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Integration of ARCS Motivational Model and IT to Enhance Students Learning in the Context of Atayal Culture

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ABSTRACT

This study involved using teaching strategies from the ARCS Motivational Model to develop new interdisciplinary curricular modules and ability assessments that combine Atayal culture with information technology. The purpose was to explore whether, through pedagogy based on the ARCS motivational model, indigenous middle-school students had a significant improvement in teamwork, creative thinking, and communication abilities, and whether or not students' interest in information technology and culture was inspired. Research subjects were 17 first-year students in an Atayal Comprehensive Junior-Senior High School in Nan'ao, Yilan County. The research period was 2016-2017, and data was collected from teaching demonstrations, thoughts written down by students, and tests. Research tools include the qualitative written thoughts of the students and a quantitative assessment of the key abilities of teamwork, creative thinking, and communication abilities. There were a total of 33 items. To explore whether there was a significant change in indigenous students' teamwork, creative thinking, and communication abilities, the Wilcoxon signed-rank test was used for statistical analysis of pre-test and post-test results. Research results show that indigenous students performed significantly better in the post-test than in the pre-test with respect to teamwork, creative thinking, and communication. The thoughts students wrote down after class clearly expressed interest in the cross-disciplinary course combining culture and information technology. Therefore, the course using an ARCS motivational model to combine Atayal culture and information technology significantly improved indigenous students' teamwork, creative thinking, and communication abilities.

Keywords: ARCS, Indigenous, Information technology, Interdisciplinary, Cultural and creative course

INTRODUCTION

This research is part of the R.O.C. Taiwan Ministry of Science and Technology, assessment, and system setup of information technology courses in indigenous secondary schools" High Scope project (No. MOST 105-2514-S-152-003). This research has worked with high schools and local development associations in the Nan'ao area, holding on average 7-10 classes each semester. Every semester includes Atayal cultural creativity classes and project-based learning (PBL) information classes on different topics, not only creating Atayal cultural crafts, but also integrating Atayal culture into project-based information classes. The research found that the courses can elevate students' understanding of local culture, prompting interest in learning how to create local cultural crafts. The analysis on project-based key abilities also show a significant rise in teamwork, communication, planning, and information literacy (Chao, Xu, Jiang, & Yao, 2014; Chao, Xu, & Jiang, 2015).

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Contribution of this paper to the literature

- This research combines Atayal cultural and non-linear information courses, using the ARCS (Attention, Relevance, Confidence, and Satisfaction) Motivational Mode to give indigenous middle school students motives to learn information technology and an interest in their own culture, while elevating their team work, creative thinking, and communication abilities.
- The ARCS interdisciplinary course prompts the indigenous middle school students' concern of information technology and their own culture.
- The value of this research lies in shifting resource from universities and communities while integrating cultural elements such as local Atayal creative culture industry, traditional tribal culture, and life experience, so that indigenous students can better understand their own culture and surrounding environment. The research also provides information technology, equipment, and diverse teaching resources to achieve interdisciplinary learning and equal education opportunity.

The strategy of combining high school and community resources to develop cultural creativity information course from a university perspective based upon past experiences is both plausible and successful. It not only elevates students' motivation for learning, but also strengthens their sense of identity towards their own culture. It also evens out the digital disparity between urban and rural areas, giving indigenous high school students the opportunity to learn about new technology, making them more competitive in both academia and the job market. Which is why it was decided that this research will build on its understanding of indigenous high school students and work towards creating cultural creative information technology courses for indigenous middle school students, honing their skills in cultural creativity, information technology, creative thinking, team work, and communication? This research combines Atayal cultural and non-linear information courses, using the ARCS (Attention, Relevance, Confidence, and Satisfaction) Motivational Mode to give indigenous middle school students motives to learn information technology and an interest in their own culture, while elevating their team work, creative thinking, and communication abilities. As mentioned above, the questions for this study are as follows: (A)For the indigenous students in the information courses employing the ARCS Model of Motivation, how should the creative content of digital audio and video material be linked to culture?(B)After implementing courses that employ the ARCS Model of Motivation, what are the effects of these courses on indigenous students' creative thinking, teamwork, and communication skills?(C) What are the effects of using teaching strategies based on the ARCS Model of Motivation on the indigenous students' cultural interests?

The objectives of this study are as follows: (A) Use the ARCS Motivational Mode to design culture and technology cross-boundary lessons; (B) Understand the changes in grade 7 indigenous students' teamwork, creative thinking, and communication abilities after going through cross-disciplinary classes based on the ARCS Motivational Model, as well as the students' learning histories, results, and reflections.

Morover, this research is to enhance junior high school students from aboriginal communities to learn information technology and to understand their culture. The ARCS Model of Motivation was employed in this study as a teaching strategy for curriculum development. This study sought to improve students' teamwork, creative thinking, and communication skills; it did not investigate students' learning motivation.

LITERATURE

New Technology Education

The development of technology not only changed our way of life, but also created more possibilities in food, clothing, housing, transportation, education, and entertainment. In terms of education, besides turning information technology into education technology, emphasis is also placed on using computers to elevate learning effects (Jonassen, 2000), focusing on student-centered digital learning, helping students learn to be independent for life (Rosenberg, 2001). With the help of new technology, innovative ideas such as "flipped classroom", "flipped education", "MOOCs - Massive Open Online Courses", and "maker education" blossomed, but they all point to one common goal, which is to revolutionize traditional teaching methods and ideas, break free from the conventional and unidirectional 'spoon-fed learning', and think about how to cultivate real skills and bring out potentials to create an education system centered around students (Datig & Ruswick, 2013; Fatbat, 2015; Yu, 2014).

The 2014 "Horizon Report: Higher Education edition" by the US New Media Consortium "NMC" points out that the growing prevalence of online learning, blended learning, cooperative learning, and social media will drive changes in the way we learn (Johnson, Adams Becker, Estrada & Freeman, 2014). A close look at the 2014-2016 Horizon Report will reveal that Bring Your Own Device (BYOD), Learning Analytics and Adaptive Learning Augmented and Virtual Reality, Makers, App, Robotics , Flipped Classroom are all future trends in information

education (Johnson, Adams Becker, Estrada, & Freeman, 2015; Johnson, Adams Becker, Estrada, Freeman, & Hall, 2016).

So far Taiwan's compulsory education also echoes the international trend. The planned learning areas for the 12 year compulsory education program will change the current 9 year program's "Science and Technology" area into separate "Science" and "Technology" areas, with information technology and living technology included in the technology area. The main reasoning behind this change is that under the current education setting, living science is not included in the comprehensive assessment program and therefore often ignored. In order to maintain the quality of living science classes, a "technology" area is added to middle school education. The courses are required throughout middle school and high school to improve students' literacy of "technology information and media literacy", so that they have the ability to utilize technology, information, and different forms of media, learning related ethical issues and media literacy, and being able to analyze, speculate, and judge the connections between humans and technology, information and media. The change in learning areas in our education program shows the growing importance of promoting information technology education.

But on the other hand, with the incoming information society, indigenous students from non-urban areas might face the impact of digital disparity, and the challenge of passing on indigenous values and cultural identity in the digital age. As part of the 12 year compulsory education plan, the National Academy for Educational Research set up a "Indigenous and Immigrant Curriculum Development Team" to map out the lesson structures, content, experimental courses, and support system of indigenous people in the new curriculum. In the current 9 year compulsory education program, it is noted that indigenous language education in the language learning area should give students the ability to freely utilize information technology media, to listen, learn, and communicate on their own or with guidance from teachers. It's a sign that information technology plays a role in promoting indigenous education. This research is conducted in accordance with the technology learning area of the 12 year compulsory education program set by the Ministry of Education, while accounting for the learning characteristics of indigenous students, integrating new information technology to cultivate information technology application and literacy in indigenous middle school students.

Also, indigenous students like to work together in hands-on projects, so after designing the lessons and going through related literature, it was decided that living technology course design and implementation should start with students' motivation for learning (Lin, 2013), therefore the ARCS Motivational Model and Atayal cultural creative designs were used in the information technology courses. Contents of the courses emphasize practicality and futurity, such as sound and video editing software.

ARCS Motivational Model

There are many theories discussing learning motivation, since the US army successfully introduced systematized education into military education after WWII, systematized education design began to develop into many lesson plans and hands-on teaching events. In the late 1970s, Keller posited that systematized learning focus mainly on what lesson planners should do, and less on the students' motivation for learning. If the student lacks motivation and interest, then the education quality and learning effect will be significantly reduced (Lin, 2014). Therefore Keller began to research learning motivation, and integrated many learning psychology theories such as social learning theory, cognitive theory, attribution theory, achievement motivation theory, expectation-value theory, and motivational models like challenge, fantasy, and curiosity to develop that ARCS Motivational Model in the 1980s.

A look at study results in recent years of applying the ARCS Motivational Model to teaching show that integrating ARCS Motivational Model in teaching is effective in boosting the students' motivation and learning results (Wicks, 2010; Worry, 2011), and though there are some studies that show little effect or adverse effect (Jokelova, 2012), there might be other factors affecting students' performance, such as multiple instructors, lesson design, and the timing of teaching strategies. Most research subjects are university students, followed by middle school students. The courses are mostly related to information technology, such as online courses, long-distance education, computer classes, and video lessons (Lin, 2014). Research in Taiwan most often use the ARCS Motivational Model teaching to teach information technology and science, followed by English, PE, music, and Chinese (Yang, 2010). Related research shows that integrating the ARCS Motivational Model into lessons can effectively elevate student's motivation for learning and learning results (Chen, 2013). A few research in Taiwan also find that the ARCS Motivational Model cannot elevate motivation for learning or learning results, which may have to do with factors such as teaching strategies, a lack of connection between students' knowledge and experience, the teachers' methods in building confidence failing to motivate students, the teachers' lack of understanding of learning motivations, or the computer systems' lack of interactive components. Look out for these factors while designing classes.

Table 1. The four elements of the ARCS Motivational Model

Four elements of ARCS	Description	Key considerations in lesson design
Attention	Understand the students' interests to attract their attention and curiosity.	Pique the students' curiosity and get their attention, make them feel like the class is worth taking in order to facilitate a long and meaningful learning experience.
Relevance	The contents of the class should feel connected to each student's personal needs, goals, and achievements, so that they develop proactive learning attitudes.	Get a grasp of the students' learning backgrounds before designing teaching materials to make sure that the materials tie in with students' past experiences, preventing students from feeling disconnected and losing focus.
Confidence	Help students build positive anticipation towards learning tasks, so that they believe in their own choices, hard work, and will to succeed.	Classes should be designed to match the students' abilities, with opportunities for students to succeed and build confidence to continue learning.
Satisfaction	The feeling that arise between results and expectation when students gain new knowledge or skills.	Try to provide contextualized learning, so that students can feel the satisfaction of their achievements matching their expectations through hard work and adequate rewards, furthering their motivation for learning.

The subjects of this research are middle school students, with the course theme being cross-disciplinary classes on cultural creativity and information technology, which is why the ARCS Motivational Model of attention, relevance, confidence, and satisfaction is used as a teaching strategy (**Table 1**). Developing information technology classes and events can motivate students to learn and give them a sense of satisfaction that prompt them to focus more on their courses, elevating their performances elsewhere (Yang, 2010).

Interdisciplinary Learning

Interdisciplinary learning falls under the umbrella concept of integrative learning, which includes both disciplinary and interdisciplinary learning. The concept of integration began to spread in the 20th century, while the concept of integration in K-12 stages comes from the 1920s progressive social democratic education perspective that prioritizes students and social care, which is how the term 'integrated curriculum' was born (Klein, 2005). Early interdisciplinary curriculum for K-12 stages was largely influenced by Herbartianism and Dewey. The former came up with the 'correlation' theory, which posits that children have the ability to connect knowledge from different fields, which is the key to building intelligence. On the other hand, Dewey criticized the disciplines for being too narrow, proposing an active education process that encourages students to take part in democracy. Looking at the course of its development, the promotion of interdisciplinary courses from kindergarten to university have a long history, but its focus has changed with the times; Early efforts focus on 'holistic' integration, while integration of knowledge across different fields are emphasized in recent years (Chou, 2001).

Interdisciplinary learning is often confused with multidisciplinary learning. By definition, multidisciplinary refers to learning multiple but not necessarily integrated disciplines (Shafritz, Koeppe, & Soper, 1998), while interdisciplinary learning combines two or more disciplines, especially when the disciplines can combine or influence one another's viewpoints (Rowntree, 1982). Many scholars have expressed their views of interdisciplinary learning, among which Jacobs (1989) summed up its focus: The main purpose of interdisciplinary learning is to incorporate viewpoints throughout disciplines to develop research focus such as topics, issues, and questions, so that students can understand the connection between different subjects as they are learning them. And through the process of shifting focus from memorizing facts to the core of the subject, interdisciplinary courses can utilize knowledge related to the subject, while also reflecting students' thought process. Another scholar Schommer (1994) believes that through interdisciplinary learning, students can receive a higher caliber source of knowledge, affirmation, and confidence, leading to better preparation to deal with complex fields of knowledge that lack structure.

With interdisciplinary learning, students are expected to have better cognitive skills (such as complex thinking, improved thinking, and learning techniques), converting knowledge and applying personal meaning, while gaining critical thinking and post-cognitive skills such as self-assessment and self-awareness management (Ivanitskaya, Clark, Montgomery, & Primeau, 2002). So far interdisciplinary application has received widespread discussion around the world, and is applied in many fields (Redchenkoa, 2016). This research focuses on two disciplines, indigenous (Atayal) culture and information technology, merged in an Atayal micro movie production course. It is hoped that through this course, indigenous middle school students will learn music and video editing

Table 2. The 5C Key Competencies correspond to the core competencies

Core competencies of the 12-Year Basic Education policy		5C Key Competencies
A: Spontaneity	A1 Physical and mental qualities and self-improvement	Critical thinking
	A2 Systematic thinking and problem-solving	Critical thinking problem-solving
	A3 Planning implementation and innovative response	problem-solving Creative thinking
B: Communicative interaction	B1 Symbol application and communication	Communication
	B2 Technology information and media literacy	Critical thinking
	B3 Artistic cultivation and aesthetic accomplishment	Creative thinking
C: Social participation	C1 Moral practices and civic awareness	Critical thinking
	C2 Interpersonal relationships and teamwork	Communication Teamwork
	C3 Multiculturalism and international understanding	Creative thinking Communication

skill, develop care and identify with their own culture, while boosting their abilities in teamwork, creative thinking, and communication.

Core Competencies of the 12-Year Basic Education Policy

The curriculum designed in this study was jointly developed by indigenous integrated secondary schools and universities, and thus the curriculum needed to correspond to the core competencies of Taiwan's 12-Year Basic Education policy and be consistent with its values. The core competencies of the 12-Year Basic Education policy are based on the three aspects of "spontaneity," "communicative interaction," and "social participation." The curriculum designed as part of the High Scope Program consisted of the culture and creativity of the Atayal people and microfilm creation. First, attention toward understanding and recognizing their cultures was aroused in students through cultural courses; art and beauty within cultures was explored to correspond to the core competencies of spontaneity (physical and mental qualities and self-improvement), communicative interaction (artistic cultivation and aesthetic accomplishment), and social participation (multiculturalism and international understanding) under the 12-Year Basic Education policy. Microfilm creation captured elements of the cultural courses, stimulating creativity and exhibiting students' personal strengths through teamwork, which also corresponded to the core competencies of spontaneity (physical and mental qualities, self-improvement, systematic thinking, and problem-solving), communicative interaction (literacy in science and technical information and media, artistic cultivation, and aesthetic accomplishment) and social participation (interpersonal relationships and teamwork) under the 12-Year Basic Education policy.

The Directions Governing for the 12-Year Basic Education Curricula (National Academy for Educational Research, 2015) assert that learning focuses during secondary school help students to establish an appropriate self-concept, conduct aptitude tests, and improve their knowledge of society while encouraging self-learning, peer learning, and teamwork and understanding and caring about the community, social, national, international, and global topics. The courses in this program were implemented through team learning and the students' learning objectives were planned in accordance with the core competencies of the 12-Year Basic Education policy. At the same time, learning motivation was triggered in students through local cultural and science and technology courses that facilitated self-learning and compelled the students to explore their cultures and technological interests.

Information technology is advancing and changing rapidly, and although the Internet and platforms can facilitate teaching and provide resources for science education, mobile learning is undoubtedly the current trend of learning to enable ubiquitous learning. At present, the Ministry of Education is dedicated to promoting teaching environments and faculty training for mobile learning in elementary, secondary, and high schools to enable learning to be free from time and space constraints, thereby achieving the objective of learning anytime and anywhere and cultivating the spirit of active learning (Chao, 2017). The Ministry of Education employed the "5C Key Competencies Scale" to promote mobile learning programs for elementary and secondary schools as a measure for assessing students' learning outcomes in relation to various key competencies (promoting mobile learning of middle and elementary school project, 2014). The 5C Key Competencies corresponds to the core competencies and learning focuses at the middle school stage, as stated in the nine core competencies under the 12-Year Basic Education policy (please refer to **Table 2**): focus on helping students establish an appropriate self-concept, conduct aptitude tests, and improve their knowledge of society while encouraging self-learning, peer learning, and teamwork and understanding and caring about community, social, national, international, and global topics.

Therefore, in the "Key Competency Assessment Scale for Teamwork, Creative Thinking, and Communication" adopted in this study to evaluate the indigenous secondary school students' learning outcomes (Duran, 1992; Jeng

& Tang, 2004; Lin & Wang, 1994; Pan, 2002; Schraw & Dennison, 1994), the assessment indicators of the three key competencies of teamwork, creative thinking, and communication contained learning outcomes for complex problem-solving, creativity, communication, collaboration, and critical thinking from the 5C Key Competencies.

In short, the curriculum developed in this study was a formal school curriculum, and thus should be based on the core competencies of the 12-Year Basic Education policy. The 5C Key Competencies correspond to these core competencies and the learning focuses at the middle school stage as stipulated by the 12-Year Basic Education policy. Therefore, the evaluation of the three key competencies was the focus for assessing learning outcomes in this study.

In 2013–2016, the research team collaborated with teachers from a single high school to develop an interdisciplinary curriculum on information, culture, and creativity. The developed project-based learning information course combined teamwork and cultural experience courses with information courses; the learning outcomes were demonstrated in after-class results presentations. Finally, the statistical results of the analysis of key competencies in project-based learning revealed that the students exhibited significant improvements in aspects such as teamwork, communication and planning, and information literacy. Following prior success with featured curriculum development in indigenous schools, this study expanded on the understanding of indigenous high school students and developed a curriculum centered on culture, creativity, and information technology for indigenous secondary school students to continue cultivating their capabilities related to culture and creativity, information technology and creative thinking, and teamwork and communication (Chao, Xu, Jiang, & Yao, 2014; Chao, Xu, & Jiang, 2015). Because of the age group of the students targeted for the course, the ARCS Model of Motivation was adopted as the teaching strategy. However, the curriculum was planned based on group collaboration (to enhance teamwork and communication), the combination of a cultural experience course and information course (to demonstrate creativity based on drawing inspiration from cultures and displaying them in works as part of the information course), and after-class results presentations (to improve communication) to enhance teamwork, creative thinking, and communication skills.

Atayal Culture and Indigenous Students' Learning Characteristics

The Atayal tribe accounts for approximately 80,000 people of the indigenous population in Taiwan, and is the third largest indigenous group after the Amis and Paiwan tribes. The Atayals are mainly located in mountainous areas in central and northern Taiwan, including those between Puli and northern Hualien County, and have an estimated population of 88,571 as of April 2017 (Council of Indigenous Peoples, 2017). The Atayal's main traditional production activities are hunting and shifting cultivation on mountains; in addition, Atayal women view weaving skills as the most crucial production work in traditional Atayal society. The Atayal tribe has a developed form of weaving craftsmanship involving sophisticated skills and exquisite colors; red symbolizes blood that possesses vitality and can protect against evil, hence their preference for red apparel. In addition, because diamond patterns are regarded as the eyes of the ancestral spirits, numerous diamond patterns are often seen on Atayal weaving and clothing (Yulan Toyuw, 2004).

Atayal culture has a custom of applying facial tattoos, which have deep social significance in addition to aesthetic value. Facial tattoos on women signify that they are skilled at weaving and qualified for marriage, whereas those on men indicate that they have participated in headhunting—a sign of adulthood, courage, and independence. Tattoos are also marks to assist Atayal people in finding their ancestral origins after death, and specific tattoo patterns on people's chests, hands, feet, and foreheads are symbols of glory; such tattoos are painted on men with special battle achievements and women with excellent weaving skills. The Atayal tribe's social organization is mainly composed of ancestral worshipping groups. The most crucial rituals are those of ancestor veneration, while performances and dances accompanied by Lubuw (a type of bamboo jew's harp) players are a major feature of Atayal music and dance culture (Council of Indigenous Peoples, 2017).

The indigenous people of Taiwan are composed of multiple ethnic groups, the cultural features and student characteristics of which differ slightly. Studies conducted in Taiwan have asserted that indigenous students enjoy a free learning atmosphere without stress and competition and prefer dynamic-, practical-, and inquiry-oriented learning scenarios. In addition, indigenous students are often inclined toward peer learning while emphasizing the values of collaboration and sharing. In accordance with these characteristics, many Atayal students strongly reject monotonous teaching methods and the abstract teaching materials employed in conventional schools under the mainstream education system (Tan & Guo, 2002; Tan & Lin, 2002; Tan, Liu & Yu, 2008). In this study, 20 secondary school students from the Atayal tribe were recruited as participants. The school in question consists of mostly indigenous Atayal people and is small, with only three classes per grade and a total of 215 students. The school is adjacent to the local community and has a close relationship with the residents of said community, whose main occupation is farming. The students generally tend toward working in groups and teams, and are interested in competitions or small class activities. They are active, willing to interact with others, and enjoy asking questions in class, while exhibiting talent in music, sports, dance, and art. Most students have culturally disadvantaged family

Figure 1. Local Atayal artisan teaching the class

Figure 2. Traditional Atayal weaving

lives and learning environments that lead to low learning motivation; however, the students are extremely interested in hands-on teaching activities and their learning characteristics are consistent with those demonstrated in the literature.

RESEARCH METHOD

This is a one-group pre- an post-test designed research, assessed through quantitative and qualitative information such as evaluation forms for key skills like teamwork, creative thinking, and communication, video interview script, and interview audiovisual work which will be collected and analyzed for added credibility.

Because the research subjects involved a population of particular identity, it was not possible to collect a large number of samples. Participants in this study were seventh-grade students from a total of three classes at an indigenous junior high school in a rural area. The objective of this study was to understand whether the innovative thinking skills, teamwork, and communication and coordination of indigenous students improved after receiving the proposed course. In addition, this study investigated whether the use of the ARCS motivational model as a teaching strategy would stimulate students' interest in their own culture. The one-group pretest–posttest design was a suitable method for comparing this group of students before and after course delivery to determine whether the proposed course achieved the desired results. Performing an experiment in which Han students are included as controls would not meaningfully contribute to the understanding of indigenous education. Moreover, a comparison of students in various classes at the same school may still be beset by errors resulting from control variables such as the instructor, timing, and location of course delivery. Other researchers, namely Lo (2015), Chou and Huang (2014), Wu and Wu (2010), also adopted the one-group pretest-posttest design for small sample studies of indigenous education. For these reasons, this study adopted the one-group pretest–posttest design.

Course Planning

The research course planning consist of two stages, Atayal cultural crafts experience classes, and information technology classes. A brief summary of the two stages are as follows:

(A) Cultural crafts experience: Before technology classes, the researcher arranged 6 cultural crafts experience classes, which included making traditional Atayal weaving keychains and tote bag sewing (**Figures 1-2**), for participating students to gain a preliminary understanding of their own culture.

Table 3. ARCS Motivational Model course planning Table

Unit	Course content
Experience cultural crafts Courses	Indigenous traditional craftsmen from the Nan'ao region taught crafts such as belt weaving, while instructors explain the meaning and importance of such crafts to the Atayal people.
Video and sound editing software Basic introduction	The teacher instructs students on the basic functions of the VivaVideo sound and video editing app, and guide them as they film and edit videos.
Hands-on filming and editing Presentation	The teacher instructs students on the principles of filming an interview documentary and how to write a script. In class, students practice writing scripts and filming videos to complete their Atayal culture micro film.
	The teacher will help students practice their oral presentation skills, and take part in the end-of-term presentation.

(B) Information technology class: After cultural crafts classes, there are another 6 classes lasting around 120 minute each, where students learn to use basic functions of the "VivaVideo" sound and video editing app, interview, write scripts for Atayal culture documentaries, use mobile devices to film videos, and post edit the videos. They will also present an end-of-term presentation at the end of the semester (**Table 3**). The reasons for choosing video and audio editing as the learning content for grade-7 students are related to the Curriculum Guidelines for Grade 1–9 Information Education implemented now as well as the Curriculum Guidelines for 12-Year Basic Education to be implemented in the future.

The current Curriculum Guidelines for Grade 1–9 Information Education indicate that the purpose of the information education curriculum is to cultivate students' capabilities in information retrieval, application and analysis, creative thinking, problem solving, and communication and cooperation, as well as to encourage them to adopt lifelong learning attitudes. Through the planning of core competencies such as "awareness of information technology concepts," "use of information technology," "data processing and analysis," "Internet awareness and application," and "integration of information technology and humanistic qualities," students' cognitive and emotional competencies are cultivated to achieve the following educational goals. Most elementary school students attain basic skills such as word processing, editing, and drawing. When students reach grades 7–9 in secondary school, the focus of their curriculum shifts to various types of computer software and corresponding applications, and interdisciplinary study is encouraged. These points represent the core spirit of the curriculum, in which indigenous culture, handicrafts, and information technology are integrated. The following skills are mentioned in the information course learning indicators for students in grades 7–9:

2-4-1 Students understand computer hardware, software, and basic input and output devices, and understand how to take advantage of free software applications.

2-4-2 Students understand multimedia and computer-related equipment, as well as integrated applications of images, videos, text, animation, and audio content.

3-4-2 Students can use presentation software to edit and display presentation content. Use of free software is encouraged.

4-4-1 Students can use the Internet, multimedia, CDs, and DVDs for data collection, and demonstrate the ability to combine these materials with the software they have learnt to use for data management and analysis.

5-4-2 Students should be capable of applying information technology in a timely manner; cooperative learning and active learning should be fostered through use of the Internet.

5-4-3 Students should establish an understanding of science and technology as means of improving human well-being. Specifically, information technology should be regarded as an instrument with which to care for other individuals and social groups.

Videos and images are the preferred media of the current generation of students. These media have become integral to students' lives, and this phenomenon is reinforced in modern education and entertainment, as well as through students' use of social media and mobile devices. The researcher used the Attention, Relevance, Confidence, and Satisfaction Model of motivation as a teaching strategy; therefore, the types of information technology of interest to students and those closely related to their lives were considered, and audiovisual editing software emerged as a popular software. Rather than requiring that students learn only professional-level video editing, the proposed method allows students to practice using the audiovisual editing software. Students can simultaneously practice editing previously collected materials, completing tasks, organizing and expressing their thoughts about a topic, and presenting creative ideas using audio and video content. The goal of this curriculum is not to focus solely on competence with audiovisual editing software, but rather to also enhance students' skills in logical thinking, aesthetics, and expression.

In the 12-Year Basic Education Curriculum to be implemented in Taiwan, the outline for the science and technology field mentions that "the science and technology courses in 12-Year Basic Education are aimed at

Table 4. Integrated ARCS Motivational Model course planning

Objective strategy / Unit	Course objectives	Integrated technology and culture dimension	Application of ARCS teaching strategy
Cultural skills and experiences course	● To understand the cultural significance of traditional crafts (e.g., weaving and sewing) through handicraft courses. ● To learn about craftsmanship through practice. ● To pass down the Atayal culture's meanings and traditional techniques.	●The cultural skills and experiences course is a course precedent to the interdisciplinary course in this study. ●Collecting materials for science-and-technology creative courses through cultural experiences (e.g., photographs of craftwork, documentaries about the creative process, and experience records). ●Teaching students to use tablet computers and other technology to photograph their work and record their work processes.	●Using the Atayal culture's primary skill, weaving, to appeal to aboriginal students; using stories and legends to arouse their interest and make them feel that the teaching content relates to their ethnic origin and cultural traditions **(Attention and Relevance)**. ●By using the hands-on learning methods that aboriginal students prefer, students can experience the weaving process and produce weaved bands with the assistance of a weaver. Students can record the creative process and share it online. Students can own the textiles created during the course; doing so can enhance their positive experiences such as learning motivation and sense of achievement. **(Confidence and Satisfaction)**.
Applying science and technology to culture and the creative process	● To document the process of cultural skills acquisition by using video editing software. ● To present ideas related to the experience of traditional crafts by using audiovisual technology. ● To gain experience of using images to tell stories and express ideas ● To apply science and technology to demonstrate and realize cultural creativity.	●Teaching students to use video editing software on tablet computers to edit materials recorded during the cultural course; using images to present Atayal culture and learning results. ●Gaining experience in creating and displaying cultural features through documentaries.	●Asking students to share YouTube videos to showcase the effects that videos have in the digital era; proposing applications of audiovisual material in daily life **(Attention and Relevance)**. ●Asking students to share and discuss documentary scripts in small groups; building up their confidence through feedback from peers and teachers; letting them use videos to produce ideas; letting them use their favorite musical scores to create their work; asking them to share their work with friends and family through social networks **(Confidence and Satisfaction)**. ●Asking students to creatively present the Atayal culture and their work; asking Students to contribute to presentations and competitions, enhancing student satisfaction by ensuring that their performance is consistent with their expectations to enhance their learning motivation **(Confidence and Satisfaction)**.

cultivating students' technological literacy and fostering their knowledge and capabilities through hands-on practice, including designing and creating technology tools and information systems using technological means and other resources. The courses also include cultivation of high-level capabilities such as creative thinking, critical thinking, problem-solving logic, and computation thinking." The life technology course will focus on "practice, application, and thinking"; specifically, the course will foster students' competencies in hands-on "practice," "application" of technological products, and "thinking" related to designing and criticizing technology. Secondary school education (grades 7–9) emphasizes the cultivation of students' competencies in creative design and hands-on practice through the use of simple machines and material-processing procedures. The purpose of these curricular foci is to help students understand the development of technology and the relationship between technology and life.

In accordance with the points discussed, the ultimate goal for both the current Curriculum Guidelines for Grade 1–9 Information Education and the proposed Curriculum Guidelines for 12-Year Basic Education (field: science and technology) is to extend students' basic skills learned during elementary school and enable students to apply these skills in the application of science and technology. Technological literacy and hands-on creativity are central to the development of science and technology. Therefore, this study chose audiovisual editing as the main focus of information technology education for grade-7 students. This choice is consistent with the goals of science and technology education in Taiwan's secondary schools.

(C) Integrating ARCS model into the course planning: **Table 4** clarifies the course objectives and shows how culture and technology are integrated into the course. Additionally, it details how the ARCS teaching strategies are applied.

Research Subject

The research subjects are mostly the 17 7th grade students of the 2016 school year in a Nan'ao region middle school. This is the students' first time participating in planned courses, and while most of them already know the basics of using tablets or desktop computers, they lack experience in using digital sound and video editing software, so lesson arrangements in this semester include hands-on local crafts experiences, and uses the ARCS Motivational Model to guide students as they complete their Atayal micro films, boosting their ability to use software, creative thinking, teamwork, communications skills, and cultural identity.

Table 5. Statistical analysis of forms assessing key skills such as teamwork, creative thinking, and communications

	Number of people	Mean value	Standard deviation	Smallest value	Largest value
Pre-test	13	4.08	0.370	3.28	4.93
Post-test	13	4.36	0.486	3.48	4.97

Table 6. Wilcoxon signed-rank test summary of teamwork, creative thinking, and communication skill assessments

	N	Medium grade	Grade sum	Z	p (two-tailed)
Negative score	1[a]	9.00	9.00		
Positive score	12[b]	6.83	82.00	-2.55	.011*
Equal score	0[c]				
Total	13				

a. post-test mean < pre-test mean b. post-test mean > pre-test mean c. post-test mean = pre-test mean
*P<0.05

Research Tools

Tools used to assess the learning effects of indigenous middle school students in this research include: (1) Evaluation form on key skills such as teamwork, creative thinking, and communication. See attachment 1; (2) Quantitative and qualitative tools such as student interview scripts and completed assignments, to be explained in detail below.

(A) Evaluation form on key skills such as teamwork, creative thinking, and communication: This form is modified from 3 forms by Jeng and Tang (2004), Lin and Wang (1994), and Duran (1992), merging the three forms into one for the assessment. Assessments are conducted on a scale of 1 to 5, 5 for 'strongly agree', 4 for 'agree', 3 for 'neutral', 2 for 'disagree', and 1 for 'strongly disagree'. Assessment is conducted by having students fill in the form before the classes (pretest) and again within a week after classes (post-test).

(B) Student interview scripts and completed assignments: Qualitative tools refer mostly to students' interview scripts and completed assignments. Students' reflection on the cultural crafts experiences and micro film classes will also be collected and cross-referenced to increase credibility of the qualitative data. Data sorting and numbering system are as follows: Interview scripts will be marked with [interview]; Student will be represented by codes S1-S17.

Time of data will be marked by seven-digit numbers. For example, April 18th of the 106th year of the Republic Era will be marked as 1060418. So student S10's reflections shared on April 18th of the 106th year of the Republic Era will be marked as "InterviewS10-1060418".

RESEARCH RESULT

Assessment Results for Team Work, Creative Thinking, Communication, and Other Key Skills

This research is conducted on the 17 students in class of the 7th grade, of which 13 are valid samples. Results of the two assessment forms will be analyzed below. The forms are divided into three parts: teamwork, creative thinking, and communication, with a total of 33 questions. Due to the small sample size, the research will be documented with the Wilcoxon signed-rank test to analyze and compare pretest and post-test data. Analysis of mean values in **Table 5** shows that participating students performed significantly better in the post-test than in the pre-test.

The Wilcoxon signed-rank test results (**Table 6**) show that 12 people receive positive pre- and post-test combined scores, while 1 person had a negative combined score, $Z=-2.55$, $p=0.011<0.05$, reaching the 0.05 significance standard, meaning that in this test, participating students' assessments show significance difference in pre- and post-test scores.

Separate analysis results for each team's teamwork, creative thinking, and communication skills are shown in **Table 7** and **Table 8**. From **Table 7** we can see that the post-test scores are higher than pre-test scores for all three skills, but in **Table 8** only the communication skill show significant pre- and post-test difference ($Z=-2.41$, $p=0.016<0.05$). That's why this project will continue to strive towards elevating teamwork and creative thinking abilities in future lesson designs. Because the curriculum was implemented for the first time, the students may not have been accustomed to performing collaborative tasks through discussion. The interdisciplinary course integrating culture and information technology was also implemented for the first time to guide students in

Table 7. Grade mean and sum analysis of teamwork, creative thinking, and communication assessment

		Number	Medium grade	Grade sum
Teamwork post-test - pre-test	Negative grade	5[a]	3.40	17.00
	Positive grade	7[b]	8.71	61.00
	Equal grade	1[c]		
	Sum	13		
Creativity post-test - pre-test	Negative grade	4[d]	5.00	20.00
	Positive grade	7[e]	6.57	46.00
	Equal grade	2[f]		
	Sum	13		
Communication Post-test - pre-test	Negative grade	3[g]	2.00	6.00
	Positive grade	8[h]	7.50	60.00
	Equal grade	2[i]		
	Sum	13		

a. teamwork post-test < teamwork pre-test b. teamwork post-test > teamwork pre-test
c. teamwork post-test = teamwork pre-test d. teamwork post-test < teamwork pre-test
e. creativity post-test > creativity pre-test f. creativity post-test = creativity pre-test
g. communications post-test < communications pre-test h. communications post-test > communications pre-test
i. communications post-test = communications pre-test

Table 8. Wilcoxon signed-rank test of teamwork, creative thinking, and communication assessment

	Teamwork post-test - teamwork pre-test	Creativity post-test - creativity pre-test	Communication post-test - communication pre-test
Z test	-1.727	-1.157	-2.410
Gradual significance (two-tailed)	.084	.247	.016*

*p<.05

Table 9. The statistics concerning the interview results

Question	Did you like the cultural experience course? Following the course, what was your opinion about making weaved bands or cloth bags?		
Number of respondents (total: 16)	Liked the course. Expressed positive opinions concerning the course and shared personal ideas about traditional craftsmanship	Don't know or no opinion	Disliked the course. Expressed negative opinions concerning the course.
	11	5	0

discussions and the division of tasks. The development of ideas related to introducing cultural elements into information works in class may require more time. This study intends to implement curriculum development for a second year, during which teamwork and creative thinking competencies will be strengthened and the curriculum will be adjusted based on the first-year outcomes.

Student Class Participation Reflection

Besides using assessment forms to understand the significant change in teamwork, creative thinking, and communication abilities of 7th grade indigenous students, researchers also asked students to reflect upon the cultural crafts and information technology classes. Such reflections are summarized below:

(A) Cultural crafts classes learning reflections: The following **Table 9** presents the statistics concerning the interview results.

The students' reflections show that most of them are satisfied with the cultural craft classes, even gaining a sense of accomplishment. Some express their love for the classes, and some discussed their thoughts and interaction with Atayal culture, such as "weaving is a job for girls", but still found it fun after trying it out; some talked about being impressed by learning through cultural heritage. These reflections show that using the ARCS Motivational Model in teaching is effective, that students are interested, feeling accomplished and satisfied with what they have learned.

"..The most memorable thing about the class is I kept pricking myself when sewing my tote bag. Do you like the class? ...it's okay. (S02-20160418)"

"At first I thought weaving is for girls, but I want to see what it would be like if a boy made it. It was fun but sewing is too hard. (S05-20160418)"

Figure 3. Traditional Atayal woven belt

Figure 4. Completed traditional cloth bag

"I like the sewing classes the most. The bags we made are simple and practical. I'm really happy with what I made. (S06-20160418)"

"My favorite is the weaving classes, because it's especially fun. I'm happy with my work because it has all my favorite colors. (S08-20160418)"

"The most memorable moment for me is helping a classmate with the homework, because he's not really sure how to do it. I'm happy with my work because I can finish it by myself. (S09-20160418)"

"The class where we make bags are fun. What we made are useful and easy to carry around. I'm impressed by the heritage classes, because we get to learn about our own culture. I'm happy with my work because I feel more accomplished when I do the weaving myself. (S10-20160418)"

(B) Information technology class reflections: Some students expressed how they like the projects in information technology class, finding it fun to add special effects with the editing software. They also found the interview part of the project refreshing and fun. Students gained a sense of accomplishment and satisfaction from their work in editing classes. The quantitative and qualitative data of this research show how the learning process and abilities of indigenous students change under the ARCS Motivational Model, providing reference data for future researchers interested in the field of indigenous learning.

"I like this interview assignment. It's fun to film other people. I'm very happy with my work, because it's cool how I can add special effects (S01-20160418)"

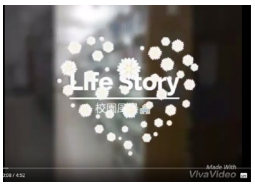
"I'm really happy with my work. Computer classes are my favorite. (S07-20160418)"

Students' Completed Projects

Throughout the semester, the students created many projects, completing 9 woven keychains, 18 traditional bags, 10 micro films, and another 2 micro films documenting the classes and presenting the class' achievements. The following is a brief introduction:

(A) Products of cultural crafts classes: The classes in this semester focused the 'weaving' part of Atayal culture, later extending towards sewing, a skill related to weaving. Completed products can be seen in **Figures 3-4**.

Table 10. Screenshot Table of group video clip examples

Group project example 1: "Campus Scenery"		
Audio and video sequence	**1**	**2**
Screenshot		
Audio and video sequence	**3**	**4**
Screenshot		

(B) Products of the information technology classes: The semester's classes are centered on "Atayal culture". The Nan'ao campus was the subject of the first lessons, and when students became more familiar with how to film videos and write scripts, they moved on to filming interview videos of people and cultural crafts lessons (see **Table 10**). The research team used the VivaVideo app to guide groups of students through video filming, post-editing, and final presentations.

CONCLUSION AND SUGGESTION

Conclusion

Throughout the course of these classes, the research team found that the indigenous students are very different from indigenous high school or elementary school students researched in the past. Middle school is a stage that connects elementary school and high school, where students have better comprehension and motor skills than elementary school students, but have yet to develop the focus or cooperation and communication skills of high school students. They are more active and harder to calm down. Which is why in the beginning of the courses, the research team found it necessary to make adjustments to the lessons and find an adequate way to introduce the materials in order to strengthen students' interest and motivation for learning.

In-class observations and analysis of data collected through quantitative and qualitative tools find that the students showed significant changes to their teamwork, creative thinking, and communication capabilities, while actively participating in mobile device and digital information learning. Because the teaching medium is closely connected to daily life, it encourages them to be creative, making the finished projects a lot of fun. Students also gained sound and video editing knowledge and skills, practiced teamwork and communication skills during group presentations, and found accomplishment and satisfaction from their work.

The value of this research lies in shifting resource from universities and communities while integrating cultural elements such as local Atayal creative culture industry, traditional tribal culture, and life experience, so that indigenous students can better understand their own culture and surrounding environment. The research also provides information technology, equipment, and diverse teaching resources to achieve interdisciplinary learning and equal education opportunity.

Suggestion

Because junior high school is the stage connecting senior high school and elementary school, junior high school students have more developed comprehension and operation skills than elementary school students. However, junior high school students' attention and cooperative communication skills are less developed than those of high school students. Therefore, junior high school students are relatively energetic, and calming them is not straightforward. Before we implemented the course, we considered adjusting the curriculum; thus, we sought suitable methods for enhancing students' learning motivation and entry points to stimulate their interest. The results indicated that students' collaborative ability was insufficient. Therefore, we recommend that before commencing a new course, teachers should assist students to practice their communication skills and discussion methods in group activities to enhance their cooperative ability.

Beside, this course is related to IT. The collaborating schools' locations and IT network stability play essential roles, and assignment uploads and teaching app downloads depend on them. We suggest installing a wireless network base station before the course or downloading required apps in advance to ensure that the course progresses smoothly.

This project's main focus is Atayal middle and high school students in the Nan'ao region. Atayal heritage, regional natural environment and culture are all part of the lesson design, limiting the research to particular subjects and regions. So we suggest other researchers wanting to conduct similar research to extend this project to middle and high school students in other groups or regions and conduct related courses and activity designs to understand the teamwork, creative thinking, and communication abilities of other groups.

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