A Study of Chemistry Teaching and Learning for Hearing Impaired Students by Using Multimedia

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ABSTRACT

In this experimental research investigation, the researcher examines the instruction and study of chemistry for a hearing-impaired student using multimedia. The researcher also compares the academic achievement of this student prior to the commencement and after the completion of this study. The research population was a hearing-impaired student who had registered to study in the field of Teaching Chemistry at Ramkhamhaeng University (RU), Hua Mak, Bang Kapi, Bangkok Metropolis.

The research instruments consisted of an academic achievement test on acid-base solutions and an observation form used to evaluate instructional capacity in four aspects. These aspects were explaining technical terms; selecting instructional media; the composing of lesson plans; and evaluation through applications of the authentic assessment method.

The data were analyzed in two ways utilizing techniques of descriptive statistics. Thus, the data for the academic achievement test on acid-base solutions used percentage and the data for the capacity of instruction on acid-base solutions used frequency.

Findings are as follows:
1. The academic achievement of the student differed prior to the commencement and after the completion of the study. Academic achievement after the completion of the study was evinced at a higher level than prior to its commencement.

2. In respect to the evaluation of instruction on the subject of "explaining technical terms," the level was at "needs improvement." On the other hand, insofar as concerns the evaluation of the subjects of "selecting instructional media" and "composing lesson plans," the levels were both at the "fair" level.

CCS Concepts

Human-centered computing → Interaction design process and methods

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Keywords

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1. INTRODUCTION

The 12th National Economic and Social Development Plan (2017-2021) is focused on the development of people's potential at all ages (National Economic and Social Development, (2017, p.20-21). This plan emphasizes to improve the working skills, the quality of people in the future in accordance with the demand of labor market[5], especially the expert teachers in science field. Ramkhamhaeng University realizes and solves the problems by training expert teachers to work in school and university such as science teacher, physics teacher, chemistry teacher and biology teacher that are shortage fields. They also found that people should have the opportunities to learn and improve their skills even for the handicapped. These groups of people are able to improve and develop to reach the standards as the research of Srisukh Sujirakul (2008, P.68) found that impaired students at Ramkhamhaeng University needed help develop their career, and work effectively like normal people or close to normal people.[8] These are the reasons that the author is interested in developing and improving the hearing impaired students who study teaching chemistry at Ramkhamhaeng University. The author helps them to improve by using multimedia and modern technology as the teaching aid that can be used to solve the impairment of the as Chanjira Chaobankho (2011, p.497) found the using multimedia to teach science, the learning achievement are higher.[2] So the author adapted to teach chemistry which related in daily life by using multimedia to improve student teaching.

2. RESEARCH OBJECTIVES

To study the chemistry teaching and learning of hearing impaired student by using multimedia.

To compare an achievement of the chemistry teaching and learning of hearing impaired student before and after learning by using multimedia.

3. SCOPE OF THE RESEARCH

3.1 Population

One hearing impaired student enrolled in chemistry teaching at Ramkhamhaeng University, Huamark, Bangkok.

3.2 Variable

There are two variables to study the chemistry teaching and learning of hearing impaired student by using multimedia, the learning achievement of hearing impaired student and the actual evaluation of the teaching ability assessment.

4. TECHNICAL TERMS AND THEIR DEFINITIONS

1. Learning and Teaching means to arrange learning activities in Chemistry subject for secondary school level.

2. Chemistry Subject means Chemistry lessons in Mathayomsuksa 1 level (Grade 7) about solutions: acid and base.

3. Hearing-Impaired Students means students with hearing impairment being able to speak, communicate with others by sign language, and read lips; who applied for Chemistry teaching department at Ramkamhaeng University.

4. Teaching with Multimedias means teaching by explaining with pictures along with the learning arrangements as well as teaching with other medias such as real objects, models, videos, etc.

4.1. Teaching by explaining means to verbally further explain the knowledge with the learning arrangements.

4.2. Teaching with pictures means using pictures with the learning arrangements.

4.3.Teaching with other medias means using real objects, models, or videos along with the learning arrangements.

5. Learning achievement test means the test on solutions: acid and base that the researcher made in order to analyze the knowledge that has been given by three types of teaching methods, which are verbal explaining, pictures, and other medias, of students who has hearing impairment.

6. Teaching ability means the teaching ability in Chemistry class including 4 of the following:

6.1.Technical Terms explanation means to effectively and correctly explain the technical terms.

6.2.Medias Selection means to select the right, suitable, interesting, and various medias during the teaching session.

6.3.Writing Lesson Plan means to write the correct and complete lesson plan accordingly to the elements of the teaching arrangements.

6.4.Evaluation means to measure and evaluate correctly and conform to the indicators.

7. Ramkamhaeng University means Ramkamhaeng University in Hua Mak, Bangkok.

5. EXPECTED RESULT

1. Know what media is appropriate to use in teaching and learning with hearing impaired students.
2. Hearing impaired student is able to use multimedia to improve teaching chemistry, diverse and more appropriate.
3. Hearing impaired student can use multimedia this research to apply teaching in other subjects.
4. To be a guideline for hearing impaired student to use this teaching method in the real life.

6. RELATED LITERATURE

The study chemistry teaching and learning of hearing impaired student by using multimedia was related literature as following:

6.1 The Learning Theory of Thorndike

This idea was found by Thorndike as well as the theory that has summed up as the learning rules of Thorndike (Chaiwat Suttirat,2009,P18 – 19) as following:

1. Law of Readiness which says the learning happens with learners are physical and emotionally ready.

2. Law of Exercise which says doing exercises or repeating the actions with comprehension prolong the learning and potentially becomes permanent.

3. Law of Use and Disuse which says learning happens from the connection between stimulus and response. Therein, the stability of learning happens when often used and easily is forgotten when disused.

4. Law of Effect which says when a person receives the satisfying result, he or she tends to continue learning. In contrast, he or she tends to stop learning when receiving unsatisfying result.[1]

6.2 Learning Meaningfully Theory of Ausubel

Learning Meaningfully Theory of Ausubel (Surang Khowtrakul,2009,P216–217) has been summed up that the significance of learning is to learn understandingly and meaningfully. Learning happens when learners gather or subsume new knowledge that can be concepts or knowledge that is newly received in the structure of intelligence with the existing knowledge and is usable in the future.[9]

6.3 Self-Learning Theory

This theory is founded by Vygotsky (Surang Kowtrakul,2009,P63) has summed up that social institutions, starting by family institution, influence intelligence development of each person which is knowledge asset of a person and language is an important tool for thinking and developing the intelligence in higher levels.[9]

Srisukh Sujirakul. (2008) ,studied the level of basic needs that support the education of disabled students at Ramkhamhaeng University. The findings found that the factors supporting the education of students with disabilities were divided into four areas: media facilities, services and other educational assistance. There are also suggestions for vocational development as in vocational training and development for people with disabilities[8]

Chanjira Chaobankho.(2011),developed a multimedia package on the digestive tract of creatures for Science department of mathayomsuksa 4. The development and the use of media teaching, comparing with the usual instruction, resulted to better learning achievement.[2]

Warangphat Sukruan. (2012).The research was conducted by using the concept of learning by using the brain as the base for leading about animal life. In Science 4 class (W 22102) The students of the secondary school were found to have the achievement after learning multimedia with brain-based learning higher than before learning at the 0.05 level of significance.[12]

Thitima Aroonrungsi.(2014), studied the creation of demonstration sets for teaching chemistry in the lesson called “Le Chatelier’s Principle” in order to increase the learning outcomes of Mathayomsuksa 5 students at Saipanya Rangsit School. The students who learned with the demonstration set had higher learning outcomes at the statistical significance level of 0.01 and the students were satisfied with the level of learning management.[10]

Saowalak Lharsing. (2015), studied learning achievement and attitudes towards science by using knowledge-based learning (5E) with multimedia in “Neuroscience and sensory organs” lesson for Mathayomsuksa 5 students. The result was found that learning achievement And the attitude toward Biology,of Mathayomsuksa 5 students who have been taught to discover knowledge through multimedia about nervous system and sensory organs,was higher

than before the experiment with the statistical significance at the 0.05 level.[7]

Panvipa Raktakanakul. (2015), developed a series of multimedia teaching about Chemical Reaction by organizing the learning system in thai students themselves discover knowledge on their own along with the KWLH Plus technique, using the concept of inside-out classroom learning to develop the ability of doing the science projects. The research was conducted in the first year of the study. After the use of multimedia instructional package, the result was found at a good level. The use of multimedia instructional packages was at a high level.[6]

Wang.(2010), studied the benefits of multimedia in education. It was found that the science-based media helped increase student achievement. And students are more satisfied with their studies because students understand the concept of education more easily and faster.[11]

Lee and Kamisah.(2014), developed interactive multimedia module in that the teacher is the mediator (IMMPA) in the management of electrical chemistry and also examines students' needs. The students who learned through the multimedia module were happy and was able to use the knowledge from the class.[4]

Charlie.(2014), studied the integration of teaching chemistry lessons with UNESCO's ICT database from UNESED and has found that these lessons can help students with low levels of learning. The average level of learning is slightly improved based on the different scientific process skills of each student, but the attitude after school is better.[3]

7. RESEARCH METHOD

The research instruments used in the study chemistry teaching and learning of hearing impaired student by using multimedia were two sets of test, an achievement test on acid-base solution for tower secondary student which the author created by herself and the observation forms to assess the teaching ability.

8. COLLECTING DATA

The steps of collecting data are as follows.

1. Contact hearing impaired student to study the acid-base solutions content

2. Contact the language interpreter to explain the content of the acid-base solutions, three hours for the acid-base solution, four hours for the acid-base test, and three hours to use acid-base in daily life. Then the hearing impaired student has to choose the interested content and teach three hours.

3. Pretest the hearing impaired student before studying the acid-base solution by using an achievement test.

4. Start teaching the hearing impaired student on the acid-base solutions by lecture, using teaching aid such as pictures and other multimedia. Then let the student does the post test for the first time, the second time and the third time in order.

5. Practice the hearing impaired student to teach chemistry on acid-base solutions, let the student choose the interested topic.

6. Invite three science teachers to evaluate the teaching of the hearing impaired student, one is the chemistry teacher from secondary school, one is the science teacher from hearing impairment school, the last one is the science teacher from the university who experts in teaching hearing impaired students.

7. The hearing impaired student teaches an interested chemistry topic at Ramkhamhaeng Demonstration School and Setsatian School. Then let the science teachers in each school evaluate the teaching.

8. Allowed the hearing impaired student teaches chemistry based on the content that the student is interested in and let the expert science teacher from Rajabhat University who has a lot of experience in teaching hearing impaired student evaluate the teaching.

9. Take the results of the assessment from three teachers to analyze data.

9. DATA ANALYSIS

The author analyze the results of the assessment by using statistic programmer.

The results of the actual teaching evaluation of hearing impaired student as shown in table 1

Table 1 shows the results of the actual teaching evaluation of hearing impaired student.

Topic of evaluation	Level of Quality			
	1 (Good)	2 (Fair)	3 (Poor)	Meaning
The explaining of the terminology		/	//	poor
The selection of multimedia		//	/	fair
The writhing of lesson plans		//	/	fair
The evaluation		//	/	fair

Table 1 shows that the result of the actual teaching evaluation of hearing impaired student by three teachers in the explaining of terminology topic is poor, the selection of multimedia and the writing of lesson plans are fair.

The results of learning achievement by using multimedia of hearing impaired student were analyzed by percentage as shown in table 2

Table 2 shows the learning achievement percentage of hearing impaired student by using multimedia.

Student	Pretest		Posttest					
			Method No.1 Lecture		Method No.2 Using Picture		Method No.3 Using multi media	
	S^*	%	S^*	%	S^*	%	S^*	%
1	15	50	19	63.33	20	66.67	23	76.67

(S^* =Score)

Table 2 shows that the pretest and the posttest of learning achievement by using multimedia of hearing impaired student at

Ramkhamhaeng University are different. The posttest is higher than the pretest.

10. RESEARCH RESULTS

The analysis of data can be summarize as follows

1. The results of the actual teaching evaluation of hearing impaired student is poor in the topic of explaining the terminology. The selection of multimedia, the writing of lesson plans and the evaluation are fair.

2. The learning achievement of hearing impaired student at Ramkhamhaeng University, the posttest is higher than the pretest.

11. DISCUSSION OF RESULTS

Based on research of studying the teaching chemistry of hearing impaired student by using multimedia, there are interesting issues to be discussed.

1. The results of the actual teaching evaluation of hearing impaired student in the topic of explaining the terminology item is poor. The selection of multimedia, the lesson plan writing and the evaluation are fair. It can be discussed in the following order.

The item of the explaining the terminology is poor because the hearing impaired student is unable to hear the voices so the student is not sure what contents has already taught. Moreover, the hearing impaired student was fainted in the classroom while he was studying the third subject. The lecturer and his friends took him to back to the dormitory. So he can't prepare well before teaching. The explaining in the topic of terminology is incomplete as written in the lesson plan. Like Thorndike's theory (Law of Readiness) found that (Chaiwat Suttirat, 2009 p.18-19) learning will be successful if learners are ready in body and mind.[1] The same as learning Lee and Kamisa's research (2005) found that learning through multimedia can't improve an achievement and the evaluation is poor.[4] In this case, the hearing impaired is unable to explain the terminology clearly by using multimedia and the result of the actual teaching evaluation is also poor. So the student has to practice many times before teaching in class. In the topics the selection of multimedia, writing lesson plans and the evaluation are fair. The student prepared multimedia, set the paper test as shown in the lesson plans so he is able to teach better than the explaining the terminology.

After teaching each time, the hearing impaired student was assessed by expert teachers. They told the student to improve teaching so the student tried hard and feel anxiety. The student has to teach in three different kinds of school so the results of teaching are not good as it should be Like Thorndike Theory (Law of effect) (Chaiwat Suttirat, 2003 p.18-19) found that people will continue to learn if the results are satisfied.[1]

In this case the student has an unsatisfaction results, although the student is smart in learning chemistry and also be a chemistry tutor so he is disappointed. The author suggested that this is the first time to learn teaching for the hearing impaired student by using multimedia, the student is able to learn and practice more different types of teaching and adapt to use in class next time.

The author also suggested that practice makes perfect. These are the reasons why the results of evaluation teaching are fair that does not much improve. Like Charlie's research (Chalie, 2014) which studios the teaching chemistry by using multimedia, the result of evaluation learning is slightly improve in average.[3]

2. The pretest and the posttest scores of learning achievement of hearing impaired student at Ramkhamhaeng University are different by research hypothesis. It can be discussed in the following order.

The pretest score pass 50 percent, this means the student still remember the content of chemistry subject and the student has just had a test of the second semester, 2016 that gets the highest scores in class. Even though the student did not read or review the lesson before doing the test, the student still pass the minimum scores. Like the theory of Vygotsky (Surang Khowtrakul,2009 p.63) found that the development of intelligent quotient is the benefit of people but language is an important tool of thinking and developing the intelligence quotient in high level[9] hearing impaired student was taught by using pictures and listening to lecture. The results of learning achievement of both methods do not much improve because the hearing impaired student has to study three subjects and do the test every week in this semester and also has to work have to make money for the final test period. There is no time to prepare before having a test so the results of the evaluation a little bit increase. Like Thorndike's theory (Law of readiness) (Chaiwat Suttirat, 2009, p.118-119) found that the learning will be successful if learners are ready in body and mind.[1] In this case the hearing impaired student has to study three new subjects and also worried about making money. These are why the results of the evaluation are fair. The results of learning achievement by using multimedia of gearing impaired student was satisfactory because the student is self-educated and interested in learning and the student is able to use the process of learning to teach in class. The lesson is meaningful better than learning by using pictures and listening to lecture. The results of the evaluation is higher. Like the theory of Ausubel (Surang Khowtrakul, 2009, p.216-217) found that learning with understanding and meaningful, the learning process is successful.[9] The student combines the ideas or the new concepts and adapts to use them in the future. Like the research of Chanjira Chobankho (2011)[2], Warangphat Sukruan (2012)[12], Thitima Aroonrungsi (2014)[10], Saowalak Lharsing (2015)[7], Panvipa Ratchatanakul (2015)[6] and Wang (2010)[11] that organize the learning activities by using multimedia and the results of the evaluation are in higher scores.

12. CONCLUSION

A summary of knowledge from the research on the teaching and learning of chemistry of students with hearing impairment using multimedia is as follows.

1. Teaching Chemistry of Students with Hearing Impairment Using Multimedia Helping students with Hearing impairment Teach students at a fair level.

2. Multimedia can help students with hearing impairment. Learn chemistry better. Because the achievement posttest is higher than pretest.

13. SUGGESTIONS

There are two topics to suggest the this research on teaching chemistry by using multimedia of hearing impaired student.

13.1 The suggestion to use the research results

13.1.1 Students should study both subjects, the teaching behavior and the curriculum and instruction to prepare the students themselves about their appearances before practice teaching.

13.1.2 Study the needs of hearing impaired students in order to give them opportunities to work as science teachers.

13.1.3 There should be jobs or activities for hearing impaired students to work and get some money to earn their living while they were studying. They will have more chances to study.

13.1.4 To give them scholarships for hearing impaired students, it should be hearing aid. As it can help them to improve their hearing comprehension.

13.2 Suggestions for the next research.

13.2.1 Hearing impaired students should be practiced more to be good at teaching science and feel confident to teach in class

13.2.2 Should study more the teaching techniques in chemistry by using multimedia, especially the impaired students that are unable to use arms or legs because it can be the choices for them to make decision in working.

13.2.3 To study the teaching chemistry of hearing impaired student, this should be the varieties of tools or instruments to collect data.

14. REFERENCES

[1] Chaiwat Suttirat. 2009. 80 Innovation in Learning Management.Bangkok: DENEX Inter Corporation

[2] Chanjira Chaobankho.2011. Development of multimedia package. Digestive tract Life Sciences Learning Group for Grade 12 students4. Conference on the 8th Kasetsart University Campus [Online] 2017. Source: http://www.researchconference.kps.ku.ac.th/article_8/p_edu.html#top [19 January 2017]

[3] Charlie P. Nacario. 2014. Integrating UNESCO ICT-Based Instructional Materials in Chemistry Lesson. Asia Pacific Journal of Multidisciplinary Research 2(4) Source: http://www.academia.edu/8002629/Integrating_UNESCO_ICT-Based_Instructional_Materials_in_Chemistry_Lessons [April 15, 2017]

[4] Lee Tien Tien and Kamisah Osman. 2014. Development of Interactive Multimedia Module with Pedagogical Agent (IMMPA) in the Learning of Electrochemistry: Needs Assessment. Research Journal of Applied Science, Engineering and Technology.7(18) Source: http://www.maxwellsci.com/jp/abstract.php?jid=RJASET&no=427&abs=05 [April 13, 2017]

[5] Office of the National Economic and Social Development Board National Economic and Social Development Plan Twelfth Edition, 2017 – 2021 Office of the National Economic and Social Development Board premier.

[6] Panvipa Raktakanakul. 2015. Development of multimedia teaching package on chemical reaction. KWLH Plus is a learning management system that utilizes the concept of reverse learning. To develop the ability to do science projects. And science of mathayomsuksa 4 students. Journal of Veridian E-Journal, Silpakorn University 8 (1)

[7] Saowalak Lharsing 2015. Study on Learning Achievement and Attitude. Science by Using Knowledge-Based Learning (5E) With Multimedia The nervous system and sensory organs. For high school students Year 5. Master Thesis (Teaching Science) Burapa University.

[8] Srisukh Sujirakul. 2008. The level of basic needs conducive to the study of students. Ramkhamhaeng University. Research Report Student Affairs Division Office of the President. Ramkhamhaeng University, Bangkok.

[9] Surang Khowtrakul. 2009. EducationalPsychology. Chulalongkorn Printing House University, Bangkok.

[10] Thitima Aroonrungsi.2014. Creating a Demonstration Lechaterie content for Teaching Chemistry to increase the learning outcomes of MathayomSuksa 5 students, Saipanya School Rangsit University. (Teaching Science), Rangsit University.

[11] Wang,Tsung juang. 2010. Educational Benefits of Multimedia Skills Training Journal of Tech Trends: Linking Research and Practice to Improve Learning. Source: http://www.eric.ed.gov/ERICWebPortal/Home.portal?_nfpb=true&ERICExtSe, [May 15,2010.]

[12] Warangphat Sukruan. 2012. Creating and using multimedia based learning concept.Using the brain as the base of the animal life science 4 (W 22102) students. MathayomSuksa2 Secondary School. Kasetsart University 6 - 7 December 2012 [Online] 2017. Source: http://researchconference.kps.ku.ac.th/conf9/article_9/o_edu.html [April 13th2017]