Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/12183
DOI URL: http://dx.doi.org/10.21474/IJAR01/12183

RESEARCH ARTICLE

KHAN ACADEMY AS A SUPPLEMENTAL LEARNING TOOL FOR NON-STEM STUDENTS IN CHEMISTRY ENGINEERING COURSE

Donnalyn Blacer-Bacolod[1] and Rudyr S. Bacolod[2]

1. College of Sciences, Palawan State University, Philippines.
2. College of Teacher Education, Palawan State University, Philippines.

Manuscript Info

Manuscript History
Received: 20 October 2020
Final Accepted: 24 November 2020
Published: December 2020

Keywords:-
Video Podcasts, Chemistry, Academic Performance, Engineering

Abstract

This study explored the effectiveness of using the Khan academy video podcast as a supplemental tool in the chemistry class of Engineering programs. This study utilized a quasi-experimental equivalent design with a post-test only. Thirty 1st year non-STEM students, equally distributed to control and experimental groups, were selected using a matched paired sampling method to participate in a two-week-long intervention. As results revealed, its utilization as a supplemental tool had a viable impact on the students' performance in chemistry. Its utilization significantly increased their test scores as compared to the students who did not use it. Likewise, a post-exposure self-report survey was administered to shed light on the learning experience of using the supplemental tool. They indicated the cognitive advantage and personalized experience of using the Khan Academy. This study can contribute to the literature of Khan Academy in the chemistry field. Nonetheless, several limitations need to be addressed to augment future research. Considering the inclusion of more topics, longer time of experimentation, size of the sample, and explicit study of their behavior, for instance, can help establish the veracity of the future results.

Introduction:-

The breakthrough of the internet and technological media paved the way for many dynamic teaching and learning approaches such as video podcasts. Studies conducted in colleges and universities reveal several benefits of video podcasting to students by reducing the cognitive load (Kay & Edwards, 2012) and controlling the speed and the pace of information presented (Wall et al., 2010). Researches on higher education suggest that video podcast is enjoyable to watch (Winterbottom, 2007); satisfying (Traphagan et al., 2010); motivating (Hill & Nelson, 2011); intellectually stimulating (Fernandez et al., 2009); and useful, helpful, and effective for improving learning (Holbrook & Dupont, 2010). Moreover, the use of video podcasts has resulted in significant gains in skills (Alpay& Gulati, 2010), test scores (Crippen & Earl, 2004), and grades (Wieling& Hoffman, 2010).

Khan Academy, a free online tutorial video podcast, has helped many educators and students since it surfaced on YouTube (Khan academy, 2014). Khan academy video podcasts tackle a variety of course contents in math, science, history, and economics, among others (Smith & Harvey, 2014) and can be used as a supplemental tool to support blended learning model (Lindstrøm, 2015) or flipped classroom (Khan, 2020). Some studies show the varied success

Corresponding Author:-DonnalynBlacer-Bacolod
Address:-College of Sciences, Palawan State University, Philippines.

of using Khan academy (Noer, 2012; Thompson, 2011). Studies revealed that Khan academy had been highly used as a supplemental tool in mathematics which focused on the effectiveness of it in learning outcomes, math attitudes, and math anxiety reduction (Murphy et al., 2014; Light & Pierson, 2014), but the study of Webley (2012) claimed that Khan academy does not meet the pedagogical standards of math teaching. This can be attributed to the fact that Salman Khan is not a professional teacher. Nevertheless, many are still using Khan academy to reinforce their teaching and learning.

Khan Academy video podcasts can be used to explain fundamental concepts applicable to undergraduate college-level general chemistry and organic chemistry (Leontyev& Baranov 2013). Significantly, many high school and university students around the world perceived chemistry as a difficult subject (Reid, 2008) because they confused basic chemistry principles (Kamisah& Nur, 2013) or the flawed fundamental chemistry theories they learned in the previous years remained uncorrected resulting to difficulty understanding complex principles (Thomas, 1997). Its difficulty can also be attributed to the complex nature of certain chemical principles, classroom teaching methods, shortage of teaching aids, and the complexity of chemistry language (Carter & Brickhouse, 1989; Nakhleh, 1992). According to the studies of Osborne and Collins (2000), students' involvement and performance in chemistry have decreased in recent decades.

Until today, no empirical research regarding the use of Khan academy video podcast as a supplementary tool in chemistry subject is offered in the extant literature. Hence, to provide important information about its effectiveness, this present study aimed to investigate how the use of Khan academy video podcasts as a supplemental tool can enhance the academic achievement of first-year non-STEM Engineering students taking a chemistry course. The research questions sought in this study were: 1.) Did the use of the Khan Academy video podcasts help improve the students' performance in chemistry? and 2.) What are the perceptions of students toward the use of Khan Academy as a supplemental video podcast?

Methods:-

In this study, the researchers investigated the effectiveness of the Khan academy video podcast as a supplemental tool in improving the performance of the first year non-STEM Engineering students in specific Chemistry course topics through quasi-experimental equivalent group comparison design with post-test. However, the main drawback of this design is its vulnerability to selection disparities. Pre-existing variations between the two groups can affect heterogeneity in learning outcomes and attitudes.To minimize the threat to validity, the researchers paired the subjects using the results of the assessment survey. This method minimized the heterogeneity between participants when they were matched such that experimental and control groups had students with identical abilities and characteristics.

Participants:

Thirty 1st year non-STEM Engineering students enrolled in selected Engineering programs inastate university in the Philippines served as the participants of this study. Most of the students who took engineering in college/university were STEM program graduates in their Senior High School years and were significantly exposed to different science disciplines. However, there were a few numbers of non-STEM graduates who proceeded to the engineering program. These students had little background in fundamental concepts of chemistry and physics. The participants were selected through a matched pairing of characteristics. After identifying their comparable characteristics and ensuring no statistical difference, they were randomly assigned to experimental and control groups. Each group had 15 students.

Data Collection Procedure:

Before the data gathering, the study participants were informed about the study's aims, and their voluntary participation will not affect their grades. The researchers also explained how the study would be conducted. First, all the non-STEM students answered a pre-assessment survey consisting of a pre-test to determine their knowledge about the topics and some questions about their demographic profile. This was done to establish the matched-pairing. After evaluating the results, only 30 non-STEM students qualified to be matched-paired. They were randomly assigned to experimental and control groups.

The chemistry lessons used were Oxidation-reduction (redox) reactions. These lessons were covered simultaneously within the two- week activity. All students were given the same tasks and test, used the course materials, and taught by the same teacher. Only the experimental group students were engaged in using the Khan Academy supplemental

video podcasts after the discussions. They were allowed to access the video after class and at home. After the experimental period, all participants were given a post-test parallel to the pre-test. However, only the experimental group was assigned a post-exposure self-report survey that asked about their learning experiences.

Statistical Treatment:
Statistical treatment was carried out through the use of the Statistical Package for Social Science (SPSS). A paired sample t-test was used to compare the results of the post-test questions administered to both groups. The normality test using the Kolmogorov-Smirnov test and homogeneity of variance using the Levene test was performed before conducting a paired sample t-test.

Instrument:
A post-test was administered to the participants to serve as the assessment tool for students' level of achievement in the chemistry topic (Oxidation-reduction reactions) after using the Khan academy. A test-retest was utilized for the pre-test and post-test to ensure their reliability. A Cronbach's alpha was determined afterward. A post-exposure self-survey report questionnaire was given to the experimental group after the intervention. It asked,"Was the use of Khan Academy helpful to you? Why or Why not? Please describe your learning experience while using Khan Academy.

Results and Discussion:-

Table1shows the result of the two groups'post-tests. The experimental group (M= 28.06, SD=2.18) was higher compared to the control group (M=25.20, SD= 2.20). Results indicated that the students who were exposed to a supplementary video performed significantly higher than those students who did not (the control group), with $t(29)= 3.37$, $p< 0.05$. Although both groups acquired similar highest and lowest scores in their post-test, it can be concluded that the Khan academy video podcastsas a supplemental tool were effective in improving the performance of the students who used them.

Table 1:- Statistics of Post-test performance(n=30).

Group	**Highest Score** (out of 30)	**Lowest Score** (out of 30)	**Mean** (out of 30)	**Standard Deviation**	**df**	**t value**	**Significance of t value** (two-tailed)
Experimental Group	30	24	28.06	2.18	29	3.37	0.00
Control group	30	24	25.20	2.20			

A post-exposure self-report survey was also given to the students who used Khan Academy to supplement their lessons. This questionnaire asked about their learning experiences. Cognitive advantage and personalized learning experiences emerged as themes during the content analysis of their answers.

Cognitive advantage and Personalized learning experiences:
All of the participants agreed that Khan Academy was a useful supplemental tool for their learning. Seven students further commented that they had gained learning and their experiences were unique and personalized.

Sample comments included:
"It was helpful to me because I can re-study the lessons even at home."
"It was an effective supplemental tool because it was easy to understand even, I am not in the class"
"The video podcast was engaging and interesting."
"Yes, Khan Academy reinforced my learning about the subject."
"I like the video podcasts because I can stop, rewind, and play the explanation."

Few students (n= 4) commented that Khan Academy promotes independent and sometimes collaborative learning.
Sample comments:
"I can use it with my friend to study the lesson together."
"..if I have spared time, I tried to watch the video for self-studying."

"I use my phone to access the videos, with that I can study anytime and anywhere as I wanted"

Four students commented that their study habits and English language skills improved because they were engaged with the video given to them. Quoting one of the comments, it said,"It improved my study habits because I have to watch it in order to understand the lesson and I can ask questions in the next meeting if the teacher will ask me" and "It was useful, aside from learning the topic, I got to mimic somewhat the voice and language of the speaker in the video."

Both the analyzed data and the survey report indicated that the use of the Khan academy wasa useful and effective supplemental tool in learning specific topics in chemistry. The students appreciated the advantages of using the video in their learning. The results gathered in this study were parallel to the claims of Leontyevand Baranov(2013), Holbrook and Dupont (2010), Crippen and Earl (2004), and Wieling and Hoffman (2010) that Khan Academy as a supplemental tool for learning is contributory to the academic success of the students.

Conclusion:-

The focus of this initial study was to explore the effectiveness of using the Khan Academy as a supplemental tool in the chemistry class of engineering. It was found out that the supplemental tool had helped facilitate students' learning. The use of it significantly contributed to students' academic performance through increased test scores. Furthermore, the results revealed that it had positive implications for students' cognitive and personalized learning experiences. This study can contribute to the literature of Khan Academy in the chemistry field. Its implication for educators and policymakers is to give more volition to the academe in providing an environment that is technologically enriched. Teachers should be given support and training to improve their pedagogical approaches and start integrating useful educational tools to improve the teaching-learning environment.

Limitation:

There are several limitations of the study worth citing to augment future studies related to this. First, the students had a short amount of time using the video podcast. Prolonged exposure should be allotted to establish the veracity of the treatment. In addition to that, more topics must be considered to come up with more reliable results. Third, adequate assessment tools must be used to know the effect of such intervention. Lastly, the perception of the students must be studied explicitly through the use of triangulation.

References:-

1. Alpay, E., & Gulati, S. (2010). Student-led podcasting for engineering education. European Journal of Engineering Education, 35(4), 415-427.
2. Carter, C.S.,& Brickhouse, M.W. (1989) What Makes Chemistry Difficult? Alternate Perceptions, Journal of Chemical Education, 66(3), 223-225
3. Crippen, K. J., & Earl, B. L. (2004). Considering the efficacy of web-based worked examples in introductory chemistry. Journal of Computers in Mathematics and science teaching, 23(2), 151-167.
4. Fernandez, V., Simo, P., &Sallan, J. M. (2009). Podcasting: A new technological tool to facilitate good practice in higher education. Computers & education, 53(2), 385-392.
5. Hill, J. L., & Nelson, A. (2011). New technology, new pedagogy? Employing video podcasts in learning and teaching about exotic ecosystems. Environmental Education Research, 17(3), 393-408.
6. Holbrook, J., & Dupont, C. (2011). Making the decision to provide enhanced podcasts to post-secondary science students. Journal of Science Education and Technology, 20(3), 233-245.
7. Kamisah,O.,&Nur,S.(2013) Conceptual understanding in secondary school chemistry: A discussion of the difficulties experienced by students. American Journal of Applied Sciences,10(5):433-441
8. Kay, R. H., & Edwards, J. (2012). Examining the Use of Worked Example Video Podcasts in Middle School Mathematics Classrooms: A Formative Analysis/Étude sur l'utilisation de podcasts d'exemplespratiques dans des classes de mathématiques à l'écolesecondaire de premier cycle. Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie, 38(3).
9. Khan Academy. Khan Academy: about. 2014: Retrieved 28.01.2020 fromwww.khanacademy.org/about.
10. KhanAcademy (2020). Official website. Retrieved on October 27, 2019 from https://www.khanacademy.org.
11. Leontyev, A., & Baranov, D. (2013). Massive open online courses in chemistry: A comparative overview of platforms and features.

12. Light, D., & Pierson, E. (2014). Increasing student engagement in math: The use of Khan Academy in Chilean classrooms. International Journal of Education and Development using ICT, 10(2), 103-119.
13. Lindstrøm, C. (2015). Using Khan Academy to support students' mathematical skill development in a physics course. age, 26, 1.
14. Murphy, R., Gallagher, L., Krumm, A., Mislevy, J., Hafter, A., & Park, M. (2014). Research on the use of Khan Academy in schools. Menlo Park, CA: SRI Education.
15. Noer, M. (2012). One man, one computer, 10 million students: How Khan Academy is reinventing education. Forbes (www. forbes. com/sites/michaelnoer/2012/11/02/one-man-one-computer-10-million-students-how-khan-academy-is-reinventing-education).
16. Osborne, J. F. & Collins, S. (2000). Pupils' and Parents' Views of the School Science Curriculum. London: King's College London
17. Reid.L.(2008).Identifying threshold concepts in geosciences; Taking inventory with students and faculty alike .threshold concepts .from theory to practice conference Queen's University,Kingston.ON.1
18. Smith, S. J., & Harvey, E. E. (2014). K-12 online lesson alignment to the principles of Universal Design for Learning: the Khan Academy. Open Learning: The Journal of Open, Distance and E-Learning, 29(3), 222-242.
19. Traphagan, T., Kucsera, J. V., &Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. Educational technology research and development, 58(1), 19-37.
20. Thomas, P.L. (1997) Student Conceptions of Equilibrium and Fundamental Thermodynamic Concepts in College Physical Chemistry, Unpublished PhD Thesis. University of Northern Colorado, Greeley, Colorado, USA
21. Thompson, D. (2011). Hear it now [Audio podcast]. Retrieved fom http://www. prairiepublic. org/radio/mainstreet/page/4.
22. Walls, S. M., Kucsera, J. V., Walker, J. D., Acee, T. W., McVaugh, N. K., & Robinson, D. H. (2010). Podcasting in education: Are students as ready and eager as we think they are?. Computers & education, 54(2), 371-378.
23. Webly.K. (2012, July 9) Reboot the School. Time, 180, 40-45.
24. Wieling, M. B., &Hofman, W. H. A. (2010). The impact of online video lecture recordings and automated feedback on student performance. Computers & Education, 54(4), 992-998.
25. Winterbottom, S. (2007). Virtual lecturing: Delivering lectures using screencasting and podcasting technology. Planet, 18, 6-8. In World Conference on Educational Multimedia, Hypermedia and Telecommunications, Montreal.