Developing a Transdisciplinary learning course for high school students

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***Abstract*—The transdisciplinary learning could be improving people learning subject around their life. In the curriculum aspect, teachers need to have an integrating concept about transdisciplinary. Both transdisciplinary learning and cooperation learning are the important term in STEAM education. For the high school curriculum, many high schools are actively developing interdisciplinary courses. In Asia, some contest make students and teachers involve to learning interdisciplinary with cooperation, such as e-ICON contest that host by Institute of APEC Collaboration Education. According to the participation of the contest yield 2017 and 2018. We considered that competition model could be developing into high school curriculum. The contest integrating learning technology for developing a mobile application by students, such as Augmented Reality, Virtual Reality. In the contest, students need to cooperation with different country students and integrating their idea in to a new mobile application. They also need to provide project proposal, promoting video, pitch deck and the complete mobile application. Above all, we developing a transdisciplinary courses through the operation of the teacher community. Understand the content of subject learning by consulting teachers in different disciplines and try to find out where they can integrated. The complete curriculum development were construct by three teachers major in mechanical, electronic, and math. The development of curriculum can provide school that need to construct transdisciplinary learning. We combined one of e-learning contest and currently curriculum for construct a sustainability, social equity method for teacher and learner.**

Keywords—interdisciplinary course, cooperation learning, learning content, mobile application, learning technology

I. INTRODUCTION

STEAM education as important issues in current years. Most Research indicated that STEM education with Art is important. STEAM education also provide multi aspect learning content, Science, Technology, Engineering, Art and Mathematic. Most high school are try to develop a course for integrating those subject in Taiwan [1]. The course need teachers with difference subject to design the learning content [2]. Thus, transdisciplinary learning course can providing learner a different aspect about course [3, 4, 5].

Transdisciplinary learning course can cultivate students' different orientations. The shift from thinking in individual subjects to thinking in chemistry can help students think about overall planning. Some research indicated course limitation, like fix course, fix time and fix teaching method. In recent year, the Ministry of Education, Taiwan encourage teachers to develop courses. but not all teacher can change their thinking to develop a transdisciplinary course [6]

Above all, we need to develop a transdisciplinary learning course for high school students which providing the transdisciplinary aspect and integrating learning [7]. Moreover, an interview conducted in a high school social studies course to develop the transdisciplinary course of the proposed approach by answering the following research questions:

(1) What is the transdisciplinary content of e-learning contest and construct?

(2) Is the transdisciplinary content can be match to teacher's transdisciplinary aspect?

II. LITERATURE REVIEW

A. STEAM education

The objective of STEM Education in Taiwan is to provide an audit of current STEM Education research and practice in Taiwan, with recommendations for researchers, educators, and

policy makers about the future of STEM education. Some recearch diverse aspects of STEM education (including possible variations, such as STEAM and STREAM) as it is currently promoted and practiced in Taiwan, and provide a platform for further research and collaboration in the STEM education community [8]. STEM education including various perspectives, empirical research on curriculum and course design, teacher education, and pedagogical approaches, or detailed case studies documenting what works in classrooms, how to plan for better learning experiences for our students and whether our teachers are ready for teaching STEM [9].

In 2009, the US government launched the "Educational Innovation" program to support the STEM education campaign and develop students' excellence in science, technology, engineering, and mathematics to improve their scientific literacy. Since STEM refers to the above subjects, interdisciplinary instructional design should carried out [10].

In terms of education policy, STEM education focuses on talent education and rewards; in teaching, STEM courses focus on improving K-12 STEM curriculum design, teaching strategies and teaching practices so that students can integrate what they have learned [11].

Above all the research, most curriculum need to consider students different aspect learning. As the reason, the Transdisciplinary learning become the matter role for students.

B. *Transdisciplinary learning*

Transdisciplinary learning being promoted in academic and professional circles as an important strategy for developing new avenues of scholarly inquiry and for generating knowledge that is immediately applicable to the resolution of real-world problems [12]. Park & Son [13] indicated that transdisciplinary learning including multidisciplinary environment. Teacher should be more encourage into course design.

Brandt's research team proposed to integrate the transdisciplinary research on science issue. They reviewed peer-review publication for ensure the transdisciplinary. Research indicated that scientists and practitioners must take responsibility to tackle real world problems[14]. Otherwise, Toomey [15] indicated that critical perspective between Inter- and Trans-disciplinary researches. The critical perspective is the main point in trans-disciplinary learning.

Above research indicated that transdisciplinary learning course need to have multidisciplinary learning environment, critical perspective and tackle real world problems.

III. METHOD

For enhancing the effectiveness of the proposed approach, an experiment conducted in a Transdisciplinary learning course of a high school in southern Taiwan. Two teachers who participate the world e-learning content had interviewed. Otherwise. Three teachers who teaching in vocational high school over ten years are interview for match the transdisciplinary aspect.

A. *Participants*

In this study, we have surveyed yield 2017 and 2018. The procedure of this study divided into two stage. First stage is collecting the transdisciplinary content from two teachers. Those two teacher are participated the world e-learning content based on two teacher's experience to develop the transdisciplinary content and three teacher

B. *Experimental procedure*

This study divided into two stage, transdisciplinary content collection and transdisciplinary aspect confirmation. The experimental procedure as shows in Fig. 1.

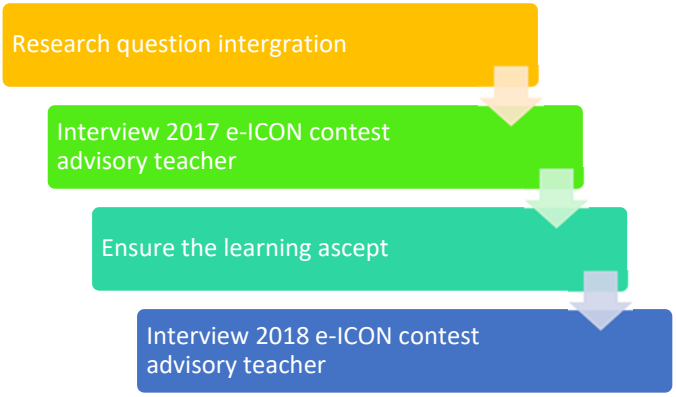

Fig. 1. The procedure flow chart

Both two stages' teachers participate the interview. After the interview, the three teacher provided a summative feedback. Both two teacher providing the information of the world e-learning content as show in Fig. 2.

Fig. 2. The world e-learning content.

As show in Fig. 2, students need to cooperate with students from other country. They are focus on the life, science and nature, and education issues.

Although the Taiwan team participate 2017 and 2018 e-ICON contest, the advisory teacher said that some change in the contest. We had interview two teachers who advisory team members for participate the contest. The interview result can be evidence for high school course.

IV. RESULT AND CONCLUSIONS

For develop a transdisciplinary-learning course, we interview two advisory teacher from 2017 e-ICON contest and

one advisory teacher from 2018 e-ICON contest. For the interview record as follows:

A. Ensure the learning aspect from 2017 e-ICON contest

The interview record of 2017 e-ICON contest advisory teacher shows:

Fig. 3. The agenda of 2017 e-ICON contest (providing by advisory teacher)

For the first experience to participate the e-ICON contest, I advisory non-subject students to participate the contest. They did not have enough information ability. For this reason, I order student to learning program logic computing skills through cord.org. The contest is more consider the cooperation between countries. Totally, 14 countries participate the contest in this year.

Fig. 4. The counties of 2017 e-ICON contest (providing by advisory teacher)

For cooperation between two countries, student need to have community, coding, problem solving ability. I prepare some learning content for coding. By the way, the students, who participate the contest and represent Taiwan, have good score in their learning field but all non-subject. They need some program training. Code.org is the platform for training their based coding ability but only for self-training.

Fig. 5. The cooperation between two country in 2017 e-ICON contest

In this year, most oversea team have a volunteer for cooperation (shows in Fig. 5). Language is not the main cooperation problem. However, students need more ability on computers science.

B. Confirmation of transdisciplinary content from 2018 e-ICON contest

According to the first year participating experience, we consider that students need to have more training on programming. Thus, we have a draft for training their transdisciplinary learning, on logic, programming and community. The agenda of 2018 e-ICON contest as show in Fig. 6. The most difference on the contest is own advisory teacher will become advisor for other country. The effectiveness is teacher not only concern own team and need to advisor the other team.

Fig. 6. The agenda of 2018 e-ICON contest (providing by advisory teacher)

The 2018 e-ICON is the first held is oversea place, Hawaii, USA. There is 12 countries participate this contest. Based on the aspect of cooperation, each team are originate by two countries member and the advisory teacher randomly assign to each team.

Fig. 7. The counties of 2018 e-ICON contest (providing by advisory teacher)

For the contest rule, the organization hope students have more community and cooperation. All advisory teacher leave when students cooperation. In this time, only student stay along with their team.

Fig. 8. The cooperation between two country in 2018 e-ICON contest

The biggest difference is Pitch Deck. Students need to prepare the slide for present their idea at assign time. The slide as show in Fig. 9.

Fig. 9. The slid of Taiwan team on the Pitch Deck

C. *The transdisciplinary course development*

The transdisciplinary course are constructing by four teachers who consult a course agenda as show in table 1.

Week	Lesson
1	Data collection
2-4	Math principle
5-6	Mechanical design
7-9	Electronic design
10-11	Pitch deck
12-13	Electronic design
14-15	App design
16	Integrating design
17	Null
18-20	Presentation

TABLE I. TRANSDISCIPLINARY SYLLABUS

For the transdisciplinary agenda, we design the difference lesson in 20 weeks for high school. It combined by three field, Math, Mechanical, and Electronic. The lesson include Data collection and Math principle in Math field. Otherwise, the pitch deck and presentation used to confirm the effectiveness of transdisciplinary course.

In this study, we combined e-learning contest and currently curriculum for construct a sustainability, social equity method for teacher and learner. The curriculum content constructed by two teachers. Three teachers are interview for ensure the transdisciplinary content. The development of curriculum can provide school that need to construct transdisciplinary learning.

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