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Implementation of Student-Centered Learning Approach in Building Surveying Course

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***Abstract*—**The curriculum of architecture department in Prince Sultan University includes 'Building Surveying' course which is usually a part of civil engineering courses. As a fundamental requirement of the course, it requires a strong background in mathematics and physics, which are not usually preferred subjects to the architecture students and many of them are not giving the required and necessary attention to these courses during their preparation year before commencing their architectural study. This paper introduces the concept and the methodology of the student-centered learning approach in the course of building surveying for architects. One of the major outcomes is the improvement in the students' involvement in the course and how this will cover and strength their analytical weak points and improve their mathematical skills. The study is conducted through three semesters with a total number of 99 students. The effectiveness of the student-centered learning approach is studied using the student survey at the end of each semester and teacher observations. This survey showed great acceptance of the students for these methods. Also, the teachers observed a great improvement in the students' mathematical abilities and how keener they became in attending the classes which were clearly reflected on the low absence record.

***Keywords*—**Architecture, building surveying, student-centered learning, teaching, and learning.

I. Introduction

THE Architecture department at Prince Sultan University (PSU) in Saudi Arabia offers a comprehensive program that fosters creativity, innovation, informed problems-solving skills, and cultivation of human needs as individuals and community. The program aims to provide students with a high-quality education that meets international standards through enriching their knowledge, motivating them to research-oriented lifelong learning, enhancing their critical thinking, and applying modern technologies in their courses. It also aims at preparing students to lead a successful career in the professional field, encouraging them to create an architecture that develops their environment and community, and boosting up their social responsibility, the involvement of sustainable designing and building for the future [1]. To fulfill this aim, architecture curriculum is composed of five main types of courses: (1) Design studio courses; (2) Technology based courses; (3) Environmental courses; (4) Theoretical courses; (5) Structures and construction courses. One of the building construction courses provided by the program is Building Surveying course which is offered to second-year students. This course introduces the students to the surveying principles and techniques. Also, it explains types of measurements, errors, corrections, differential and cross-sectional leveling, traverse, construction and topographic surveys and using traditional and advanced techniques. At the end of this course, the students should be able to command concepts, theories, principals and instruments used in building surveying, determine and correct the errors associated with surveying measurements, calculate the line's direction, the points' coordinates, traverse enclosed area and volume of earthwork. This course is not a conventional architecture course, it is actually civil engineering course, and it necessarily requires students to solve numerical problems which offer many challenges to the students. the majority of the students face difficulties with learning this course where the main reason was due to the nature of building surveying course itself as it requires a strong knowledge of physics and mathematics that are not available in the studying and learning the background of most of the architectural students [2], [3].

Using traditional ways of teaching like lecture format and the chalkboard is not suitable for engineering curricula, as engineering curriculum is uniquely challenged with its technical complexity and sometimes abstract concepts [4]. Due to such complexity, engineering theme has a complex form of learning that is basically based on understanding the concepts which lead to merge and integrate the knowledge as well analyzing the information. This kind of learning needs the involvement of the students in the learning process [5]. One of the challenges that higher education instructors face is to match the students' learning styles with teaching strategies in order to improve the academic achievement [6]. This should help the instructor in being more effective in the classroom, also give the students the necessary support to enable them to be a more efficient learner and make the student-faculty interaction as effective and efficient as possible [2].

The main problem in the course that the instructor had to deal with was managing and motivating the students to achieve an acceptable level of knowledge and get the most benefit from learning and studying this course. The results of the Teaching/Learning Evaluation (TLE) institutional survey for this course in the second semester of 2014-2015 showed dissatisfaction of the students especially in items related to the way of acquiring the knowledge, importance and usefulness of the course, improving their ability to problem-solving and communications as well as the general quality of the course.

This paper focused on implementing student-centered learning approach to increase the students' involvement in the course, improve the weakness points, upgrade their mathematical skills and help them to gain required

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information.

II. Student-Centered Learning Approach

Learning rarely happens in passive ways. When students are involved in their own learning, instruction became more effective [7]. According to Jones [8], in a student-centered class, students do not depend on their teacher to get information, instructions, correction or even advice. They cooperate, communicate and learn from each other, and help each other. They work together, in pairs, in groups, and as a whole class. They can ask for teacher help or advice but only after they have tried to solve the problem among themselves. Student-centered teaching techniques draw upon the right hemisphere, therefore the visual tool is found to be most useful in transforming to a student-centered classroom is mind mapping [9].

Cooper et al. [10] emphasized the importance of group work on the teaching process. In the beginning of applying this approach, it usually faces resistance from students themselves, as they will not like becoming the focus of classroom. They have spent most of their time in the traditional learning environment and they have no reason to assume that the new learning experience will be different [7], [11].

The implementation of student-centered approach is certainly challenging to both teachers and students. On one hand, in adapting the curricula, teachers are required to adopt whole new approaches that are more practical and undoubtedly creative; on the other hand, students are called to recognize the necessity of more responsibility and discipline on their part [7].

The student-centered approach was applied in many engineering courses as in general; engineering students prefer active approaches of learning rather than traditional lectures especially in courses associated with tutorial practices [12]. For example, this method was applied in Environmental Impact Assessment (EIA) course included in the undergraduate Civil Engineering program at the University of Minho [7].

III. Methodology

The course was organized into weekly four contact hours; two hours for lecture and the other two hours for the tutorial and practical session. The attendance was mandatory. The students with more than 16 hours absence receive "Denied Entry". The lecture sessions followed a more traditional approach, using PowerPoint to explain the theoretical part supported by discussion and critical thinking questions. In these classes, students adopt a more passive behavior. However, student-centered learning was adopted in this course throughout the following activity:

A. Research Project

The research project was designed to include topics not covered in the lectures. Two themes were proposed: (1) Modern Surveying, which includes topics of Geographic Information System (GIS), Remote Sensing (RS) and photogrammetry. (2) Applications of surveying in the construction industry, which covers applications of surveying in roadways and buildings. The students were required to set-up as teams of 3 to 5 members. Each group had to propose a topic related to one of the previous themes.

The process of setting up teams and selecting the topic took about 3 weeks. The students have to submit a written report and conduct an oral presentation after 8 weeks according to rules and guidelines provided by the instructor. The instructor conducted three scheduled meetings with the groups to monitor the progress and give the students her advice if needed as well as her feedback. These meetings helped the instructor in evaluation the group work at the end of the semester.

Assessment of the research project includes peer assessment and self-assessment. Therefore, at the end of the group's presentation, there was 10 minutes period for open discussion between the group members and fellow students. Also, the other groups had to evaluate the presented work by mentioning the points of strengths and weaknesses. After that, the group members were asked to evaluate their work. Finally, they received the instructor assessment.

B. Tutorial

For tutorial sessions, the same students' groups of the research project were used in these sessions. Each group had to solve some problems offered by the instructor in the class time. The group members were encouraged to share their information and search for new ones through the internet. The instructor worked only as a facilitator. This work was graded and replaced homework assignment.

C. Practical

The design of the course included two practical sessions. Before each session, the students were asked to watch some multi-media videos at home provided by the instructor as well as making their own research on using the surveying instrument. Therefore, in the practical time, the students will apply what they learned directly on the job prepared by the instructor. According to [2] & [13], using multi-media help architecture students in learning as they learn better through graphs, pictures, and multimedia applications.

The study was applied to three semesters with 31 students in the first semester of 2015-2016; 49 students in the second semester of 2015-2016 and 19 students in the first semester of 2016-2017. The course was taught by the same instructor in the three semesters to avoid any misleading in the results due to instructor's teaching style.

The evaluation of applying student-centered approach was based on a casual conversation with random students, the students' progress with mathematical skill, their involvement of the class, their keen to attend the class as well as the results of oral referendum done in the middle of the semester. Finally, the applied method is evaluated using TLE survey for three consequently semesters. It included 21 questions which were rated on a 5 points scale, 1 for "strongly disagree" through 5 for "strongly agree".

IV. Results and Discussion

In the beginning of the semester, the students were informed of the teaching strategy of the course. More than 50% of the students did not feel comfortable with it especially with the tutorial part. They thought it will be very difficult for them to learn by this way and preferred the traditional way. Three weeks later, the instructor made an oral referendum on the applied method, and the results showed that more than 90% of the students were in favor of applying the method.

The instructor noticed that the students were more engaged in the class and very keen to attend the class. More of 60% of the students never missed a class and there were no DN cases. The research project helped the student to discover more information about the proposed themes. Peer assessment encouraged other students to gain information about other groups' topics and helped them to improve their research and presentation skills. Solving the problems in groups with facilitating of the instructor improved their mathematical skill as the instructor noticed the miscalculations mistakes in solving the problems were reduced in a significant manner and their ability to solve the problems correctly was improved. Using multimedia in the practical part course improved the performance of the students in their practical assignment as it matches architecture students' nature [2].

The results of the TLE survey were used to evaluate the success of the implementation of the student-centered approach instead of focusing on students' grades and the reason of this was because 70% of the total grades were assigned to the final exam, mid-term exam, and quizzes while only 30% were assigned to assignments, research project, and practical.

As shown in Table I, the average for the 21 question ranged from 4.33 to 4.48. The global evaluation of the course was 4.41 out of 5 which reflected great acceptance of the students to the teaching approach especially for this kind of courses in architecture curriculum. The results of the survey agreed with the information gained from the casual conversation with random students as well as the results of the oral referendum that done in the middle of the semester. The rating scale was shown in Table II.

The comparison is made between the least rated parameters of the TLE survey in the second semester of 2014-2015 while applying teacher-centered approach and the three following semesters while applying student-centered approach. The least rated-parameters were: (1) Class activities, assignments, laboratories etc. helped me acquire the knowledge and skills intended by the course. (2) What I learned in this course is important and will be useful to me. (3) This course helped me to improve my ability to think and solve problems rather than just memorize information. (4) This course improved my ability to communicate effectively. (5) Overall, I was satisfied with the quality of this course. Table III shows the number of involved students in each semester. The results of the survey for these parameters showed a significant improvement as shown in Fig. 1. In 2nd semesters of 2014-2015, the 5 parameters ranged from 3.4 to 3.6 while it ranged from 3.9 to 4.6 in the following three semesters which reflected great acceptance of the students to student-centered approach.

TABLE I
TLE Survey Results

Parameters	1st semester, 2015-2016	2nd semester, 2015-2016	1st semester, 2016-2017	Average
The course outline/syllabus was made clear to me. This included course content and objectives.	4.32	4.65	4.27	4.48
Assessment tasks and their criteria were made clear to me.	4.23	4.63	4.27	4.44
During the course, sources of help were made clear to me.	4.32	4.66	4.15	4.46
The course conduct and assignments were consistent with the course outline.	4.29	4.63	4.21	4.45
The instructor was fully committed to the delivery of the course. (E.g. classes started on time, materials were well prepared, etc.)	4.32	4.67	4.21	4.48
The instructor was available during office hours.	4.29	4.59	4.21	4.42
The instructor was enthusiastic about the course.	4.32	4.65	4.21	4.47
The instructor cared about my progress in the course.	4.32	4.57	4.05	4.39
Course materials (texts, handouts, references etc.) were up-to-date and useful.	4.26	4.59	4.15	4.40
The resources needed for the course (textbooks, library, computers etc.) were available when I needed them.	4.26	4.59	4.15	4.40
Technology was very effectively used to support teaching and learning.	4.19	4.63	4.27	4.42
The instructor encouraged me to ask questions and develop my own ideas.	4.23	4.63	4.27	4.43
The instructor inspired me to do my best work.	4.29	4.57	4.05	4.38
Class activities, assignments, laboratories etc. helped me acquire the knowledge and skills intended by the course.	4.26	4.65	4.15	4.43
The amount of work I had to do in this course was reasonable for the credit hours allocated.	4.19	4.51	4.27	4.36
The links between this course and other courses in my total program were made clear to me.	4.23	4.61	4.32	4.43
What I learned in this course is important and will be useful to me.	4.19	4.61	4.05	4.37
This course helped me to improve my ability to think and solve problems rather than just memorize information.	4.19	4.55	4.00	4.33
This course helped me to develop my skills in working as a team member.	4.19	4.59	3.95	4.34
This course improved my ability to communicate effectively.	4.16	4.63	3.95	4.35
Overall, I was satisfied with the quality of this course.	4.23	4.59	3.89	4.34
Average	4.25	4.61	4.15	4.41

TABLE II
RATING SCALE OF TLE SURVEY

Scale	Rate
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

TABLE III
NUMBER OF THE STUDENTS IN EACH SEMESTER AND THE APPLIED TEACHING STRATEGY

Semester	Number of students	Teaching Strategy
2nd semester 2014-2015	41	Teacher-Centered Approach
1st semester 2015-2016	31	Student-Centered Approach
2nd semester 2015-2016	49	Student-Centered Approach
1st semester 2016-2017	19	Student-Centered Approach

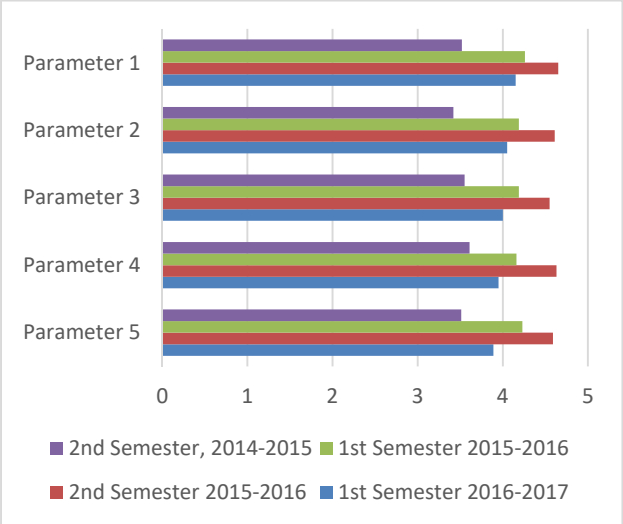

Fig. 1 The progress of the least-rated parameters in 2nd semester 2014-2015 through the following three semesters

V. CONCLUSION

In this paper, the problem with teaching building surveying course to architecture students using traditional method was addressed. Architects think and learn differently than engineers. Also usually, the architecture students lack the required skills and background for this course. Hence, the teaching method should help the students to overcome these problems and improve their skills and understanding. This research focused on implementation a student-centered teaching strategy in teaching building surveying course to improve student engagement, learning, and understanding. The research project, solving problems with groups as well as using multi-media application was the tools of applying student-centered approach. This study was conducted on 99 students throughout in a period of three semesters. The evaluation of this strategy was measured using TLE survey, an oral referendum in the middle of each semester, casual discussion with random students as well as the observations of the instructor of students' engagements. The global evaluation of the course according to the results of the survey was 4.41 out of 5. Also monitoring the changes in the least-rated parameters of the survey while applying teacher-centered approach and after applying the student-centered approach showed great improvement of these parameters. All these findings reflected the great acceptance of the students to the applied teaching strategy.

For future consideration, the researcher will try to increase the student role even in the lecture session as well as add more activities that will help students in learning such as field trips to under-construction sites.

In conclusion, the findings of this research outlined that applying student-centered approach made the students more engaged, improved their mathematical skills, improved their research skills and helped them to gain required information about a method more suitable for architecture student nature.

REFERENCES

[1] PSU, 2017, "The PSU Academic Curricula Bulletin", Prince Sultan University, KSA.
[2] Labib W. (2016), "An Implementation of Multi-Media Applications in Teaching Structural Design to Architectural Students". International Journal of Social, Educational, Economic, Business and Industrial Engineering, Vol. 10, No 1.
[3] Fahmi. M. and Abdul Aziz A., 2012. "The Integration of Structural Knowledge in Studio Design Projects, An Assessment Curriculum in Architecture Course in SUST", Journal of Sciences and Technology, 13, 1, 59-71.
[4] Nelson, J., & Lawson, J. W. (2013, June), Teaching Architecture, Engineering, and Construction Disciplines: Using Various Pedagogical Styles to Unify the Learning Process Paper presented at 2013 ASEE Annual Conference & Exposition, Atlanta, Georgia.
[5] Danko, Cristina Carvalho, and António AL Duarte. "The challenge of implementing a student-centered learning approach in large engineering classes." WSEAS Transactions on Advances in Engineering Education 6.8 (2009): 225-236.
[6] Tulbure, 2012, "Learning styles, teaching strategies and academic achievement in higher education: A cross-sectional investigation" - Procedia-Social and Behavioral Sciences 33, 398-402.
[7] Catalano, G.D., and Catalano, K., 1999. Transformation: From Teacher-Centered to Student-Centered Engineering Education. Journal of Engineering Education, 88(1), pp.59-64.
[8] Jones, L. (2007). The student-centered classroom. New York, NY: Cambridge University Press.
[9] Ehrenberg, S. D., and Ehrenberg, L. M (1978). Building and Applying Strategies for Intellectual Competencies in Students (Basics), Miami, FL: Institute for Curriculum and Instruction.
[10] Cooper, J. L., Robinson, P., and McKinney, Molly, (1992) "Cooperative Learning in the Classroom", Changing College Classrooms, (ed.) D. H. Haperin, Jossey-Bass Publishers, San Francisco, Ca., pp. 74-91.
[11] Doyle, Terry, 2008. Helping students learn in a learner-centered environment: A guide to facilitating learning in higher education. Stylus Publishing, LLC.
[12] Ipbuker, C (2009)., Learning styles and teaching models in engineering education, in Proceedings of the 6th WSEAS International Conference on Engineering Education (EE'09). Edited by P. Dondon et al., World Scientific and Engineering Academy and Society Press.
[13] Burd A. & Buchanan E., 2004, "Teaching the Teachers: Teaching and learning online", Reference Service Review, 32, 4, 404-412 Learning