**Experiential Learning on Distance Education**

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**Abstract:** Distance education is a teaching method which usage has increased rapidly on the last few decades. The most advantages of the distance education are to be independent from the place and time. Especially for the people who have a job, distance education offers a good opportunity to last lifelong education for everybody.

Thanks to rapid developed information technology there are some new methods used by teaching for technical courses as a distance. Multimedia is a flexible and creative teaching tool that supports distance education. Using simulation and animation by course materials on virtual environment enable for the students to follow technical courses like robotics.

Experienced learning can be explained as a teaching method where the students act the real roles. They learn doing experiment on the computer screen. Experiential learning is a knowledge management of the human capital. To catch the success a team work is necessary for teaching a technical course online.

Human capital is a potential of the competences, knowledge and personality attributes for offering a technical course online. A team work is necessary for preparing a learning strategy based on experiential learning. The main target on experienced learning is to be able to create a bridge between human capital and knowledge management.

We have taught robotics course online since 2001 at Firat University. At that time some people bearded this method because they adduced that it will not be possible to teach a technical subject as a distance. We prepared all course materials online supported by animation and simulation. Students experienced course contents on virtual environment.

We followed the success of all students who have taken robotics courses online. We built an institution called Distance Education Center where human capital was evaluated and a creative knowledge management applied.

In this paper experiential learning methods that applied at Firat University are discussed. The organization applied on human capital was evaluated and findings are criticized and finally some recommendations are offered for the management of the human capitals by robotics course.

**Keywords:** Distance education, online course, robotics, technology related courses

1. **Introduction**

Each year brings new technological infrastructure improvements. It is obvious that these improvements change the lifestyle of the community, such as some difficult to perform tasks getting easier and larger devices are getting smaller, more mobile and portable. One other improvement that affects our community is the robotic technology and their applications.

A robot can be described as a mechanical device programmed to perform a manipulative task under automatic control. Another definition for the robot is that it is an electro mechanic device that is driven by a computer program or an operator administrator. Overall, we can say that robotics generally perform the tasks that a human would do. With this definition, the devices at our home can be considered as robots. For instance, the iRobot (Sung et al., 2007) is one of the newest technologies that sweep the floor. Another definition for robots is that the robots are devices which have at least one arm, one hand, and sensors to find their positions that are used in industrial applications. One common point from all these definitions is that the robots can be re-programmed and they have mechanical parts.

Nowadays, the robots are extensively used in industry. Especially the robotic applications in auto industry have yielded better quality product and have speed up the process. Most of the robotic technology in the industry is arm type of devices where their main tasks are to build, install and paint.

Overall, the robots have the following properties.

1. Sensors: The sensors are primarily used for location detection.
2. Brain: The brain is used to decide on the momentary actions.
3. Movement parts: The movement parts apply the given directives by brain.

The discussed robotic technology is the product of Computer Engineering, Mechanical Engineering, Control Engineering, and Electrical and Electronics Engineering departments. Although these entire fields play role in Robotics, Mechatronics Engineering is the newborn department name for the Robotics related education and research.

Distance education of this type of technology related courses has not been offered extensively, due to budget constraints, quality of the education, and several failure stories (Varol, 2010). Moreover, knowledge management in distance education type of course is a challenging task. However, we have created a framework where the instructor act as supervisor at a remote location and students act as role players in their class environment without degrading the quality of education and increasing the human capital.

In this work, first we will discuss distance education and technology related courses. Second, we will discuss about the robotics course that has been offered online at Firat University. At the end, we will evaluate the outcome of the education style and provide some suggestions.

1. **Technology related courses in distance education**

Distance education (online programs) is getting more attention every day. Online programs courses do not require physical presence and in most cases it is independent from the time. Obviously, these attract the students. From instructor’s perspective, teaching the course from any part of the world and having a casual presence are the tempting points. However, this education system is not only preferred by students and instructor, but also very vital for educational institutes as well. The University of Phoenix is one of the well-known distance education conducting institutes which had approximately 500,000 registered students in the 2009-2010 academic year (Phoenix, 2011). The university offers more than 100 degree programs at the associate, bachelor's, master’s and doctoral levels (Phoenix, 2011). The interest level to Phoenix University also encourages other classic educational schools to offer online programs to attract more students from all over the world and to increase their revenue.

Once, the belief was only theoretical courses used in online education can achieve the expected quality, since other science related fields require more visual interaction and representation (Jeschofnig, 2004; Reeves & Kimbrough, 2004; Kostka & Ralston, 2005, Gillet, et al., 2001; and Villaverde & Kanagiri, 2005). Therefore, offering technology, engineering, science, and medical related courses were seen seldom. However, having high internet bandwidth, high quality multimedia items, and virtual simulations helped us to overcome this particular problem. From science to technology a number of courses and online programs have been offered (Martínez-Jiménez, et al., 2003; Mathiyalagan, et al., 2005; Grunwald, et al., 2005; Bicchi, et al., 2001; and Dormido, 2002). Although these courses and online programs posted success stories, they have not compared the student success while applying different online teaching techniques.

In a recent study the authors discussed the analysis of student to student, student to instructor, and student to content interaction in distance education (Bernard, et al., 2009). The authors found out a strong association between strength and achievement for asynchronous DE (Distance Education) courses compared to courses containing mediated synchronous or face-to-face interaction. Greenhow, et al. discussed about the two important themes, learner participation and creativity and online identity formation, emerged from their analysis and support a new wave of research questions in distance education (Greenhow, et al., 2009). However, after three decades of technology initiatives in the U.S., high levels of integration of technology with classroom learning remains much more the exception than the rule (Lowther, et al., 2009).

1. **Robotics Course at Firat University**

The robotics course at Firat University has been offered under Electronics and Computer Education Department since 1994 and online since 2001. The students from Sakarya and Kahramanmaras Sutcu Imam Universities joined the online classroom in their respective universities. The students graduated from these universities have been appointed to work in high schools to teach electronics and/or computer related courses.

We used two different teaching techniques, student-centered online education (SCOE) and hybrid type of online education (HTOE), to compare the quality of the education using virtual environment. Therefore, each class was randomly separated into two different sections. SCOE is applied to one section and HTOE is applied to another section. Although there were significant differences in the educational styles, in both techniques, the theoretical foundations of the robots and automation systems were always virtually presented by the instructor, students worked as a group in Robotics project, and both groups took the exact same exams.

**3.1 SCOE:** In this technique, the history and fundamental topics of the robotics were discussed by the instructor. Since this is a distance education, the course materials were prepared as power point presentations, with the additions of videos and animations. Students also presented advanced course topics to the audience (20 points). The students at remote locations had immediate access to the robotic equipment. Therefore, with analyzing the lecture materials and getting support from other classmates, students applied the theoretical knowledge on the robotic sets as a final project (30 points). Moreover the students had to take one midterm (20 points) and one final exam (30 points) during the course work.

***3.1.1 Lecture and Presentations (20 points)****:* Later in the semester, the students conducted a 15 minutes online presentation related with robotic topics, such as automation, carrying the materials automatically, robotics versus humans, the application areas of robotics, types of robots, arm type robots, robot sensors, programming languages that are used in robotics, programming syntax and rules, and other type of robots. These topics were interactively discussed in the virtual classroom where the audience (students) asked questions or commented about them. Basically, this knowledge management addressed how to transform individualized learning into organizational learning in order to build a knowledge sharing culture. The students also used power point and/or video techniques during their presentations. If necessary, the gained theoretical knowledge was applied to the robotic sets in their respective institutes. At the end, students prepared a report of their findings and deliver it to the course instructor online. The evaluation criteria for the presentations were shown in Table 1.

**Table 1:** Student Presentation Evaluation Criteria

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date: | Student No: | Name: | Topic: | A | B | C | D | E | F | G | H | I | Total | Comments |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

*Date:* This particular field represents the date of the presentation.

*Student No:* This field represents the students’ school number.

*Name:* This field consists of first and last name of the student.

*Topic:* This field shows the name of the selected topic.

*A: (1 point)* There is a dire need to keep up with the changes in Robotics area to be successful. Therefore, this grading field is based on to see whether the presentation contains up-to date information.

*B: (2 points)* One of the main goal of the course is to encourage students to learn how to do a research and use the databases in the library. Therefore, this grading field is based on to see whether the student did the necessary research study to find relevant information from the internet and available databases.

*C: (1 point)* Our another goal is to teach our students how to write a report and use appropriate citation techniques. For the delivered report, we require our students to use APA style bibliography for citations. Therefore, this grading is to see if the student knows how to cite a paper and use appropriate technique for it.

*D: (2 points)* Since the department raises electronics and computer educators, our another aim is to help our students with their writing skills. Although writing courses are taken in freshmen and sophomore year, their writing skills in the report were still evaluated in this course.

*E: (4 points)* One of the effective teaching techniques is considered as to bring visual effects to the lecture (Varol, 2010). Therefore, we designated 20 points to see if the student used animation and videos during his/her presentation.

*F: (2 points)* Another grading criteria is the presentation skills. We’d like to give feedback about the student’s presentation skills so that they can improve their ability to talk and teach.

*G: (2 points)* This particular grading is based on student’s knowledge about the discussed topic.

*H: (2 points)* The interactive skills with the virtual classroom is evaluated under this grading field.

*I: (4 points)* During or after the presentation, the presenter are asked questions (QA session) by the audience. Handling of these questions and providing satisfying answers are part of the grading.

*Total: (Out of 20 points)* This field represents the final grade from the presentation and the report.

*Comments:* The instructor takes a note of his/her observations to this field.

At the end, a detailed report of the student’s grading was distributed. The report also covered comments from the instructor.

***3.1.2 Project (30 points):*** The students were divided into a group of four. Each group proposed a research topic for the project. If the project was approved by the instructor, the students shared the tasks among its group members and worked on the case for 2 weeks with the robot set they had in their institutes. In order to build a strong human capital, the students determined the task distribution based on the skill set of each group member. At the end, the students prepared the robot set and in virtual environment demonstrated their project to their classmates and to the instructor. The instructor manages the performance of the students by evaluating their project based on the originality of the topic (5 points), quality of the presentation (body language, using multimedia, etc.) (5 points), QA session (5 points), robot demonstration (5 points), quality of coding (5 points), and final report (5 points)

***3.1.3 Exams (50 points):*** The students took two online exams, one midterm and one final exam. The midterm exam was worth of 20 points and the final exam was worth of 30 points.

**3.2 HTOE:** Compared to SCOE, in this type of education, the course topics were only discussed by the instructor in virtual environment. Besides the presentations, videos and animations, the instructor demonstrated the key topics on the robotic set. Students were only responsible for a project (40 points), a midterm (25 points), and a final exam (35 points).

***3.2.1 Project (50 points):*** In this type of education, the instructor provided a list of projects to the students. Once again the students formed their project group (4 people). After they form their group, they selected a project topic from the list. Compared to SCOE, the students did not have direct access to the robot sets. Therefore, the students used the knowledge that they previously gained from modeling and simulation course to build their project simulations. At the end, the students virtually demonstrated their project to their classmates and to the instructor. The instructor evaluated their project based on the quality of the presentation (body language, using multimedia, representation, etc.) (10 points), QA session (10 points), modeling (10 points), simulation (10 points), and final report (10 points).

***3.2.2 Exams (50 points):*** The students took the exact same exams with the SCOE section. In detail, virtually one midterm and one final exam were conducted where each of them worth 20 and 30 points respectively.

1. **Discussions and Conclusions**

The discussed techniques were applied for 5 years to the robotics course. The distance education center in Firat University collected the statistical data from the instructor to evaluate the effectiveness of the teaching techniques. As represented in Figure 1 and Figure 2, each year the average student success in the exams were higher in SCOE.

**Figure 1:** Average student grades in Midterm Exam

**Figure 2:** Average student grades in Final Exam

Also a survey was conducted to all students during those 5 years. According to the survey results, 85% of the students felt comfortable during their project presentations because that they performed lecture presentations earlier. While 83% of the students in SCOE type of education sad happiness with the course, only 62% of students in HTOE type of education were satisfied with it. Although 52% of the students in SCOE type education were not comfortable with teaching the course materials by themselves, 78% claimed that they have learned more by teaching the materials. An average of 92% of the students felt the distance education did not have any negative impact on learning the course materials.

The students had experiential learning throughout the course period with both of the discussed techniques. They were able to combine (manage) the knowledge gained from the instructor, videos and animations, feedback from the classmates and doing hands on experience with the robotic set. In other words, the students leveraged the knowledge internally and externally in order to achieve success from this course. However, as shown above, the human capital gained from SCOE is more collective and effective compared to the HTOE.

As reflected by the results, online teaching of technology related courses can provide satisfying results. However, these types of courses require different teaching materials and facilities. Putting the student in the center of the education, supporting the course with variety of multimedia items and having the student to perform the lecture materials on the real-environment increased the student’s knowledge in the topics and student’s self-confidence.

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