Crystal Based Approach Model on Massive Open Online Course with Augmented Reality to Enhance Analytical Thinking Skills

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***Abstract* - The purposes of this research are: 1) to develop crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills and 2) to assess learners' analytical thinking skills in using crystal based approach on massive open online course with augmented reality and traditional teaching approach. The research found that: 1) this crystal based approach model on MOOC with augmented reality is composed of 5 components: (1) input, (2) crystal based approach, which is consisted of planning, creating, presenting, analyzing, crystalizing, and improving, (3) massive open online course with augmented reality to enhance analytical thinking skills, (4) output, and (5) feedback. Five experts in the field assessed the developed model and came up with a result of highest level of overall suitability while the score of learners' analytical thinking skills is at 93.21, higher than the set standard score.**

***Keywords* - Crystal Based Approach; Massive Open Online Course; Augmented Reality; Analytical Thinking Skills**

I. INTRODUCTION

The changes of learning process in the present are there to help learners coping up with the shifting of society into digital era. The approach must be various to deliver learners in searching for knowledge and learning by themselves through internet which is in accord with Thailand's national Educational Plan of 2017 – 2036 in focusing on sustainability and lifelong learning in 21st century [1].

Crystal based approach is a learning process emphasizing analysis, synthesis, and extraction of the knowledge. This approach includes 6 processes: 1) planning, 2) creating, 3) presenting, 4) analyzing, 5) crystalizing, and 6) improving [2-5].

Massive online open course (MOOC) is an online course which multiple learners could access through internet. MOOC provides videos, online materials, forums, online activities, learning assessment, and understanding tests which learners could use and integrate into their own learning [6].

Augmented reality (AR) is a technology where objects in the real world are enhanced with computer-generated information. This technology consists of 3 components: 1) sensor, to

locate the real world location of the users, 2) processor, to process the sensory information, and 3) display, to immerse the augmented reality along with the real world [7].

Analytical thinking skills refer to the ability to determine, classify, categorize, give reasons and find relationship or seek additional data to make decision, and apply the knowledge into new situations [8].

With the importance of the innovation in mind, the researcher believed that it is crucial to help learners developing analytical thinking skills and, in doing so, it is needed to explore the effect of crystal based approach on massive online open course with augmented reality in reinforcing teaching approach.

II. OBJECTIVE

1) To develop the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

2) To assess learners' analytical thinking skills after using the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

III. METHODOLGY

Methodology is divided into 2 phrases.

Phrase 1: Develop the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

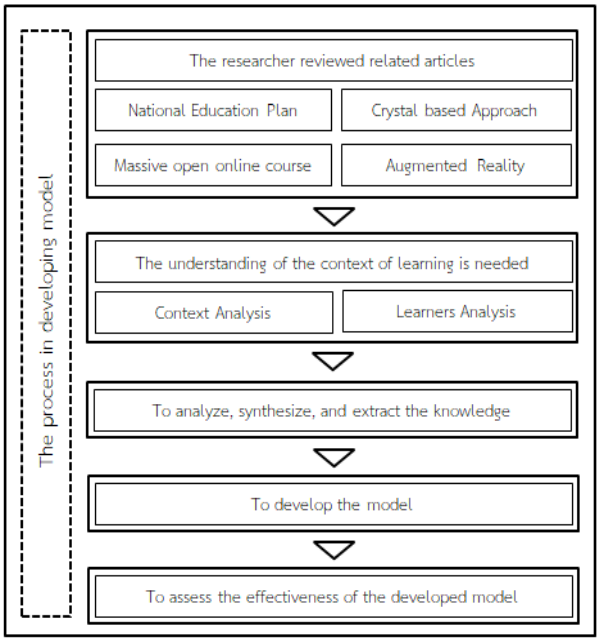

Figure 1. The Process in Developing the Crystal Based Approach Model on Massive Open Online Course with Augmented Reality to Enhance Analytical Thinking Skills.

1) The researcher reviewed related articles, textbooks, and researches to study about national Education Plan, crystal based approach, massive open online course, and augmented reality.

2) To develop the model, the understanding of the context of learning is needed. This came from 2 aspects as follow.

- *Context Analysis*

It was a preliminary analysis before developing the model of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills. The researcher studied about

the problems in the current teaching setting and the needs of this crystal based model, which includes: 1) exploring the problem in teaching setting, 2) understanding the basic needs of the crystal based model, and 3) describing the characteristics of grade 12 learners to help developing the model.

- *Learners Analysis*

This step of learners analysis is important in helping teachers to choose the suitable approach regarding of learners' level, aptitudes, and interests. Teachers must learn of learner's general information, language level, basic skills, learning style, and preferences to help determining the suitable teaching approach.

3) To analyze, synthesize, and extract the knowledge, this approach includes 6 processes: 1) planning, 2) creating, 3) presenting, 4) analyzing, 5) crystalizing, and 6) improving. Each part of the processes was labeled with learners' role, teachers' role, method, tools, and expected outcomes.

4) To develop the model, the theories of crystal based approach, MOOC, and AR were used in systematic approach, which included input, process, output, and feedback, additionally, augmented reality in massive open online course was used to improve the analytical thinking skills.

5) To assess the effectiveness of the developed model, 5 experts in the field of teaching development and educational multimedia were asked to assess the approach before employing.

Phrase 2: Study the effect of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

To study the effect of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills, the authentic assessment was employed. This assessment will assess learners by letting teachers choosing the statements that is closest to the behavior of learners in rubric score. The criterions are from 5 subskills which are: 1) determining, 2) categorizing, 3) finding relationship, 4) summarizing, and 5) applying the knowledge. The learners must have at least 80% of the total score.

IV. RESULTS

1) The result of development of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

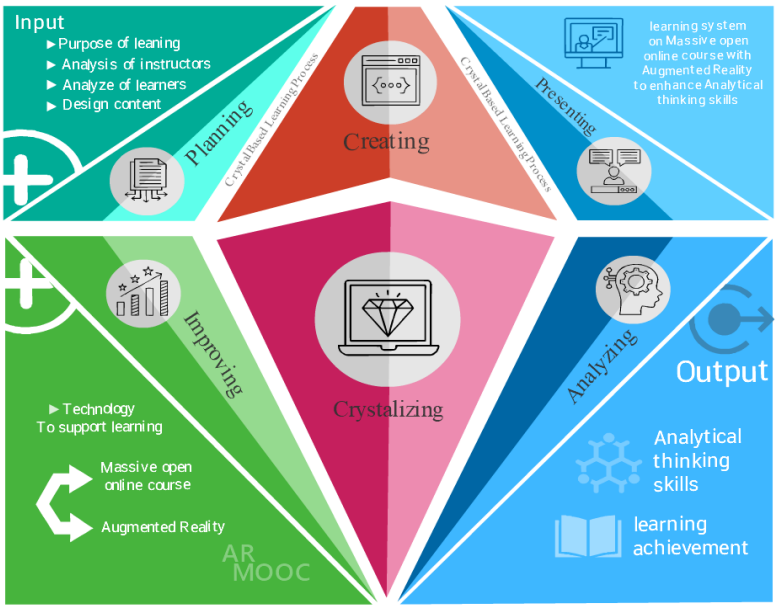

Figure 2. The Crystal Based Approach Model on Massive Open Online Course with Augmented Reality to Enhance Analytical Thinking Skills

As shown in figure 2, the components of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills were developed based on systematic approach, with 4 components as follow:

Input is composed of: 1) learning objectives, 2) teacher assessment, 3) learners assessment, 4) content development, and 5) educational-supportive technology; massive online open course and augmented reality.

The process of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills consisted of 6 processes: 1) planning, 2) creating, 3) presenting, 4) analyzing, 5) crystalizing, and 6) improving. The result shows that the suitability is at the highest level.

Massive online open course with augmented reality included the programming knowledge in data input and output, conditions, and loop.

TABLE I
THE RESULT OF THE ASSESSMENT OF LEARNERS' ANALYTICAL THINKING SKILLS AFTER USING THE CRYSTAL BASED APPROACH MODEL ON MASSIVE OPEN ONLINE COURSE WITH AUGMENTED REALITY TO ENHANCE ANALYTICAL THINKING SKILLS

The score of analytical thinking skills	n	Total Score	$\bar{x}$	S.D.	Percentage	t	Sig
Score	42.00	20.00	18.64	0.82	93.21	-10.71	.00

The result of the analysis of learners' analytical thinking skills after using the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills in programming among 42 grade 12 learners by teachers shows that the mean score is 18.64. SD at 0.82 equals to 93.21% with t level of 10.71. The significant level is at .00 indicating that the score is higher than the set standard score of 80%.

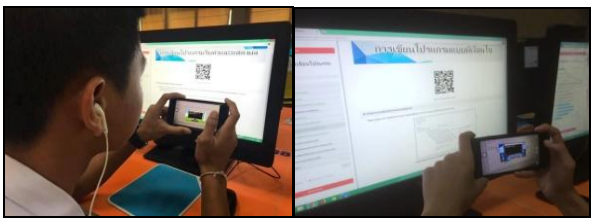

Figure 3. The Pictures of Massive Online Open Course with Augmented Reality

Output is composed of 1) analytical thinking skills; determining, categorizing, finding relationship, summarizing, and applying the knowledge and 2) learning outcomes. In conclusion, experts in the field assessed the developed model and found that it has the result of highest level of overall suitability ($\bar{x}$ = 4.97, SD = 0.16).

2) The assessment of learners' analytical thinking skills after using the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills.

V. DISCUSSION AND CONCLUSION

The development of crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills consists of 5 factors: 1) input, 2) the process of crystal based approach; planning, creating, presenting, analyzing, crystalizing, and improving, 3) augmented reality in massive online open course, 4) output, and 5) feedback. Crystal based approach is a learning process emphasizing the learning, researching, and creating the knowledge by the assessment of learners' analytical thinking skills after using the crystal based approach model on massive open online course with augmented reality to enhance analytical thinking skills themselves with the

help of massive online open course to improve and cultivate learner's analytical thinking skills, in accordance of Jarumon and Namon's research [9]. The integration of teaching approach with MOOC could greatly improve bachelor degree students in using multimedia. The assessment of this model could contribute in helping student understand the content of the class and greatly develop analytical thinking skills. This could also be seen in Kobkiat's work [5] that using 'augmented book' could improve undergrads analytical thinking skills with the post-learning mean score showing higher than pre-learning mean score, with the significance level of .01.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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