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THE EFFECTS OF REMEDIAL TEACHING STRATEGIES ON UNDERGRADUATE CHEMISTRY STUDENT'S LEARNING IN UNITS OF MEASUREMENT

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Abstract

The purposes of this study were (1) to investigate the effects of remedial teaching on improving the undergraduate chemistry students' ability, and (2) to assess the undergraduate chemistry students' satisfaction towards the remedial teaching. The participants were 19 chemistry undergraduate students of Faculty of Science and Technology, Suan Sunandha Rajabhat University. The researchers provided the activity sheets and technology-based learning (Kahoot!) through the remedial teaching strategies: Engagement (E), Discussion (D), and Conclusion (C) to develop 'mathematical concepts' in units of measurement: Scientific Notation, Standard International Unit--SI Prefix, Unit of Volume, and Unit of Mass. The results showed that the students were seen to do marginally better overall significantly, and there was highly satisfaction with the implementation of the remedial teaching strategies.

Keywords: Remedial Teaching / Technology-Based Learning / Units of Measurement

Introduction

There were 19 chemistry undergraduates of Faculty of Science and Technology, Suan Sunandha Rajabhat University, with mixed abilities in high school mathematics before starting Semester 1, Academic Year 2017. On the basis of this evidence, broadly flat students with having lower than a grade B in high school mathematics must undertake a bridging module to introduce key mathematical concepts and techniques. However, those with grades A and B were required to share their experiences. In investigating chemistry undergraduate students' difficulties in applying mathematical concepts to solve problems in chemical kinetics and thermodynamics, the main difficulties were due to students' inability to use the units of measurement concepts in chemistry contexts.

This study was the collaboration of the lecturers from Mathematics Education Program, Chemistry Program, and graduate students studying at International College, Suan Sunandha Rajabhat University. The researchers applied the remedial teaching process and strategies to design the active learning activities for developing chemistry undergraduates understand the importance of units and transfer mathematical concepts in chemistry context with technology-based learning, Kahoot!.

Research of Objective

The objectives of this study are the following:

1. To investigate the effects of remedial teaching on improving the undergraduate chemistry students' ability to use the units of measurement
2. To assess the undergraduate chemistry students' satisfaction towards the remedial teaching

Scope of the Study

In this study, the researchers only investigated the usage of remedial teaching on first year chemistry undergraduate students. This study was done at the beginning of Semester 2, Academic Year 2017.

Related Literature

Remedial Teaching Process

Providing remedial teaching is an alternative approach for the regular classroom teacher by using of activities, techniques and practices to eliminate weaknesses that the student is known to have by re-teaching the content that was not learned earlier or had misconceptions.

Education Bureau of The Government of the Hong Kong Special Administrative Region (2007) suggested about the process of remedial teaching as the following: Step 1: Analysis of pupils' performance: prerequisite, learning needs, learning abilities, learning styles, interests;
Step 2: Preparation before classroom teaching: setting teaching objectives, adapting the curriculum, organizing teaching materials, choosing appropriate teaching strategies, collecting and preparing supporting materials;
Step 3: Teaching (group/individual/co-teaching);
Step 4: Evaluation / Observation.

The results from Step 4 (evaluation / observation) can be considered in two categories: (1) Obstacles in learning—revise / adapt teaching plans, and (2) Achieving Targets—advanced learning / learning new topics.

Engagement in Learning

There are three levels of engagement in learning mathematics: cognitive, affective and behavioral. Cognitive engagement requires a student to recognize the value of learning and have a willingness to continue learning. Affective engagement includes the student's thoughts and believe.in learning, especially student's ability to apply their learning to the real world context. For behavioral engagement, students have active participation in learning (Fredricks, Blumenfeld, & Paris, 2004).

In mathematics learning, engagement can motivate students enjoy learning and doing mathematics as a valuable and useful. However, at the beginning of lesson, the teacher can engage student to connect the previous knowledge to the new knowledge. The integration of technology was found to have significant influence on student engagement (Attard & Curry, 2012).

Technology-based learning is increasingly important in the 21st century. This is the new way of teaching and learning and is underpinned by constructivist theory of learning focusing on learner-centered. There are many tools provided for the classroom, e.g., mobile devices, interactive whiteboards, online media, digital games, etc. Digital games are technology-based environment and provided as tools for the classroom and have a lot of positive feedback including higher motivation for students and enables active engagement and equal access. In addition, an activity as a game composes of competition, engagement, and immediate rewards (Teed, 2016).

Kahoot! is a free game-based learning platform, used as education technology not only in the classroom but outside the classroom. Students can play Kahoot! anywhere and anytime they have mobile phone with the internet. Kahoot! is commonly used to review students' knowledge and for formative assessment. It can be played through different web browsers and mobile devices through its web interface (Gibson, 2015). Teachers can customize different kinds of Kahoot! such as quiz, discussion, survey, and jumble.

Active Learning in Mathematics

There are many mathematics teaching strategies to apply in supporting students' achievement. The National Council of Teachers of Mathematics states that

"effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well (NCTM, 2000, p.16). For Learning Principle, "students must learn mathematics with understanding, active building new knowledge from experience and prior knowledge (NTCM, 2000, p. 20).

Active learning instructional strategies can be created and used to engage student during learning process to build new knowledge. It requires students to do meaningful learning activities and think about what they are doing (Prince, 2004). Discussion is one of the best methods to fostering active learning and promoting learning in the classroom. Students have opportunity to express their opinions, share ideas, and exchange experiences with teacher and other students (Won, 2015).

In this research study, the researchers developed remedial teaching by determining the process and teaching strategies shown in Figure 1:

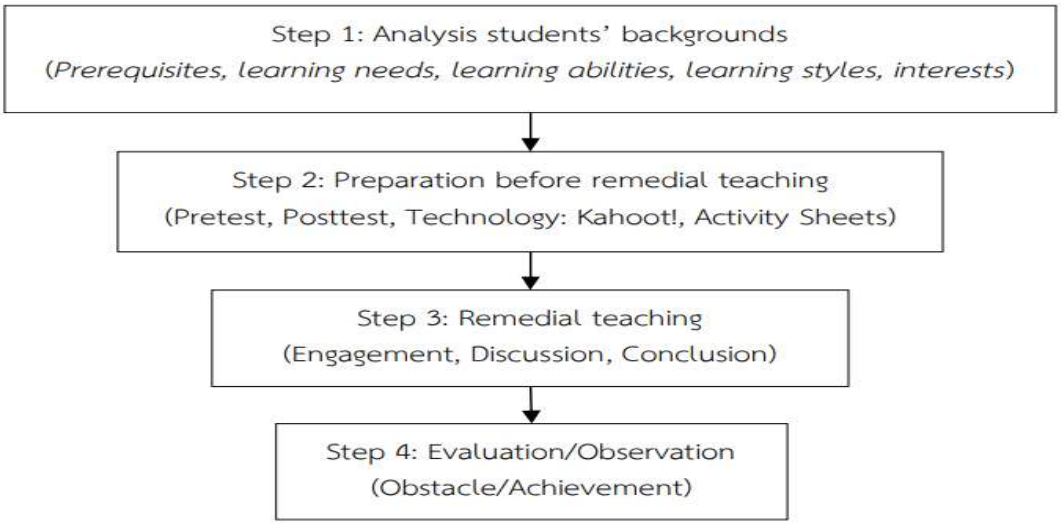

Figure 1: Process of Remedial Teaching

In Figure 1, the researchers adapted the process of remedial teaching which suggested by The Government of the Hong Kong Special Administrative Region, and applied the active learning through 3 steps: Engagement (E), Discussion (D), and Conclusion (C) during remedial teaching as follows:

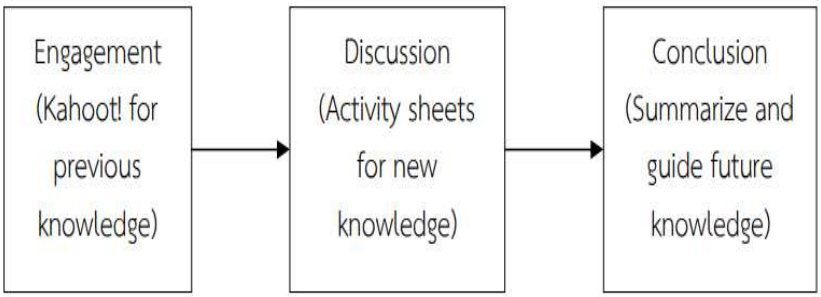

Figure 2: Remedial teaching strategy

There are different lesson closure strategies to help students summarize their notes from the lesson. In this study, the researchers used for closure by having students go through to wrap up learning with 3 strategies: (1) Math Journaling, (2) Whip Around and (3) Pair-Share (Duplanty, 2013).

Research Methodology

Participants

The participants in this research were 19 first-year chemistry undergraduate students in Faculty of Science and Technology at Suan Sunandha Rajabhat University in Bangkok, Thailand.

Research Instruments

1. Three-period lesson plans in the topic of basic mathematics calculation, units of measurement, distance, volume, and density
2. Activity sheets and technology-based learning lessons
3. An achievement subjective test consisting of 20 questions
4. Students' Satisfaction Questionnaire consisting of 3 categories: Knowledge (3 items), Affective (3 items), and Behavior (3 items)

Research Procedure

The procedure of this study was divided into 3 phases as follows:

Phase 1: Before Remedial Teaching

The researchers constructed three-period lesson plans, activity sheets, Pre-test, and Post-test.

Phase 2: During Remedial Teaching Students took the pre-test and started learning through 3 steps of remedial teaching (Engagement (E), Discussion (D), and Conclusion (C)) as follows:

Step 1: Engagement Students played an easy Kahoot! game to become familiar with Kahoot! and variety games following to the lesson plan.

Step 2: Discussion Students learned the concepts through discussion on activity sheets (content and exercises). The researchers as the lecturers were facilitators to help some students who had misunderstood the concepts and explain individually case by case.

Step 3: Conclusion In this study, the researchers closed the lesson by having students wrap up learning with 3 strategies: (1) Math Journaling, (2) Whip Around and (3) Pair-Share. Phase 3: After Remedial Teaching

1. Students responded the satisfaction questionnaire at the end of the remedial teaching.
2. Students took the post-test after the remedial class for comparing students' abilities before and after using the remedial teaching.

Data Collection

This research composed of 2 types of data:

1. Quantitative Data: Pre-test scores and Post-test scores
2. Qualitative Data: Students' Satisfaction Questionnaire (Five Likert-Type Items)

Data Analysis

Researchers analyzed quantitative data and qualitative data as follows: Quantitative Data

Objective 1: The researchers applied descriptive statistics by calculating a paired t-test to compare before-and-after using the remedial teaching (pre-test scores and post-test scores).

Qualitative Data

Objective 2: The researchers analyzed Likert-Type items (Strongly Agree, Agree, Neutral, Disagree, Stronly Disagree) by using frequencies in percentage.

Research Results

Objective 1: The results of data were analyzed by using a paired t-test ($t = 5.44$, $df = 18$) as shown in Table 1.

Table1:The improvement of undergraduate chemistry students' ability using the remedial teaching

Method	Pre		Post		t	df	Sig.
	Mean	S.D.	Mean	S.D.			
Remedial teaching	10.39	3.825	13.58	3.429	5.442	18	.000

* at the .05 level of statistical significance

Remedial teaching .000 * at the .05 level of statistical significance

Table 1 showed results of values of mean and standard deviation of pre-test and post-test. The pre-test has a mean of 10.39 with a standard deviation 3.825. While the post test has a mean of 13.58 with standard deviation 3.429. The comparison shows that the average score after remedial class is higher than before at the .05 level of statistical significance.

Objective 2: The results of data were analyzed by using frequencies in percentage and determined the mode of students' satisfaction towards the remedial teaching (RT) as shown in Table 2.

Table 2: Overall Students' satisfaction towards the remedial teaching (%) **Levels of agreement (N = 19)**

Statements	Levels of agreement (N = 19)				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Knowledge (concepts and skills)					
1. The RT made more learning and understanding.	89.47	10.53	-	-	-
2. The RT enabled students to connect between the knowledge in math and	78.95	21.05	-	-	-
science.					
3. The RT activity sheets were appropriate to understand.	52.63	36.84	10.53	-	-
Average Percentage for Knowledge	*73.68*	*22.81*	*3.51*	-	-
Affective (feelings or emotions)					
4. The RT using Kahoot! was interesting and motivation for learning.	94.74	5.26	-	-	-
5. The RT reduced anxiety in learning math for science.	78.95	21.05	-	-	-
6. The RT activity sheets were appropriate for each period.	52.63	36.84	10.53	-	-
Average Percentage for Affective	*75.44*	*21.05*	*3.51*	-	-

Behavioral (tendency or disposition to act)					
7. The RT made students for actively participation.	94.74	5.26	-	-	-
8. The RT created learning activities for diverse thinking.	78.95	21.05	-	-	-
9. The RT activity sheets encouraged student's ability.	73.68	26.32	-	-	-
Average Percentage for Behavioral	*82.46*	*17.54*	-	-	-
Total Average Percentage	77.19	20.47	2.34	-	-

Average Percentage for Behavioral **- Total Average Percentage -**

Discussion of Research Results

The results showed that the remedial teaching supported in improving the mathematics abilities of the undergraduate chemistry students on units of measurement in science context according to the research objective 1. The mean of post-test score was higher than the pre-test at the .05 level of statistical significance.

The results from the questionnaire showed that there was highly satisfaction for the implementation of the remedial teaching strategies with "strongly agree", i.e., "Behavioral Satisfaction" (82.46%), "Affective Satisfaction" (75.44%) and "Knowledge Satisfaction" (73.68%). However, there were only two students (10.53%) responded "Neutral Satisfaction" for appropriate time doing activities.

As the researchers conclude this research, the researchers have realized that the remedial teaching using technology-based learning and activity sheets related to students' needs and active learning styles can improve students' abilities and students have positive
attitude in learning mathematics for related contexts with the foundational skills needed to success in regular teaching and using technology is a way to provide students with customized to meet students' need with different achievement levels, interests, or learning styles (Kozma & Schank, 1998).

For further study, the researchers will plan to apply this method for other topics and prepare appropriate time for discussion activities

Suggestions

To develop 'mathematical concepts' in units of measurement: Scientific Notation, Standard International Unit--SI Prefix, Unit of Volume, and Unit of Mass. The results showed that the students were seen to do marginally better overall significantly, and there was highly satisfaction with the implementation of the remedial teaching strategies. When studying The Effects of Remedial Teaching Strategies on Undergraduate Chemistry Students' Learning in Units of Measurement to help find answers. Other studies should be conducted to verify the undergraduate chemistry students' satisfaction towards the remedial teaching.

References

Attard, C. & Curry, C. (2012). Exploring the use of iPads to engage young students with mathematics. In Mathematics Education: Expanding Horizons: Proceedings of the 35th Annual Conference of the Mathematics Education Research Group of Australasia; Dindyal, J., Cheng, L.P., Ng, S.F., Eds.; Mathematics Education Research Group of Australasia: Singapore.

Duplanty, B. (2013, Jan 14). Lesson closure strategies. Retrieved from http://k12edresources.com/229/

Education Bureau, The Government of the Hong Kong Special Administrative Region. (2007, July 1). Chapter 3-Remedial teaching strategies. Retrieved from http://www.edb.gov.hk/en/edu-system/special/resources/serc/irtp/book-3.html Fredricks, J.A., Blumenfeld, P.C., & Paris, A.H. (2004). School engagement: Potential of the concept, state of the evidence. Rev. Educ. Res. 74, 59–109. [CrossRef]

Gibson, S. (2015, June 14). Why Kahoot is one of my favourite classroom tools. Retrieved from http://tomorrowslearners.com/why-kahoot-is-one-of-my-favourite-classroom tools/

Kozma, R., & Schank, P. (1998). Connecting with the twenty-first century: Technology in support of educational reform. In C. Dede (Ed.), Technology and learning. Washington, DC: American Society for Curriculum Development.

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: NTCM. Available online at http://standards.ntcm.org Prince, M. (2004). Does active learning work? A review of research. Journal of engineering education, 93(3), 223-231.

Teed, R. (2016, Nov. 14). Game-based learning. Retrieved from https://serc.carleton.edu/ introgeo/games/index.html

The Institute for the Promotion of Teaching Science and Technology (IPST). (2008). The Basic Education Core Curriculum B.E.2551 (A.D. 2008): Mathematics. Bangkok, IPST. Won, J. (2015) Use discussion to promote active learning in the classroom: Strategies and tips for college teachers. Retrieved fromhttps://successfulteaching.wordpress.com/ 2015/01/09/promoting-discussion-in-class/