionnaires were considered valid samples for the study.

Therefore, the subsequent analysis was based on these 28 questionnaires. Notably, the discrepancy in questionnaire numbers was primarily due to the impact of the COVID-19 pandemic). The study analyzed learning attitudes, cognitive load, and flow experience using mean values, as shown in Table 3.

Table 3. Learning Attitudes, Cognitive Load, and Flow Experience.

Aspect	Question	Average	
		Pre	Pro
Learning Attitude	1. I find this course interesting and valuable.	1.86	2.29
	2. I want to learn more about the content of this course and observe it further.	1.82	2.54
	3. I believe learning the topics related to this course is worthwhile.	1.71	2.50
	4. I believe it is important to understand the relationship between this course and the living environment.	1.89	2.46
	5. I will proactively search for additional information to learn more about this course.	1.79	2.68
	6. I believe this course is important for everyone.	1.96	2.61
Cognitive Load	1. The learning content in this activity is challenging for me.	3.00	3.11
	2. I put significant effort into answering the questions in this activity.	3.50	3.18
	3. Answering the questions in this activity caused me distress.	3.25	3.75
	4. Answering the questions in this activity made me feel frustrated.	3.25	3.89
	5. I did not have enough time to answer the questions in this activity.	3.39	3.93
	6. The way the course material is presented in this activity is somewhat challenging for me.	3.46	3.50
	7. I have to exert considerable effort to complete this learning activity and achieve its objectives.	3.04	3.25
	8. The teaching method used in this learning activity is difficult to understand or keep up with.	3.36	3.75
Flow Experience	1. The tasks I performed in this activity were completely within my control, and the outcomes were exactly as expected.	2.79	2.86
	2. I am highly engaged in this activity.	2.50	2.54
	3. I find this activity enjoyable.	2.29	2.32
	4. I am fully immersed in this activity.	2.43	2.54
	5. I find this activity interesting.	2.14	2.86
	6. During this activity, time passes quickly.	2.07	2.21
	7. This activity sparks my curiosity.	2.07	2.43
	8. I understand what I need to do in this activity.	2.04	2.43

In addition, suggestions based on interviews with students include: "The course allows us to go to nearby villages through off-campus teaching to listen to the sounds in the villages and associate them with each other. It is interesting and can stimulate imagination", "Through careful listening and sound analysis to improve one's own observation and imagination." "Going into the field with a study sheet and actually collecting sounds will really help in learning sound construction and analysis." "Different sounds can be transformed into other sound effects. "I think it's interesting to record sounds and then imagine the imaginary parts. It helps me pay more attention to the sounds around me." This course brings learning in the classroom into the rural field. In addition to making students feel fresh and interesting, everyone generally thinks Through the observation, listening and recording of environmental sounds, they have more concepts and imagination about sound design.

Based on the above and post-activity interviews, this study found that in terms of learning attitude, students initially felt curious and intrigued by the integration of digital music fundamentals with field-based learning. They considered learning about field sounds and music fundamentals important and worth exploring. Regarding cognitive load, students experienced confusion and concern when field-related topics were integrated into the basic course. Overall, in terms of flow experience, students felt engaged in the activities and experienced curiosity and enjoyment after implementing field-based teaching.

Course Reflection and Suggestions

In summary, reflecting on the course execution, this course began with experiential observation of rural landscapes, guiding students to Wutu Village, Linnei Township, Yunlin County. It focused on problem exploration and experiential observation in this rural area, addressing issues faced by field partners and future development needs, with proposals for soundscape audiovisual marketing ideas and production plans. The course utilized the 4D design method and a workshop format, guiding students through the process of field-based experiential observation, which led to the initiation of the 4D design process, culminating in potential solutions for the field's challenges. The 4D workshop primarily focused on the preliminary resource research and experiential observation phases of the creative process, which corresponds to the 1D (Discover) and 2D (Define) stages of the 4D design thinking method. Through field observation, sensing, insight, and on-site learning methods, students uncovered and analyzed characteristics to create local highlights using digital music design thinking. The teaching process of field observation and experience is illustrated in Figures 7. The field design development and proposal, corresponding to the 3D (Develop) and 4D (Deliver) stages of the 4D design thinking method, are shown in Figures 7 as well. Based on the feedback and suggestions from the students who participated in this course, the following points were highlighted: The field sound construction and analysis section was generally regarded as interesting. Students appreciated the opportunity to listen to and imagine sounds from the surrounding environment in actual field settings, which sparked their imagination. They found it a valuable experience that enhanced their

observation and creativity. Different sounds could be transformed into various sound effects, and the process of recording and re-imagining these sounds was particularly engaging, helping students pay more attention to the sounds around them. Using a worksheet during fieldwork and actively collecting sounds aided the learning process of sound construction and analysis. The field theme soundscape and soundtrack production section allowed students to combine natural sounds recorded in the field with artificial compositions to create the most suitable sound effects for videos. By visiting rural hidden spots in Linnei Township, students were able to create location-appropriate soundtracks. They also learned how to execute a project, where problems were analyzed, and solutions were developed through observation, experience, and analysis.

Based on the above feedback from students, as well as the instructor's own observations of the course (the course instructor is also the observer for this study), practical application and problem-solving abilities, guided by field issues, can be integrated into the teaching environment and classroom context after the curriculum reform. Historically, field-based teaching in this study has mainly been applied to upper-year students. However, through the practice of this course, it was found that first-year students can also engage in field-based, problem-oriented, thematic learning, which combines theoretical knowledge with problem-solving processes. Additionally, this study suggests that if such a course is offered in the future, it should span at least one academic year. The course structure should include field observation and analysis, audiovisual documentation, and music and video editing production, serving as a bridge between the two semesters. It is hoped that the analysis of the teaching process from this study will serve as a reference for future courses or related research topics.

Figures 7. The collection of the field observation and experience, development and proposals.

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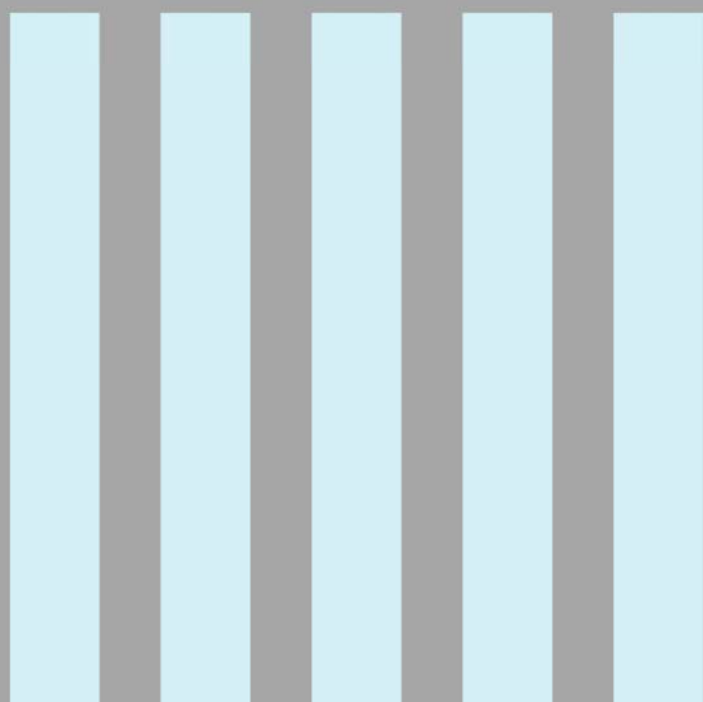
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