USE OF THE ANKI SOFTWARE IN COASTAL ENGINEERING COURSES: METHODOLOGY AND RESULTS

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Abstract

Many people believe that engineering subjects require only mathematical and physical abilities as well as space perception. However, some aspects of the syllabus, must be memorized to achieve optimal academic results. The pandemic situation has meant a reduction in face-to-face classes, which has made it difficult to highlight (through repetition by teachers) those concepts that must be learnt by heart due to their importance.

As is well known, the Notecard Question and Answer Technique (NQAT, based on Leitner's system) helps students to learn those important ideas that must be kept in the long term memory to remember when needed. Therefore, an educational project is presented here that contemplates the creation of a database of question-answer cards to facilitate the memorization of concepts, formulas and key values of different parameters essential for understanding coastal engineering problems. The methodology was experimented in different courses, related to Coastal and Port Engineering. These coursed are included in the third year of the Marine Sciences and Civil Engineering Bachelor degrees as well as in the MSc degree in the University of Cadiz. The program chosen was the ANKI, of broad application, easy to use and free to access. As a collateral advantage, students became familiar with this software and were able to use it in other subjects. Through a selective distribution of the different topics, all the students participated in the task of preparing the cards. Their use was encouraged by a series of online tests and a "supplementary bonus" to the final examination.

The results obtained between the current course (with flash cards) and the previous one (without flash cards) did not show any substantial change in the number of students who pass the subject. However, students reported that it took less time to memorize formulations and key concepts.

Keywords: Educational Innovation, Technical Education, Tutorials, Pedagogy, NQAT, ANKI.

1 INTRODUCTION

Throughout these last years, academic plans in Spain have changed to fit in with the new European Higher Education Area (EHEA). Thus, good practices and values must be established not only to follow European criteria and guidelines, but to guarantee the quality of higher education [1]. This means a change in the educational methodologies by the substitution of excessively theoretical teaching by a more practical training and education as well as the use of new technologies [2]. To achieve it, students must be involved in the learning process [3]. Therefore, Spanish universities are implementing information and communication technologies (ICT) to improve the teaching/learning process. Hence, students are encouraged to try new working methodologies through ICT (v.g Tagalou et al., [4]).

Within university education, engineering grades have a deserved fame of high number of failures. Engineering subjects have a difficulty inherent to their very nature, especially those related to physical-mathematical equations. In order to improve this ratio, different methodologies have been applied all over the world [5]. For instance, amongst others, audiovisual resources [6], use of GPS and Google Earth [7], development of tutorials [8], literature search [9], science history and gender [10], aerial photographs [11], naturalization [12], problem based learning [13], "semi-attendance" technique [14], training in specific vocabulary [15], return of the "rules of thumb" [16] and other methods [17-19], have contributed to increase the number of students that pass these engineering subjects [20].

Coastal Engineering (CE) is one of the subject taught into the Civil Engineering degree. There are a lot of coastal processes whose interpretation can be difficult for engineering students who come for the first time to this topic, v.g. [21-23]. Moreover, not only mathematical and physical abilities are required. Some aspects of the syllabus must be learnt by heart to achieve the best academic results. However, the pandemic situation has meant a reduction in face-to-face lectures, which has made it difficult to highlight (through repetition) those important concepts that must be memorized.

In order to help students to remember those important ideas, a methodology has been introduced: the Notecard Question and Answer Technique (NQAT), based in the Leitner's system [24]. It employs the concept of spaced repetition, i.e. memorization that uses time intervals. Therefore, an educational project was launched where a database of question-answer cards was created to facilitate the memorization of concepts, formulas and key values of different parameters essential for understanding coastal engineering problems. The methodology was experimented in different courses, related to Coastal and Port Engineering. These courses are included in the third year of two Bachelor degrees (Marine Sciences and Civil Engineering) as well as in a MSc degree in the University of Cadiz.

Hence, the aim of this paper is to present an innovative e-teaching project based on the use of the NQAT and the analysis of the improvements (if any) in the learning of the Coastal Engineering subject.

2 METHODOLOGY

The Spaced Repetition System is based on the premise that the bits of knowledge are better memorized in the long-term when the memorization exercises are performed in short intervals of time. Furthermore, the frequency of repetition decreases as knowledge becomes fixed.

The software chosen was the ANKI, of broad application, easy to use and free to access (https://apps.ankiweb.net/). It is content-agnostic and supports images, audio and videos. A distribution of the different topics was made to let all the students to participate in the task of preparing the flash cards. The cards were reviewed by the professors prior to their upload to the virtual classroom. Their use was encouraged by a series of online tests included in the virtual classroom meaning a "supplementary bonus" to the final examination system.

The Teaching Innovation project obtained a grant from the University of Cadiz which allows the hiring of a student to help in the presentation of the software, in the revision of the material and in the preparation of surveys and treatment of their results.

According to the methodology presented by Marin-Paz and Casado-Arjona [25], two surveys were distributed before the flash cards were performed, while the last one was completed on the day of the examination.

The questions allowed to obtain data about:

- Number of students (%) who participated in the creation of the flash cards
- % of students who already knew this method
- % of students who already had used this method
- % of students who used them to prepare for the subject exam
- % of students who considered it to be a useful tool
- % of students who will continue to use it

3 RESULTS AND DISCUSSION

As already mentioned, the study was conducted in three courses, two undergraduate (Marine Sciences and Civil Engineering) and a MEng. Results of the surveys are presented in table 1.

First of all, it should be noted that there are no major differences between the three courses (the standard deviation of the results did not exceed 10% in any case). Most of the students (92% in the average) participated in the creation of the flash cards (218 were created), though almost nobody had ever listened about this method and, therefore, had ever used it. It should be also noted that the use of the flash cards was encouraged by some online tests included in the virtual classroom, as a part of the continuous assessment and as a "supplementary bonus" to the final examination system.

The participation of the students was slightly lower in the degree of marine sciences due to the also slightly lower class attendance. On the other hand, the participation was absolute in the master probably due to the smaller number of students (10 versus 70, approximately).

Similarly, 90% average of the students used them to prepare for the exam. Moreover, the same percentage of students considered it to be a useful tool and will continue to use it in the future. Despite the fact that the surveys are anonymous and students are reminded of this before taking them, it is not ruled out that a certain part of the answers were not completely honest, trying to "please the professor".

For instance, Park and Cheong [26] already established the existence of response patterns and how some of these types of behaviour are the indication of satisficing, affecting the credibility/reliability of the responses.

Table 1. Results of the surveys

	Marine Sciences Bachelor	***Civil Engineering Bachelor***	***Coastal Eng. Master***	***Average***	***Standard Deviation***
Students who …	***%***	***%***	***%***	***%***	***%***
Participated in the creation of the flash cards	84	92	100	92,0	8,0
Already knew this method	5	4	10	6,3	3,2
Already had used this method	2	2	10	4,7	4,6
Used them to prepare for the exam	80	90	100	90,0	10,0
Considered it to be a useful tool	80	90	100	90,0	10,0
Will continue to use it	80	90	100	90,0	10,0

The results of the grades obtained between the current course (with flash cards) and the previous one (without flash cards) have also been compared (see table 2).

As can be seen, the results did not show a substantial increase in the number of students who passed the subject. No improvement in grades was detected either. However, students reported that it took less time to memorize formulations and key concepts.

Table 2. Comparison of the results obtained with and without flash cards in two different years (percentage)

	fail		***pass***		***B (5-6)***		***A (7-8)***		***A* (9-10)***	
	Flash cards									
	No	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***	***Yes***
Marine Sciences Bachelor	8	10	92	90	18	15	46	44	28	31
Civil Engineering Bachelor	21	18	79	82	24	23	39	41	16	18
Coastal Engineering Master	0	10	100	90	0	0	50	40	50	50

4 CONCLUSIONS

Results of an innovative e-teaching project based on the use of the NQAT, also known as the spaced repetition model or Leitner's system, is presented here. This methodology has been applied to the learning of the Coastal Engineering subject in three courses.

No major differences were found between the different courses. Most of the students, 90% average, used the flash cards to prepare for the exam. Furthermore, the same percentage considered the software interesting and consider to use it in the future.

The results of the grades obtained between the current course (with flash cards) and the previous one (without flash cards) did not show any substantial change in the number of students who passed the subject or any improvement in the grades either. However, students reported that it took less time to memorize formulations and key concepts.

It should be highlighted that almost nobody had ever listened previously about this method. Thus, as a collateral advantage, students learnt to use the ANKI software and were eager to use it in other subjects.

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REFERENCES

[1] J. Carrasco-Gallego, C. Hernández-Rubio (2010). “Adaptation of the University tutorial programs to the EHEA”. EDULEARN10 Proceedings, pp. 2028-2036.

[2] R. Kaushalya, B. Raju, H. Hemlanaik, S. Jaganath (2009). “Emerging technologies in Education”. EDULEARN09 Proceedings, pp. 5067-5073.

[3] L. Rabiej (2013). “Making students involved in the learning process. Cooperative learning - How and who with?”. EDULEARN13 Proceedings, pp. 2385-2394.

[4] A. Tagalou, V. Massourou, K. Kuriakopoulou, A. Efthimiopoulos (2013). “ICT in Educational Management”. EDULEARN13 Proceedings, pp. 3840-3846.

[5] M.G. Neves, S. Fontul, M. Miguez, S. Solari, F. Pedocchi, L. Teixeira, M. Navarro-Pons, C. Ramos-Amaya, J.J. Muñoz-Perez (2015). “Methodologies for teaching an engineering subject in different countries: comparison and results”. INTED2015 Proc., pp. 1339-1346.

[6] P. López-García, M. Navarro-Pons, J.J. Muñoz-Pérez, G. Anfuso-Melfi (2014). “Audiovisual resources as a useful tool to improve the teaching of Coastal Engineering (Marine Science BSc degree)”. Proceedings of EDULEARN14 Conference, Barcelona, Spain, pp. 6117- 6124.

[7] B. Jigena, A. de Gil, J. Walliser, J. Vidal, J.J. Muñoz, L. Pozo, J. Lebrato (2016). “Improving the learning process in the subject of Basic Maritime Training using GPS and Google Earth as useful tools”. INTED2016 Proc., pp. 6161-6171.

[8] T. Plomaritis, M. Puig, I. Laiz, I., J.J. Muñoz-Perez (2017). “Development of tutorials to promote selfdirected programming learning: application to postgraduate studies”. Proceedings of EDULEARN17 Conference, Barcelona, Spain, pp. 3120-3126.

[9] J. Romero-Cózar, A. García-Yeguas, M. Gázquez, J. Reyes, M. Bruno, A. Contreras, J.J. Muñoz-Pérez (2019). “Meteorology for maritime students. Literature search for relevant information on meteorological subject and promotion of teamwork”. INTED 2019 Proceedings, pp. 900-904.

[10] J.M. González Moreno, A. García-Yeguas, J. Romero Cózar, M.J. Gázquez González, J. Reyes, J.J. Muñoz Pérez (2019). “On the shoulders of giants” the history of women and men in Physics as a teaching innovation in Engineering degrees. Proceedings of INTED2019 Conference, Valencia, Spain, pp. 905-913. ISBN: 978-84-09-08619-1

[11] P. Cabrera, G. Chamorro, B. Jigena, L. Moreno, J.J. Muñoz Pérez (2016). “Aerial photographs: a tool for Coastal Engineering Students”. Proceedings of ICERI2016 Conference, Seville, Spain, pp. 1646-1472. ISBN: 978-84-617-5895-1

[12] L. Pozo, Lebrato, J., Garvi, D., Jigena Antelo, B., Muñoz Pérez, J. J. (2016). “Naturalization: a new concept developed and carried out in the subject ‘Environmental Technology’ of degree in Industrial Engineering”. Proceedings of INTED2016 Conf., Valencia, Spain, pp. 7891-7895.

[13] J. Walliser, Jigena, B., Muñoz Pérez, J.J., Pozo, L., García Gómez de Barreda, D. (2016). “Problem Based Learning: a tool to improve maritime safety learning in the Merchant Maritime University degrees”. Proceedings of INTED2016 Conf., Valencia, Spain, pp. 6142-6150.

[14] L. Pozo-Morales, Lebrato, J., Garvi, M.D., Jigena, B., Muñoz-Pérez, J.J., Vidal, J. (2016). “Master in Water Engineering a ‘semi-attendance’ University-specific degree with international participation”. Proceedings of INTED2016 Conf., Valencia, Spain, pp. 7886-7890

[15] C. Contero, Cross, I., López, J. A., Albendín, M. G., Bartual, A., Hernández, I., Muñoz-Perez, J.J., Rebordinos, L. (2015). “Training in content and language integrated learning of Marine and Environmental Science in the Univ. of Cadiz (Spain)”. ICERI 2015, Seville, Spain, 8591-8595.

[16] G. Chamorro, P. Cabrera, J.J. Muñoz-Perez (2016). “A return to the ‘Rules of Thumb’ in Maritime Engineering for digital native students”. Proceedings of ICERI2016 Conf., Seville, Spain, pp. 1522-1531.

[17] F. Contreras de Villar, Muñoz-Pérez, J.J., Contreras de Villar, A., Castillo, O., Torregrosa, A.V., Duarte, A.L., Ruiz, F. (2019). “Methodological improvements in the final project of Civil Engineering Degree”. Proceedings of ICERI2019 Conf., Seville, Spain, pp. 2326-2332.

[18] A. Contreras de Villar, Muñoz-Pérez, J.J., Contreras de Villar, F., Lopez-Garcia, P. (2019). “Virtual resources for the improvement of teaching in the course of Port and Coastal Engineering (Civil Engineering degree)”. Proc. of ICERI2019 Conf., Seville, Spain, 4191-4195.

[19] A. García-Yeguas, Gonzalez, C., Piñero, M., Cárdenas, J.L., Rosa, M.L., Muñoz-Pérez, J. J., Vazquez, A. (2015). “Students frequently ask: ‘Yes but... What is the utility of physics?’ ”. Proceedings of INTED2015 Conf., Madrid, Spain, pp. 1024-1029.

[20] M. Navarro-Pons, J.J. Muñoz-Pérez, G. Anfuso, J. Román-Sierra, L. Moreno (2014). “Success on increasing number of students that pass the coastal engineering subject”. Proceedings of EDULEARN14 Conference, Barcelona, Spain, pp. 4443-4448.

[21] J.J. Muñoz-Perez. Ondas regulares y su aplicación a la Ingeniería de Costas (2012). Pub. University of Cadiz, 100pp.

[22] J.J. Muñoz-Perez, Khan-Mozahedy, A.B.M., Neves, M.G., Tejedor, B., Gomez-Pina, G., Campo, J.M., Negro, V. (2015). “Sinking of concrete modules into a sandy seabed: A case study”. Coastal Engineering, 99, 26-37.

[23] A. Aboitiz, Tejedor, B., Muñoz, J.J., Abarca, J.M. (2008). “Relation between daily variations in sea level and meteorological forcing in Sancti Petri Channel (SW Spain)”. Ciencias Marinas, 34(4), 491-501.

[24] S. Leitner, “That is how you learn to learn,” Applied Learning Psychology - A Path to Success, Freiburg im Breisgau, Basel, Wien: Verlag, Herder, 1972. (in German).

[25] A.J. Marín-Paz, V. Casado-Arjona (2020). “Drug learning through the spaced repetition system using ‘ANKI’ and ‘mnemosyne’ software in nursing students, EDULEARN20 Proceedings, pp. 7809-7814.

[26] H.S. Park, Y.F. Cheong (2012). “Course evaluation survey response patterns”. EDULEARN12 Proceedings, pp. 3627-3635.