Asia-Pacific Journal of Educational Management Research
Vol. 7, No. 1 (2022), pp. 55-64
http://dx.doi.org/10.21742/ajemr.2022.7.1.04

Impact of Game-Based Learning (GBL) Teaching Innovation Model in Quantitative Courses: A Self-reflection

Greeni Maheshwari

RMIT University, Ho Chi Minh City, Vietnam,
https://orcid.org/0000-0003-4470-6040
greeni.maheshwari@rmit.edu.vn

Abstract

This paper is a self-reflection of a researcher teaching and coordinating different Quantitative courses in South East Asian countries (Vietnam) with second language learners. The paper discusses a game-based innovative teaching model with a touch of a humanist approach in Quantitative courses, which creates an authentic learning environment by embedding authentic learning activities using online technology tools like Socrative, Quizlet, hands-on activities, and authentic assessment to enhance overall students' engagement and their performance with the course. The innovative teaching model is presented in this paper with some examples of teaching practices that the researcher uses in her classes. This innovative teaching model had a positive impact on students' grades and the lecturer's Good Teaching Score (GTS) and performance. This innovative teaching approach has helped the researcher get recognition in the form of various teaching awards for several years internally within the university and externally by being recognized as Senior Fellow externally from Higher Education Academy, UK. This self-reflection study might help other lecturers teaching business statistics courses by creating or adjusting the same model in their settings.

Keywords: *Quantitative courses, game-based teaching approach, self-reflection, students' engagement, teachers' performance*

1. Introduction

The concept of reflective practice is considered a critical process in evaluating own experience [1]. Self-reflection in education gives a chance to the lecturer to self-reflect on the teaching practices and hence helps in professional development based on that [2]. It is essential for the teachers to self-reflect on their teaching practice as this gives them the chance to learn from their mistakes and hence enables them to explore how they can improve in the future. The objective of this research is to share the researcher's experience with other lecturers based on the researcher's self-narration as a lecturer teaching various Quantitative courses in an international university in Vietnam. The paper reflects on how the innovative game-based teaching approach helped the researcher grow as a lecturer in the journey of working in Higher Education (HE). The researcher never undertook any formal training before starting teaching in HE and always relied on self-studying and self-learning regarding improving teaching in Higher Education. The researcher was regularly reading scholarly articles on learning and teaching to understand as what are the effective ways of teaching in

Article history:
Received (January 11, 2022), Review Result (February 18, 2022), Accepted (March 30, 2022)

Print ISSN: 2207-5380, eISSN: 2207-290X AJEMR

the classrooms and at the same time keeping students engaged? Initially, the goal was just to become an effective teacher and hence never thought of any innovative ways of teaching. As a part of formal professional development activity, later on, a researcher had undertaken a course 'Graduate Certificate in Tertiary Teaching' as the first activity in Higher Education. During the formal development certificate, the researcher learned various in and outside classroom practices that can be undertaken to enhance teaching and increase students' engagement with the course. As the researcher progressed further in their career and tried different innovative teaching approaches, the researcher felt that it was equally important to start looking for different ways of designing the curriculum with the given opportunities regarding course coordination. It is believed that a good curriculum can be an integral aspect of an educational program along with an innovative teaching approach. It was also felt that it is essential for teachers to self-explore themselves as a part of their development. Hence, this paper aims to share the author's experience of using an innovative teaching approach with other academics so that it helps the academics improve their teaching in their settings.

2. Literature review

Innovation in teaching and learning has become the need of the 21st century for teachers and learners. It is crucial to change the teaching practices from traditional to innovative to change the learning process from passive to active [3]. The world is constantly changing, especially after COVID-19, and hence there is a need to change the educational process to cope with this changing environment, which can influence and motivate the students in their learning [4]. Embedding technology in teaching and learning is needed in the 21st century for both teachers and learners. In an era of technology, it is vital to switch to the learner-centered approach from the teaching-centered approach to change the learning process from passive to active. Game-based learning refers to the usage of games to support teaching and learning. The past research suggests that GBL enhances the engagement and motivation of students, and hence it is helpful to integrate gaming into teaching pedagogy [5]. Most of the current learners are familiar with using technology; hence, digital GBL can be an effective way of teaching [6]. Hence the researcher's teaching approach is based on the belief that the best way to educate the students of this generation is via using technology and games, which they are familiar with. GBL is an innovative instructional approach to motivate and engage the learners to develop the students with real-world skills such as critical thinking, problem-solving, teamwork, and decision making where they get the opportunity to learn from their own mistakes [7].

In this era, an educator needs to combine teaching pedagogies with relevant, authentic class learning activities to increase student's engagement and motivation with their classroom learning [8]. With these changing demands, a teacher needs to adopt the appropriate teaching approaches to facilitate the students' learning. Accumulating skills and strategies are not enough in becoming an effective teacher. However, rather teachers need to adopt various learning activities by integrating online technological tools and game-based learning in the class to build an authentic learning environment to meet the needs of this era [9]. As per [10], educational institutions pay attention to building a learning environment that accommodates pupils from diverse backgrounds with different cultures and learning difficulties. Hence, teachers must prepare the pupils for the changing and diverse environment by using new technologies, changing assessments relevant to real-world applications, and appropriately teaching pedagogies.

It becomes essential for the teachers to try new learning activities. However, at the same time, it is also very critical to self-reflect on their practices to discover whether what they have tried fits well with the learning environment and whether there is an improvement in student's performance and engagement in the class by introducing new teaching techniques or learning activities in the class [11]. Hence, it is beneficial to self-reflect on teaching practices, an essential part of higher education, and considered an active process requiring an analysis of one's immediate experiences [12]. Reflective practice is a core component of the professional development of teachers within the field of education [10]. The need for the teachers is to become active in analyzing their practices for their growth in terms of professional standards and the progress in students learning [13].

3. Background: Teaching constraints

The researcher faced some constraints in the university as most of the students who study are second language learners and the confidence level of the students is not as high as compared of the native speakers. Due to this, they lack motivation and are hesitant to participate in classroom discussions. Hence, it was essential for the researcher to build a collaborative and engaging learning environment to overcome students' shyness and unwillingness to participate. This inspired and motivated the researcher to develop a game-based innovative teaching approach and design authentic learning activities wherein the student can learn in a fun way by playing some games or using technological tools that might trigger their zeal to learn and may result in active participation.

In Quantitative courses with second language learners at the university, it is hard to motivate and engage the students as they are shy to participate in class discussions. The students are afraid to answer as they feel that if they give incorrect answers, then other students might laugh, and they do not want to end up in this embarrassing situation. The Game-Based Learning (GBL) approach is especially beneficial in Quantitative courses where the students can participate in game-based quizzes or other games based on hands-on activities without the fear of losing face. Hence, the GBL approach is innovative as playing games or using appropriate technological tools can enhance students' understanding of course content. This approach provided the opportunity to educate and enhance student engagement inside and outside the classroom. Inside the classroom, the students get the opportunity to learn in more fun and engaging ways, and outside the classroom, they can relate to the theory better by applying real-world applications in their assessments.

Another constraint that the researcher faced was with some quantitative courses offered to first-year students, and this brings another new level of challenge compared to some introductory non-technical courses. The students are in their first year and are in the settling phase in the new environment of the university, and it is challenging to grab the students' attention and make them comfortable at the start of their new journey right after high school. Hence, the important task of the lecturer is to keep the students engaged and motivated in the classroom. This can be done using a student-centered constructivist teaching approach [14], which uses authentic learning activities and tests their knowledge later on through authentic assessments.

4. GBL innovative teaching approach: Beliefs and values

There are two central beliefs that the researcher has regarding teaching and learning, and these have influenced the teaching practice heavily. The first one is that students come to learn with their own unique set of experiences, knowledge, and ways of learning. This means

that the lecturer must fundamentally understand that students learn differently. The second is that learning is a journey that is explored together by the lecturer and the students. This means that the learners should be able to take responsibility for learning, and the role of the lecturer is to facilitate their learning.

Throughout many years of teaching experience in higher education, the researcher has understood how students learn. The researcher reviewed diversified pieces of literature from different sources [15][16][17], observed colleagues with ample experience in teaching and learning, and invited peers to the researcher's lectures. This scholarly activity has played a vital role in improving the researcher's teaching.

The teaching experience of the researcher to date has included teaching various quantitative courses, and the researcher uses a game-based technologically innovative approach that helps create a student-centered learning environment and actively engages the learners. At the heart of the researcher's teaching practice is respect for the students. The fundamental belief of the researcher is that what stands in the way of many students learning quantitative skills courses is not a lack of ability but a lack of self-efficacy. Also, the researcher believes that one of the most important tasks of a lecturer is to stimulate students' interest and enthusiasm in studying the courses and support them in applying concepts in real-world research and problem-solving.

In terms of teaching philosophy, the researcher adheres broadly to a constructivist student-centered teaching approach, which comes through in the teaching practice that encourages active engagement and participation by the students [14]. It is essential to try and understand the students' conceptions and help them build on these. This can be done by setting real-life problems, teamwork in the classroom settings, and the use of authentic assessments. The researcher designed a strong structure for the teaching sessions but with space to allow students to construct knowledge and their understanding with the lecturer.

The fundamental of the researcher's teaching practices has been laid by their own experience in teaching Quantitative courses for many years. Initially, the researcher used the teacher-centered approach in the classroom. After a few years from several discussions and informal feedback from students and senior staff and by reading some scholarly articles [18][19], the researcher recognized the need to change the teaching style to be less teacher-directed and more student-centered. Since then, the teaching approach was changed to a student-centered approach to support students more and make the environment in the classroom more enjoyable for all. This development in teaching has had an impact on both students and colleagues. Students started to participate more and link between the subject and the experience in the workplace. In addition, through the classroom peer visits and observations, several colleagues appreciated this interactive teaching method. Singer et al. approach to constructivist teaching helped the researcher stimulate students' understanding [16]. The researcher observed that students were actively involved in the process of knowledge construction instead of passively receiving information.

Furthermore, the researcher's enthusiasm for new teaching techniques provoked some action research that involved planning, then making a change and then reviewing the situation to generate learning. For example, the researcher taught several courses such as Business Statistics, Quantitative Methods, and Basic Econometrics. For a few semesters, the researcher faced a problem with the students' engagement and understanding of the technical, and quantitative courses. The problem was that even after trying my best to explain the concepts, many students felt scared, and the course was not relatable and valuable for most of them. Therefore, to tackle such a problem, the researcher decided to conduct action research to develop the teaching methodologies and learning activities in a way that motivates students to

participate more and supports them in understanding the subject more. The details of the activities used for action research are explained in section 5.2 of this paper.

The researcher realized that applying a practical approach using authentic learning activities in the class might work out well, and this is where the researcher felt that teaching via the inclusion of authentic and engaging learning activities might increase students' engagement and success level in the course. The researcher also felt it was imperative to arrange and update the curriculum with the changing technological world. With the existence of many learning online learning tools and various software packages, the teaching should be designed to enhance learning and creative, transformative learning experiences for the students and develop them as lifelong learners.

When the students are taught using authentic activities, it also helps create a student-centered classroom wherein the students take ownership of their learning and explore new ideas [14]. It is pretty essential to link the authentic learning activities with authentic assessments rather than traditional standardized tests as authentic assessments allow students to apply the knowledge they have learned in the class to apply in a real-world setting rather than just applying the formula and solving the traditional tests, which does not hold much relevance in a real-world setting as the student might not be able to apply the concepts learned [20]. Students need to demonstrate their knowledge in the real world. Hence, the researcher structured the classes to embed the new teaching approach well with authentic learning activities, and authentic assessments in the courses the researcher teach, which has resulted in increased students' engagement, improved performance, and increased teaching performance.

5. Teaching model: Conceptual framework

To overcome the constraints mentioned in section 3, the first step taken was to change the teaching methodology from a teacher-centered approach to a student-centered constructivist approach. Nevertheless, with changing times, it was realized that along with using a constructivist teaching approach, it is also essential to develop appropriate class learning activities that can keep the students engaged in the class and give them meaningful learning that can be applied in real-world situations. The below figure shows the conceptual framework for this study.

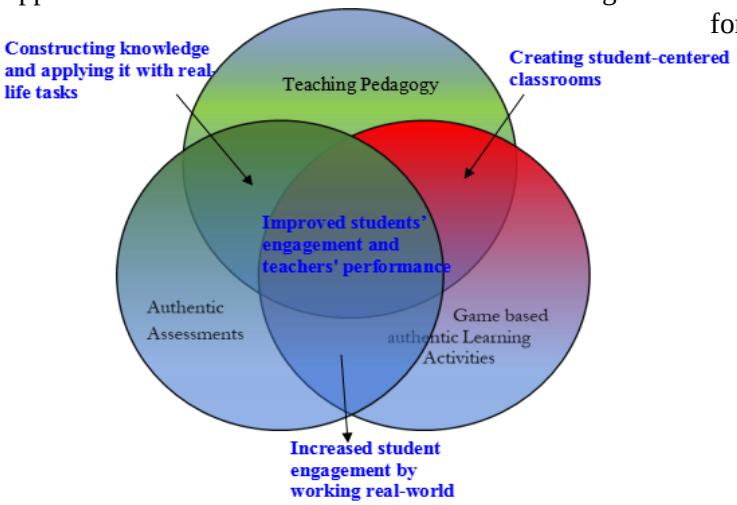

Figure 1. Conceptual framework: Teaching model in business statistics class

5.1. Constructivist learning environment and humanistic approach

The researcher uses a learner-centered constructivist teaching approach by integrating GBL and technology [19]) to structure the classes. In the constructivist teaching approach, the students construct their knowledge as it is believed that learning occurs best when learners are actively involved in constructing their knowledge rather than passively receiving information [21]. The constructivist learning environment is even more effective when it is weaved with a humanistic approach.

According to Tani [22], the Humanistic approach focuses on the development of students with an emphasis on the emotional aspects of the students with three main objectives; 1) Development and promotion of self-direction and independence. 2) Developing the ability to take responsibility in their learning, 3) Promoting and developing curiosity amongst the students. The researcher's approach of humanistic approach is demonstrated by the researcher's approachability to students, rapport building with the class, acting as a facilitator in the class rather than an instructor, showing care for the students, displaying enthusiasm, dedication, organization, and passion for the students. This helped make students realize that the lecturer is also one of them, and this has a significant influence on building rapport with the students, which allowed the researcher to connect well with the students right from the beginning of the semester. This connection helped further the entire semester, where students were comfortable approaching the researcher.

5.2. Embedding the authentic activities and authentic assessments to build the constructivist teaching

STEM (Science, Technology, Engineering, and Mathematics) courses are effective when taught using hands-on activities and live demonstrations. Hence, game-based learning activities are used by integrating technology in the class to engage the students. This approach is especially beneficial in Quantitative courses where the students find it quite difficult to relate the theory with real-world application. Gamification is an approach to teaching various concepts by using games in a non-game environment to enhance deep learning in the subject [17] and move up in Bloom's taxonomy of learning from just remembering the concepts to being able to analyze and evaluate the concepts. The various concepts in statistics such as probability, confidence interval estimation, hypothesis testing, and regression analysis are taught by embedding the learning activities in the form of games or simulations. At the same time, also the presentation of examples are used in the pictorial form (for example, a tree diagram while teaching probability) to make the complicated concept easier for the students to understand.

The researcher first realized the need for game-based learning activity in the hypothesis testing concept. Based on the score on Hypothesis testing and from students' feedback in and outside the class, the researcher found that the most challenging topic students found to understand and apply in Business Statistics are "Hypothesis Testing." This inspired the researcher to develop new learning resources for this topic. With this thought, the researcher began the action research in the year 2015 by changing the teaching methodology and the learning activity for teaching hypothesis testing. In the past, the researcher used to teach this topic by first explaining the theory and then practical examples. After reading more on this topic, the researcher decided to embed this concept in a class activity to cater to diverse needs and learning approaches. Now first, the researcher explains the practical importance of

hypothesis testing and how the claim can be proved in real-world situations. Once the students experience the practical application, the complete theory behind it is taught, and this way, learning this topic becomes fun and engaging, and this has also been evidenced by improved students' performance in this topic. This action research was tested on a small group with 35 students, and the midterm scores of students were recorded on the question related to hypothesis testing in two semesters in the year 2015 and found the students were performing better after this activity had been incorporated into the class and since then this activity is used in the class.

After successful implementation of game-based dice activity with hypothesis testing, the teaching methodology was further developed on game-based technological innovation being influenced by Sadik, Singer et al., and Biggs et al., [15][16][17]. As Sadik [15] points out, integrating technology into the curriculum and the classroom positively impacts students' cognitive development, deep learning, and engagement in their learning, and the same the researcher has observed after using this teaching approach in the classroom. Kiryacova et al. [17] viewed gamification as an approach to teaching various concepts by using games in a non-game environment to enhance deep learning in the subject. This game-based approach was especially beneficial in Quantitative courses where the students find it quite difficult to relate the theory with real-world application. Also, various technological tools such as Socrative, Quizlet, and QR codes were used in classroom teaching to support the learning activities in the course.

The researcher further designed various learning activities which involved students' collaboration with peers in the class in the form of playing games by using dice marbles, solving the challenging exercise problems in a group, and actual data collection in the class by using google docs and then analyzing the collected data right in the class. It was found that this innovative game-based teaching approach is a more engaging way of teaching by adding a fun element to the class, which further enhances the collaborative, inspiring, and enjoyable learning environment. Further, using various online educational tools such as Socrative, and Quizlet to check the students' understanding of the subject content gives a chance for the lecturer to revise unclear concepts once again.

For the students to be able to apply the concepts in the real world, it is also essential to align the assessments closely, and this can be done by using authentic assessments that have real-world applications in the course. The deep learning of concepts is essential if the students have to complete the authentic assessments, and game-based learning helps in enhancing the deep learning in the subject, and students are successful in making a connection to the real-world application, which was evidenced by students' comments, improved students' scores and lecturer's teaching scores. To achieve constructive alignment [18], it is ensured that assessments are closely matched with the course learning objectives and are authentic through connection to the real-world application which helps in developing students' employability skills in the future [23].

6. Results and discussion

To understand the effectiveness of the variation in teaching techniques with these game-based activities, the researcher did observe their teaching scores and students' grades before and after these activities were introduced. It was found that there was an increase in students' overall average score by a significant amount and also there was an increase in students' motivation level, which could be seen from one of the questions asked in end of year course survey results which students take up at the end of the semester. The data on teaching and

student scores cannot be published here as the ethics approval is not sought for this research on self-reflection, which is one limitation of this study currently.

The improvement in the student results indicates that the new technique helped students to apply the concept better and also engage with peers in classroom activities. It was also observed that the classrooms attendance has gone up, and more of the students were regularly attending the classes due to this new teaching technique which kept them motivated and engaged in the classrooms, and they were more willing to attend the sessions. Many students had provided positive comments on the new teaching technique and how these activities were fun and interesting way of learning dry subjects. Students also appreciated that this new approach has helped them to understand the role of statistics and connect them with real-world situations. It has further helped in improved teaching scores in all the semesters after these new teaching activities were introduced as compared to the earlier semesters. Overall, the self-evaluation shows the following, and it might be fruitful for other academics using the same approach in their teaching:

- The increased engagement and motivation of students learning STEM courses in a fun learning environment
- The integration of authentic class learning activities and authentic assessment together had a positive impact in terms of student results and THE RESEARCHER'S teaching scores for a sustained period.

This approach has not only benefitted students but has also helped the researcher in their teaching career. Internally, the researcher has received various teaching awards at the university for more than four years for the innovative and inclusive teaching approach. Not only this, but this innovative teaching approach was also helpful in getting the external recognition from Higher Education Academy, UK, wherein the researcher was awarded the Fellow of Higher Education (FHEA) and then Senior Fellow of Higher Education (SFHEA). In conclusion, the researcher has gained huge benefits both personally and professionally by changing the teaching pedagogy to this innovative GBL approach.

7. Conclusion

The researcher found that reflection on self-teaching practice has helped to understand how the students felt about the teaching practice, and the input the researcher received from the students and own observation has helped the researcher make the changes in the teaching pedagogy and overall teaching model. This study, which is the self-reflection of teaching as a lecturer teaching various Quantitative courses, has also revealed how it is crucial to bring innovations in teaching to adapt to the changing environment.

The self-reflection on the teaching practices allowed the researcher to explore how the teaching style and teaching activities should be adjusted to accommodate the growing needs of the students and how to prepare the students ready for work and life. It was good to see how the game-based learning using some technological tools aided students' learning and performance. The effect of an authentic learning environment was not only seen in students' performance but has also shown a positive effect on lecturer's teaching scores which are consistently strong for many semesters since the researcher started using the teaching model discussed in the paper, which is a mix of the student-centered teaching pedagogy, authentic learning activities, and authentic assessments. With this new teaching model, the increased attendance of students in the class was also observed, which is also a positive sign as this also allows students to develop their social skills and collaborate with their classmates. In the

future, the researcher plans to enhance students' engagement by introducing online videos in the course using LightBoard wherein the students can feel the presence of the lecturer and can get a 'real' classroom experience for online students who cannot come face-to-face for learning.

However, there are some limitations and future implications to this study. As a first limitation, this study is currently about the self-reflection of the researcher and not being tested by other lecturers. Hence, this research on this innovative teaching model can be expanded in the future to compare whether the effectiveness of this model is the same with different lectures, a different cohort of students, different courses, different countries, and settings. The next limitation is the lack of empirical research as currently this study did not collect the data and analyzed the results, and thus in the future, empirical research can be conducted to find the effectiveness of the GBL approach to provide robust results. To generalize the results in different countries, it will be interesting to have some comparative studies in the future to see the differences/similarities in the effectiveness of this new teaching model.

References

[1] J. M. Ferraro, "Reflective Practice and Professional Development," ERIC Digest, **(2000)**.

[2] Dr. Ningamma and C. Betsur, "Reflective Practice–an Innovation in Teacher Education," Asian Journal of Development Matters, vol.5, no.1, pp.236-238, **(2011)**

[3] M. Klyap M. Klyap, "Innovative directions of the higher education of Ukraine," Studia Universitatis, Vasile Goldis, Arad–Economics Series, vol.26, no.4, pp.54-66, **(2016)**

[4] M. Waring, "Social pressures and curriculum innovation: A study of the Nuffield foundation science teaching project," Routledge, **(2018)**

[5] C. Perrotta, G. Featherstone, H. Aston, and E. Houghton, "Game-based learning: Latest evidence and future directions." Slough: NFER, **(2013)**

[6] M. Prensky, "Digital game-based learning," Computers in Entertainment (CIE), vol.1, no.1, pp.21-21, **(2003)**

[7] C. –H. Chen and V. Law, Scaffolding individual and collaborative game-based learning in learning performance and intrinsic motivation," Computers in Human Behavior, vol.55, pp.1201-1212, **(2016)**

[8] C. M. Khairnar, "Advance pedagogy: Innovative methods of teaching and learning," International Journal of Information and Education Technology, vol.5, no.11, pp.869, **(2015)**

[9] J. M. Amador, R. Kimmons, B. G. Miller, C. D. Desjardins, and C. Hall, "Preparing preservice teachers to become self-reflective of their technology integration practices." In Pre-Service and In-Service Teacher Education: Concepts, Methodologies, Tools, and Applications, pp. 1298-1325. IGI Global, **(2019)**

[10] P. Zwozdiak-Myers, "The teacher's reflective practice handbook: Becoming an extended professional through capturing evidence-informed practice". Routledge, **(2018)**

[11] T. S. C. Farrell and J. Ives, "Exploring teacher beliefs and classroom practices through reflective practice: A case study," Language Teaching Research, vol.19, no.5, pp.594-610, **(2015)**

[12] S. Gustavsson, A. Andersén, and M. Berglund, "To challenge and to be challenged–teachers collective learning in higher education," Reflective Practice, vol.20, no.3, pp.339-354, **(2019)**

[13] Indicators, O. E. C. D, "Education at a Glance 2016," Editions OECD 90, **(2012)**

[14] G. Maheshwari and S. Thomas, "An analysis of the effectiveness of the constructivist approach in teaching business statistics," Informing Science, vol.20, no.99, no.83-97, **(2017)**

[15] A. Sadik, "Digital storytelling: A meaningful technology-integrated approach for engaged student learning," Educational Technology Research and Development, vol.56, no.4, pp.487-506, **(2008)**

[16] F. M. Singer and H. Moscovici, "Teaching and learning cycles in a constructivist approach to instruction," Teaching and Teacher Education, vol.24, no.6, pp.1613-1634, **(2008)**

[17] G. Kiryakova, N. Angelova, and L. Yordanova, "Gamification in education," Proceedings of 9th International Balkan Education and Science Conference, **(2014)**

[18] J. Biggs and C. Tang, "Teaching for quality learning at university," McGraw-hill Education (UK), **(2011)**

[19] M. U. Paily, "Creating constructivist learning environment: Role of "Web 2.0" technology," In International Forum of Teaching and Studies, vol.9, no.1, pp.39-50, **(2013)**

[20] S. A. Macht and S. Ball, "Authentic alignment" – A new framework of entrepreneurship education," Education+ Training, **(2016)**

[21] J. S. Kim, "The effects of a constructivist teaching approach on student academic achievement, self-concept, and learning strategies," Asia Pacific Education Review, vol.6, no.1, pp.7-19, **(2005)**

[22] S. Tani, "Reflected places of childhood: Applying the ideas of humanistic and cultural geographies to environmental education research," Environmental Education Research, vol.23, no.10, pp.1501-1509, **(2017)**

[23] K. Sambell, L. McDowell, and C. Montgomery, "Assessment for learning in higher education," Routledge, **(2012)**