

# The Study of Activity Based Learning (ABL) and their Challenges in Implementation for Higher Education Institutions

**Binoy Kurian**

Assistant Professor, Department of Biotechnology,  
Christukula Mission English Medium Degree College, Satna, Madhya Pradesh, India  
E-mail: biobinoy@gmail.com

(Received 19 May 2022; Revised 12 June 2022; Accepted 3 July 2022; Available online 10 July 2022)

**Abstract** - Activity based learning (ABL) is apprehended to be a promising approach that improves student learning in higher education. Empirical studies on ABL with a focus on student have been revealed cognitive outcomes, affective outcomes, behavioral outcomes and challenges in implementation. Future researches should investigate more about student learning outcomes and implementation of ABL for knowledge utilization and management.

**Keywords:** Activity Based Learning, Cognitive Outcomes, Affective Outcomes, Behavioral Outcomes, Learning Outcomes

## I. INTRODUCTION

In recent years higher education institutions have been trying to provide students with both hard skills, namely cognitive knowledge and professional skills [1] and soft skills, such as problem-solving and teamwork [2]. However, these skills related goals are not easy to be achieved as traditional learning. Because traditional learning simply played a role where teachers are “the transmitter of the knowledge” while students act as “the receptor of the information” [3]. Project, Internship, Apprenticeship and Field training in higher education are activity based learning (ABL); rooted in the common notion that students are active learners rather than passive recipients of information.

Project, internship, apprenticeship and field training have a greater role on the basis of cognitive development, concept learning and problem solving [4]. It is difficult for students to fully engage in educational practices, which may lead to a superficial understanding of disciplinary knowledge. Besides, universities and research universities, in particular, are more focused on the cultivation of student’s research skills rather than professional skills or transferable skills.

Thus, this might cause a gap between what students learn at the university and what they need in the workplace [5]. In order to change this situation, it is suggested that students are provided with the opportunity to participate in real problem-solving and knowledge construction in authentic professional contexts. The ways to achieve this goal is through ABL. It is beneficial to students for practical knowledge and exposure, higher initial salaries, faster promotions and quick job orientation [6].

### A. Project-Based Learning

Project-based learning refers to an inquiry-based instructional method that engages learners in knowledge construction by having them accomplish meaningful projects and develop real-world products [7], [8]. Several review studies have predominantly focused on project-based learning in post-secondary education. The studies reviewed were confined to course descriptions in terms of course scope, instructor requirements and team size. As for the impact, the review found that only a few studies investigated the influence of project-based learning on student learning related to either cognitive (e.g., knowledge) or affective outcomes (e.g., motivation) [9].

Another study reviewed fourteen cases that adopted project-based learning in STEM education [10]. It proved that project-based learning increased the development of both learner’s knowledge and skills. Students also felt that project-based learning encouraged their collaboration and negotiations within the group. However, some students reported a lack of motivation for teamwork. The studies of project-based learning in engineering education by adopting bibliometrics (e.g., analysis of keywords) and classifying research methods from the studies reviewed. Bibliometric results showed that the top three keywords used were project-based learning, engineering education, and problem-based learning. The classification results revealed that more than 70% of studies focused on undergraduates and case study was the most frequently adopted research approach. In addition, some studies showed that student’s academic knowledge, skills, and motivation were improved after project-based learning.

### B. Internship-Based Learning

Internship required students to apply classroom learning, theories and experiences to professional settings. Internships for graduate students have been a part of American higher education since its beginning. Pragmatism is an educational philosophy that says education should be teaching students the things that are practical for life and encourages them to grow into better people. Pragmatists believe in the idea of practical learning i.e., education should apply to the real world [11].

Internship is a process of training by which intern can develop their future job performance. It permits them to understand the connection between theory and practice. It enhanced student's knowledge and their potential to reach the goals set for various professions. It is essential to acquire proficiency in the job. Training which interns got during their internship improves knowledge and skills which helps their performance turns excellent. Graduate or post graduate students who attend internship will definitely develop personality. It supports socialization within the profession, stimulates development of teaching-learning concepts, provides a protected field of experimentations, allows new perspectives and enhances motivation to continue learning and reflecting. This would help them to choose, design, organize and conduct meaningful classroom activities [12].

### *C. Apprenticeship-Based Learning*

Apprenticeship is a system for training students or a new generation of practitioner of a trade or profession with on-the-job training and often some accompanying study (classroom work and reading). It combines classroom instruction and on-the-job learning. It is the most common method used to train post-secondary education instructors in teaching. So, there is a wide range of applications for an apprenticeship approach to teaching [13].

Apprenticeship model of teaching and learning are deeply embedded within complex and highly variable contexts, allowing rapid adaptation to real-world conditions. It provides learners with clear models or goals to aspire and accelerate learners to the values and norms of the trade or profession. It is common in teaching motor skills, such as learning to ride a bike or play a sport. But examples can also be found in higher education, such as teaching practice, medical internships, and laboratory studies. In addition, there was a social and cultural element exists for learning process; which is about understanding the accepted practices, customs and values of experts in the field [14].

Department of higher education in India and their statutory bodies like UGC, MHRD, AICTE, NCTE, Ministry of Science and Technology and their department like DBT, DSIR, DST were offered solid apprenticeship programs that set graduate and post graduate students on the path to good careers. Department of education in United States started Youth apprenticeship programs and pre apprenticeship programs for students at high schools, secondary or post secondary education to gain academic and technical skills to open remarkable career opportunities. In many cases, students of US leave high school with college credits through dual enrollment and industry- recognized credentials and certification. Similarly, Swiss companies also implemented apprenticeship programs for high school students that will continue beyond high school. In Switzerland, two-thirds of graduates from compulsory education choose to enter apprenticeship program of three to four years. Apprentices attended classes and work for an

employer. They are paid and earn college credits; in some cases, apprenticed students are awarded with PhD's [15].

### *D. Field Training-Based Learning*

Knowledge could be improved during training when students solve a specific task in the field. Furthermore, the interaction between the teacher and students at the test site helps to resolve those problems that may not be solvable in the classroom or with online training. It is necessary to satisfy student's expectations from training related to lectures and field training. Afterwards, we can compare them with real trends in the dynamics of changes in educational technologies. The basic principle of practical training is a combination of practical exercises with simulation methods in the development of practical skills and fluency with new equipment. Field training in biological science education is much more effective because it connects both types of skills: soft and hard.

Moscow State University of Geodesy and Cartography (MIIGAiK) educates students in the scope of problems of geodesy, cartography, and cadastre as well as such specific fields as precise instrument-making, geoinformatics, ecology, and remote sensing [16]. The University study provides theoretical and practical training in STEM education disciplines. The evidence that has emerged from the studies has proved that the field-based approach was effective in helping students to attain the required knowledge for the understanding of the natural context, and to illustrate phenomena and confirm their skills [17]. As well as soft skills, other competencies such as scientific reasoning and inquiry capacities are also developed [18]. Field training offers the opportunity to work as part of a team. Students also learn safety rules, which are more crucial than in general conditions in classrooms. In most European universities, field practices are study tours lasting 1-2 days for teaching students to work on a specific topic in small groups [19].

### *E. Objectives of the Study*

Although these reviews have mentioned student learning outcomes to a certain extent, there is no comprehensive picture of learning outcomes that can be connected to project, internship, apprenticeship and field training based learning especially in higher education institutions. Therefore, in the current study, I will provide an overview of student outcomes of ABL in higher education based on a review of empirical studies. To fully understand student outcomes, three research questions are answered in this study.

1. What student outcomes of ABL are evaluated in higher education?
2. What instruments are adopted to measure student outcomes?
3. What are the challenges in implementation of ABL in higher education institutions?

## II. MATERIALS AND METHODS

I reviewed a variety of important educational and psychological science journals, web of science and google scholar for the study. The results were taken from more than 100 peer-reviewed English articles. The articles were randomly selected based on the following criteria (a) the studies had to be empirical and should provide original data; (b) the studies had to focus on student learning; (c) the process of project, internship, apprenticeship and field training based learning had to be conducted in higher education institutions; (d) the impact of project, internship, apprenticeship and field trainings based learning on student learning outcomes (i.e. cognitive, affective, and behavioral outcomes) had to be measured; (e) challenges in implementation of project, internship, apprenticeship and field training based learning in higher education institutions were studied.

Based on the content of the selected articles, I had set up a matrix that involved the research design, learning outcomes, measurement instruments, findings and challenges in implementation reviewed. Based on this matrix, I summarized the outcomes that were measured and the instruments that were used to measure these outcomes based on commonly used clustering of learning outcomes and research methods [20], [21]. I divided the outcomes into four categories namely cognitive, affective, behavioral outcomes and challenges in implementation of ABL in higher education institutions.

## III. RESULTS AND DISCUSSION

### A. Cognitive Outcomes

In many studies content knowledge, conceptual understanding and course achievement were reported as outcomes of ABL. For example, biological knowledge, such as cloning and DNA isolation [22], psychological knowledge relevant to healthy living habits and pressure management [23], and technical knowledge related to space engineering were investigated [24]. Students academic performance of programming course was measured [25].

In a parallel study, students understanding of chemistry via the analysis of their projects evaluated. Semi-structured interviews were conducted to investigate students cognitive processing for understanding of chemistry. It was found that better understanding of science concepts by students were done by ABL [26].

### B. Affective Outcomes

A number of studies explored student's perception of the improvement of content knowledge and skills [24], [27], [28], [29], [30], [31], [32]. Some studies reported student's attitude [33], motivation [34], and self-efficacy to the subject [29], [35], [36], [37], [38], [39]. Some studies reported about student's perceived ability, skills, and

motivation to master science and technology courses [40]. Other benefits of ABL that students perceived, such as the help with their horizon [25] and future career were also reported [41].

Several studies reported students general feeling about ABL [1], [28], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51]. Some studies evaluated student's attitude towards ABL [26], [52], [53], [54], [55] and satisfaction with it [56], [57], [58], [59]. Some studies investigated student's perceived challenges during the learning process in a property course integrated with the ABL method [60]. Other study explored whether ABL method supports student's autonomy during learning activities [61].

### C. Behavioral Outcomes

Hard skills, such as marketing skills for students of hotel administration, [1] general care skills for nursing students, [39] EFL learners writing skills [62] and the skills of students of engineering management to decide where to locate public services in real-life situations were reported [44]. Besides hard skills, several soft skills were also reported, such as skills of problem-solving and critical thinking, [1], [39], [63] collaboration and team working skills [1], [24], [44] and lifelong learning skills [1], [39]. Learner's perceived engagement was reported in ABL. Three aspects of student's engagement are the level of general involvement in the semester project, the degree of participation in class discussions and application of the course concepts to practice.

### D. Challenges in Implementation of Activity Based Learning in Higher Education Institutions

These include the teacher's content knowledge, student's lack of experience in ABL and their preference for a traditionally structured approach that emphasizes passive learning. The organization and administration of ABL can be very time-consuming [9], [46], [64]. It is important that ABL programs are designed to sustain student motivation. The teachers are supported by management in creating ABL type of learning task. A number of factors are considered in ABL program to make sure the intended outcomes were attainable or not [65]. These include whether the students find the ABL to be interesting and worth doing, whether they have the competence to complete the program, and whether they focus on learning rather than on grades.

Due to the constraints on time and resources, the ABL programs needed to be feasible and manageable for both teachers and students [65]. Also, students who are inexperienced in the collaborative learning environment may find difficulties working in groups [66]. Consequently, the teacher should provide support for group work and conflict management to facilitate the process.

The ancient Indian universities like Takshashila, Nalanda, Vallabhi and Vikramshila which had thousands of students

from India and the world studying in vibrant multidisciplinary environments demonstrated the type of great success that large multidisciplinary research and teaching universities could brought. India urgently needs to bring back this great Indian tradition to create well-rounded and innovative individuals and which is already transforming other countries educationally and economically. Multidisciplinary and holistic approach of education was possible by overcoming the challenges of implementation of ABL in higher education institutions (HEIs).

Integrating humanities, arts with Science, Technology, Engineering and Mathematics (STEM) have consistently showed positive learning outcomes. It includes increased creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in- depth learning and mastery of curricula across fields. It increased social and moral awareness, besides general engagement and enjoyment of learning. Practical implementation of integration in between the students of different faculty was quite difficult. But in reality, it was possible only through the ABL. Research studies also improved and enhanced through a holistic and multidisciplinary education approach.

Large multidisciplinary universities and colleges already facilitated the move towards high quality holistic and multidisciplinary education. Flexibility in curriculum and novel and engaging course options are offered to students, in addition to rigorous specialization in a subject. This was encouraged by increased faculty and institutional autonomy in setting curricula. But students from socio-economically disadvantaged background and mentality of a general student were a challenge to the institutions for implementation of ABL. Anyway, the pedagogy with an increased emphasis on communication, discussion, debate, research, opportunities, encouragement and support for cross-disciplinary and interdisciplinary thinking may reduce the problem.

A robust ecosystem of cutting edge research was more important than ever with the rapid changes occurring in the world today, e.g., in the realm of climate change, population dynamics and management, biotechnology, an expanding digital marketplace, and the rise of machine learning and artificial intelligence. So, coordination of the pedagogy and the activity based learning was only a solution for sustainable knowledge utilization and management in Higher education institutions.

#### IV. CONCLUSION

The implementation of project, internship, apprenticeship and field training in higher education institutions leads to sustainable application of concepts for innovation of novel products and process development. It will require multiple initiatives and actions, which will have to be taken by multiple bodies in a synchronized and systematic manner.

These innovative polices will contribute more towards the utilization and management of knowledge in higher education institutions and contribute more employment opportunities in our nation.

#### REFERENCES

- [1] J. S. Vogler, P. Thompson, D. W. Davis, B. E. Mayfield, P. M. Finley and D. Yasseri, "The hard work of soft skills: Augmenting the project-based learning experience with interdisciplinary teamwork," *Instructional Science*, Vol. 46, No. 3, pp. 457-488, 2018.
- [2] J. Casner-Lotto and L. Barrington, *Are they ready to work? Employers perspectives on the basic knowledge and applied skills of new entrants to the 21<sup>st</sup> century U.S. workforce*, 1 Massachusetts Avenue NW Suite 700E, Washington DC: Partnership for 21st Century Skills, 2006.
- [3] B. Alorda, K. Suenaga and P. Pons, "Design and evaluation of a microprocessor course combining three cooperative methods: SDLA, PBL and CnBL," *Computers & Education*, Vol. 57, No. 3, pp. 1876-1884, 2011.
- [4] M. Mariamma, *Teaching Science*, Malappuram, Kerala: Nas Publishers, 2014.
- [5] L. M. Holmes, "The effects of project based Learning on 21st century and skills no child left behind Accountability Standards," Doctoral Dissertation, *ProQuest Dissertations and Thesis database*, 2012.
- [6] R. Subba and T. Venkatram, *Personnel and Human Resource Management*, 5<sup>th</sup> ed. Himalaya Publishing House, 2015.
- [7] K. Brundiers and A. Wiek, "Do we teach what we preach? An international comparison of problem- and project-based learning courses in sustainability," *Sustainability*, Vol. 5, No. 4, pp. 1725-1746, 2013.
- [8] J. S. Krajcik and N. Shin, "Project-based learning," "The Cambridge Handbook of the Learning Sciences," Vol. 2, pp. 275-297, 2014.
- [9] L. Helle, P. Tynjala and E. Olkinuora, "Project-based learning in post-secondary education - Theory, practice and rubber sling shots," *Higher Education*, Vol. 51, No. 2, pp. 287-314, 2006.
- [10] R. A. Ralph, "Post-secondary project-based learning in Science, technology, engineering and mathematics," *Journal of Technology and Science Education*, Vol. 6, No. 1, pp. 26-35, 2015.
- [11] Chickwring, Arthur and Z. Gamson, "The Seven Principles for Good Practice in Undergraduate Education," *The Wingspread Journal*, Vol. 9, No. 2, 1987.
- [12] N. J. Sushma, "Evaluating the Effectiveness of a School Internship," *International Journal for Social Sciences*, Vol. 5, No. 2, 2019.
- [13] D. Pratt and J. Johnson, *The Apprenticeship Perspective: Modelling Ways of Being, Five Perspectives on Teaching in Adult and Higher Education*, Malabar FL: Krieger Publishing Company, 1998.
- [14] D. Schon, *The Reflective Practitioner: How Professionals Think in Action*, New York: Basic Book, 1983.
- [15] M. Wanda, "The critical role of apprenticeship programs," *National association of state boards of education*, 2019.
- [16] S. A. Krylov, G. I. Zagrebina, A. V. Dvornikov and O. I. Kotova, "Geoinformation technologies in the educational process of the department of cartography of MIIGAiK." *Actual Quest. Educ*, Vol. 1, pp. 217-222, 2019.
- [17] H. Esteves, I. Fernandes and C. Vasconcelos, "A Field-Based Approach to Teach Geoscience: A Study with Secondary Students," *Procedia Soc. Behav. Sci*, Vol. 191, pp. 63-67, 2015.
- [18] A. Boyle, S. Maguire, A. Martin, C. Milsom, R. Nash, S. Rawlinson, et al., "Fieldwork Is Good: The Student Perception and the Affective Domain," *J. Geogr. High. Educ.*, Vol 31, pp. 299-317, 2007.
- [19] R. Teasdale, K. Ryker and K. Bitting, "Training Graduate Teaching Assistants in the STEM education: Our Practices vs. Perceived Needs," *Journal of Geoscience Education*, Vol. 67, pp. 64-82, 2019.
- [20] J. R. Brinson, "Learning outcome achievement in non-traditional (virtual and remote) versus traditional (hands-on) laboratories: A review of the empirical research," *Computers and Education*, Vol. 87, pp. 218-23, 2015.
- [21] L. S. Post, P. Guo, N. Saab and W. Admiraal, "Effects of remote labs on cognitive, behavioral, and affective learning outcomes in higher education," *Computers & Education*, pp. 140, 2019.

- [22] L. B. Regassa and A. I. Morrison-Shetlar, "Student learning in a project-based molecular biology course," *Journal of College Science Teaching*, Vol. 38, No. 6, pp. 58-67, 2009.
- [23] N. Lucas and F. Goodman, "Well-being, leadership, and positive organizational scholarship: A case study of project-based learning in higher education," *Journal of Leadership Education*, Vol. 14, No. 4, pp. 138-152, 2015.
- [24] J. Rodriguez, A. Laveron-Simavilla, J. M. Del Cura, J. M. Ezquerro, V. Lapuerta and M. Cordero-Gracia, "Project based learning experiences in the space engineering education at Technical University of Madrid," *Advances in Space Research*, Vol. 56, No. 7, pp. 1319-1330, 2015.
- [25] H. C. Celik, H. Ertas and A. Ilhan, "The impact of project-based learning on achievement and student views: The case of AutoCAD programming course," *Journal of Education and Learning*, Vol. 7, No. 6, pp. 67-80, 2018.
- [26] M. Barak and Y. J. Dori, "Enhancing undergraduate students chemistry understanding through project-based learning in an IT environment," *Science Education*, Vol. 89, No. 1, pp. 117-139, 2005.
- [27] A. Affandi and D. Sukyadi, "Project-based learning and problem-based learning for EFL students writing achievement at the tertiary level," *Rangsit Journal of Educational Studies*, Vol. 3, No. 1, pp. 23-40, 2016.
- [28] M. Botha, "A project-based learning approach as a method of teaching entrepreneurship to a large group of undergraduate students in South Africa," *Education as Change*, Vol. 14, No. 2, pp. 213-232, 2010.
- [29] D. Costa-Silva, J. A. Cortes, R. F. Bachinski, C. N. Spiegel and G. G. Alves, "Teaching cell biology to dental students with a project-based learning approach," *Journal of Dental Education*, Vol. 82, No. 3, pp. 322-331, 2018.
- [30] E. Cudney and D. Kanigolla, "Measuring the impact of project-based learning in six sigma education," *Journal of Enterprise Transformation*, Vol. 4, No. 3, pp. 272-288, 2014.
- [31] W. Y. Dzan, C. C. Chung, S. J. Lou and H. Y. Tsai, "A study on project-based learning in a boat design and building university course," *International Journal of Online Pedagogy and Course Design*, Vol. 3, No. 3, pp. 43-61, 2013.
- [32] T. Y. Mou, "Students evaluation of their experiences with project-based learning in a 3D design class," *The Asia-Pacific Education Researcher*, pp. 1-12, 2019.
- [33] M. Genc, "The project-based learning approach in environmental education," *International Research in Geographical and Environmental Education*, Vol. 24, No. 2, pp. 105-117, 2015.
- [34] M. J. Terron-Lopez, M. J. Garcia-Garcia, P. J. Velasco-Quintana, J. Ocampo, M. R. Vigil Montano and M. C. Gaya-Lopez, "Implementation of a project-based engineering school: Increasing student motivation and relevant learning," *European Journal of Engineering Education*, Vol. 42, No. 6, pp. 618-631, 2017.
- [35] L. Bilgin, Y. Karakuva and Y. AV, "The effects of project based learning on undergraduate students achievement and self-efficacy belief towards science teaching," *Eurasia journal of mathematics, science & technology education*, Vol. 11, No. 3, pp. 469-477, 2015.
- [36] R. Brennan, R. Hugo and P. Gu, "Reinforcing skills and building student confidence through a multicultural project-based learning experience," *Australasian Journal of Engineering Education*, Vol. 19, No. 1, pp. 75-85, 2013.
- [37] M. A. Ocak and C. Uluyol, "Investigation of college Students intrinsic motivation in Project based learning," *International Journal of Human Sciences*, Vol. 7, No. 1, pp. 1152-1169, 2010.
- [38] K. H. Tseng, C. C. Chang, S. J. Lou and W. P. Chen, "Attitudes towards Science, technology, engineering and mathematics (STEM) in a project-based learning (PBL) environment," *International Journal of Technology and Design Education*, Vol. 23, No. 1, pp. 87-102, 2013.
- [39] T. T. Wu, Y. M. Huang, C. Y. Su, L. Chang and Y. C. Lu, "Application and analysis of a mobile E-Book system based on project-based learning in community health nursing practice courses," *Educational Technology & Society*, Vol. 21, No. 4, pp. 143-156, 2018.
- [40] M. E. Beier, M. H. Kim, A. Saterbak, V. Leautaud, S. Bishnoi and J. M. Gilberto, "The effect of authentic project-based learning on attitudes and career aspirations in STEM," *Journal of Research in Science Teaching*, Vol. 56, No. 1, pp. 3-23, 2019.
- [41] M. Papastergiou, "Learning to design and implement educational web sites within pre-service training: A project-based learning environment and its impact on student teachers," *Learning, Media and Technology*, Vol. 30, No. 3, pp. 263-279, 2005.
- [42] D. Assaf, "Motivating language learners during times of crisis through project-based learning: Filming activities at the Arab International University (AIU)," *Theory and Practice in Language Studies*, Vol. 8, No. 12, pp. 1649-1657, 2018.
- [43] M. Basbay and A. Ates, "The reflections of student teachers on project based learning and investigating self-evaluation versus teacher evaluation," *Procedia Social and Behavioral Sciences*, Vol. 1, pp. 242- 247, 2009.
- [44] J. Berbegal-Mirabent, D. Gil-Domenech and I. Alegre, "Where to locate? A project-based learning activity for a graduate-level course on operations management," *International Journal of Engineering Education*, Vol. 33, No. 5, pp. 1586-1597, 2017.
- [45] M. Mahendran, "Project based civil engineering courses," *Journal of Engineering Education*, Vol. 84, No. 1, pp. 15-19, 1995.
- [46] M. Frank, I. Lavy and D. Elata, "Implementing the project-based learning approach in an academic engineering course," *International Journal of Technology and Design Education*, Vol: 13, No. 3, pp. 273-288, 2003.
- [47] W. Hall, S. Palmer and M. Bennett, "A longitudinal evaluation of a project-based learning initiative in engineering undergraduate programme," *European Journal of Engineering Education*, Vol. 37, No. 2, pp. 155-165, 2012.
- [48] W. T. Ngai, "Learning in introductory e-commerce: A project-based teamwork approach," *Computers and Education*, Vol. 48, No. 1, pp. 17-29, 2007.
- [49] K. Poonpon, "Enhancing English skills through Project based learning," *The English Teachers*, Vol. XL, pp. 1-10, 2017.
- [50] W. R. Thomas and S. K. McGregor, "Online project based learning: How collaborative strategies and problem solving processes impact performance," *Journal of Interactive Learning Research*, Vol. 16, No. 1, pp. 83-107, 2005.
- [51] K. Yang, G. R. Woomeer and J. T. Matthews, "Collaborative learning among undergraduate students in community health nursing," *Nurse Education in Practice*, Vol. 12, No. 2, pp. 72-76, 2012.
- [52] M. Frank and A. Barzilai, "Integrating alternative assessment in a project-based learning course for pre-service science and technology teachers," *Assessment & Evaluation in Higher Education*, Vol. 29, No. 1, pp. 41-61, 2004.
- [53] Y. M. Lee, "Project based learning involving sensory panelist improves student learning outcomes," *Journal of Food Science Education*, Vol. 14, No. 2, pp. 60-65, 2015.
- [54] F. Musa, N. Mutti, R. A. Lalit and M. M. Amin, "Project based learning; promoting meaningful language learning for workplace skills," *Procedia Social and Behavioural Sciences*, Vol. 18, pp. 187-195, 2011.
- [55] R. P. Raycheva, D. I. Angelova and P. M. Vodenova, "Project-based learning in engineering design in Bulgaria: Expectations, experiments and results," *European Journal of Engineering Education*, Vol. 42, No. 6, pp. 944-961, 2017.
- [56] P. Balve and M. Albert, "Project-based learning in production engineering at the Heilbronn Learning Factory," *Procedia Cirp*, Vol. 32, pp. 104-108, 2015.
- [57] A. Dehdashti, S. Mehrizadeh and M. M. Kashani, "Incorporation of project-based learning into an occupational health course," *Journal of Occupation Health*, Vol. 55, No. 3, pp. 125-131, 2013.
- [58] Y. Gulbahar and H. Tinmaz, "Implementing project-based learning and E-Portfolio assessment in an undergraduate course," *Journal of Research and Technology in Education*, Vol. 38, No. 3, pp. 309-327, 2006.
- [59] G. E. Okudan and S. E. Rzaa, "A project-based approach to entrepreneurial leadership education," *Technovation*, Vol. 26, No. 2, pp. 195-210, 2006.
- [60] L. H. S. Yam and P. Rossini, "Effectiveness of project based learning as a strategy for property based education," *Pacific Rim Property Research Journal*, Vol. 16, No. 3, pp. 291-313, 2010.
- [61] C. Stefanou, J. D. Stolk, M. Prince, J. C. Chen and S. M. Lord, "Self-regulation and autonomy in problem and project-based learning environments," *Active Learning in Higher Education*, Vol. 14, No. 2, pp. 109-122, 2013.

- [62] H. Sadeghi, M. Biniiaz and H. Soleimani, "The impact of project-based language learning on Iranian EFL learners comparison/contrast paragraph writing skills," *International Journal of Asian School Science*, Vol. 6, No. 9, pp. 510-524, 2016.
- [63] S. Wurdinger and M. Qureshi, "Enhancing college students life skills through project based learning," *Innovative Higher Education*, Vol. 40, No. 3, pp. 279-286, 2015.
- [64] R. I. Anderson, A. L. Loviscek and J. R. Webb., "Problem-based learning in Real Estate Education," *Journal of Real Estate Practice and Education*, Vol. 3, No. 1, pp. 35-41, 2000.
- [65] P. C. Blumenfeld, E. Soloway, R. W. Marx, J. S. Krajcik, M. Guzdial and A. Palincsar, "Motivating project-based learning: sustaining the doing, supporting the learning," *Educational Psychologist*, Vol. 26, No. 3, 4, pp. 369-398, 1991.
- [66] D. W. Johnson and R. T. Johnson, *Cooperation and competition, theory and research*, Edina, MN, Interaction Book Company, 1989.