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Game Based Learning Approach (Gbl) To Improve Student's Learning Performance In Dental Academics

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Abstract

Background: Rapid advancements in computer technology have created a new platform for teaching students of present generations. Dental education is rapidly evolving and expectation for variety in curriculum teaching for improving student's performance skills is the need of an hour. Hence, the **Aim** of this study was to analyze a game based learning method in the subject of Oral pathology to improve student's learning performance in the subject.

Objectives: (1)To analyze TAO game based learning software in the subject of Oral Pathology (2)To compare the learning performance using Traditional learning method and the Game Based Learning method (3)To examine student's perception for same and to evaluate student's satisfaction by applying Likert's Scale.

Materials & Method: An interventional experimental study design was conducted among 120 dental students registered in 2nd and 3rd BDS for the subject of Oral Pathology. The topic selected was "Odontogenic Cyst". Students were divided into 2 groups - Control group (exposed to traditional method) and Experimental group (exposed to TAO game based learning software). To evaluate the measurable academic improvements in both groups, pre/ posttest questionnaire consisting of 15 questions were formulated & performance scores to relevant content based sessions on the topic was assessed and subjected to statistical analysis. Finally, the attitude of students towards GBL approach was measured using Likert's Scale.

Results: Paired t test was done to compare between both groups. The Mean ± Std. Dev of pre-test of control group & experimental group showed statistical significant difference between 2nd and 3rd years students.Unpaired t test was done to compare students satisfaction by applying Likert's Scale (2nd year students - 4.3 ± 0.6 was significantly higher than mean satisfaction of 3rdyear students - 3.9 ± 0.4 (p=0.009)

Conclusion: Game based learning method can improve students' learning performance.

Keywords: Curriculum, Experimental, Games, Recreational, Motor skills, Dental games.

Introduction

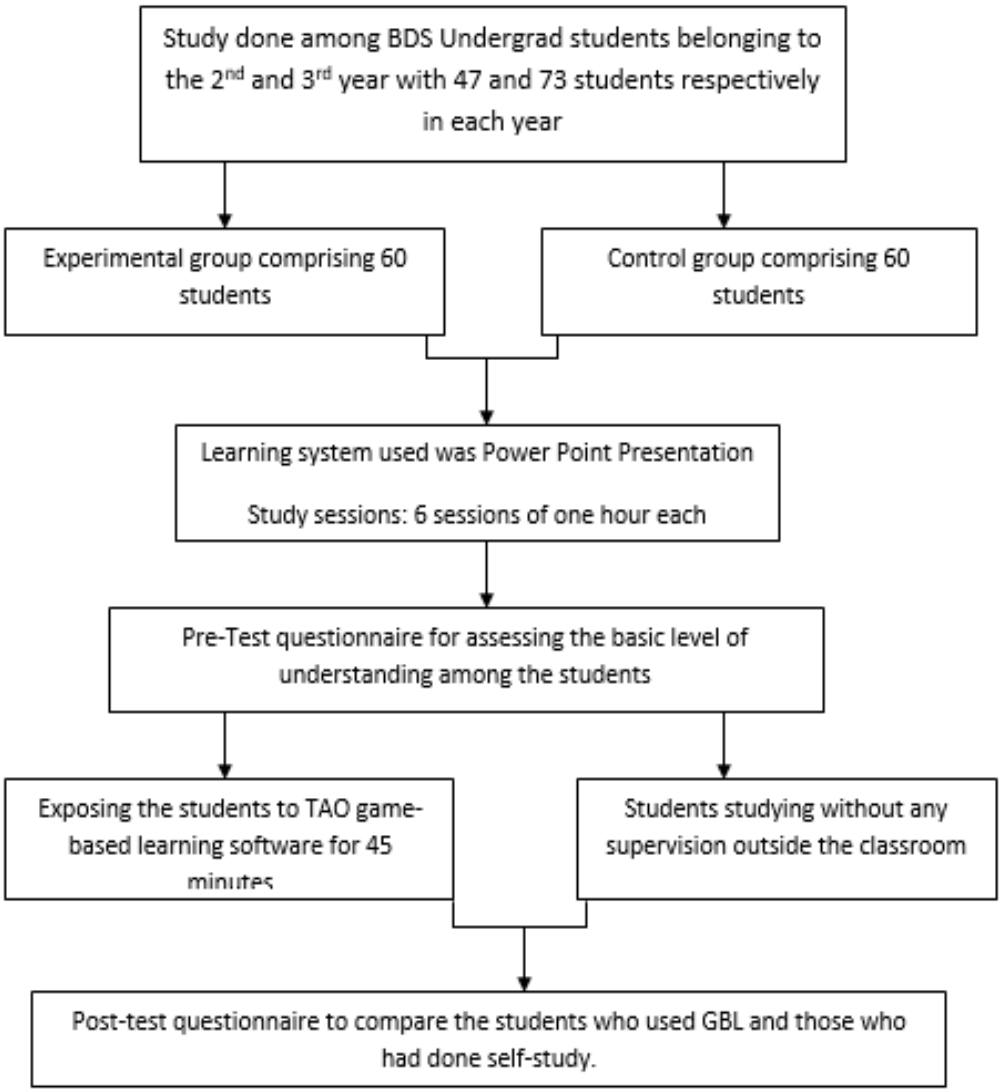
Globalization and revolutionary change in digital technology by using computer games, during recent decades, are becoming most popular and new mode of interaction in education system .[1] Students of the present generation love to learn when there is unique combination of enjoyment & interaction instead of unilateral knowledge acquisition concept used in traditional teaching method. [2] Advances in dental education are rapidly evolving and expectation for variety in curriculum teaching for improving student's performance skills is the need of an hour. To add up, one of the most important organizations i.e. library in any institute are also in need of finding new innovative ways to engage and increase students involvement in library websites and operations.[3]To combat all these issues, an effective learning methodology using games can thus provide a sound platform and novel opportunities for many dental education systems in India. Game Based Learning (GBL) is a new innovative approach of teaching that will allow students to engage with educational materials in playful and lucid way. It's not just creating games for students but designing learning activities that can incrementally introduce newer concepts and also add an extra level of motivation in the respective subjects. It also stimulates student's abstract thinking by process of cognitive development theory and situated learning theory.[3]Cognitive theory emphasis that learners should master basic things while learning new things whereas situated learning theory states that the learners should enter learning scenarios to acquire knowledge.[4]Few studies in yester years were conducted using game based method on medical education, nutrition course and system analysis course. [1,3,4] No studies have yet been conducted in dental education in the subject of Oral Pathology. Hence, the present study was aimed to analyze a game based learning method in the subject of Oral pathology so as to improve student's learning performance in the subject.

Materials and Method

An experimental interventional study design was approved by the Ethical committee of Krishna Institute of Medical Sciences, KIMSDU, Karad bearing the protocol number 0298/2017-2018/ Ref. no. KIMSDU / IEC/03/2018. The study was conducted among 120 dental students registered in 2nd and 3rd BDS at School of Dental sciences, KIMSDU, Karad during the period of November 2018 to November 2019. The age group ranged from 19 – 21 years. The inclusion criteria were students of 2nd and 3 rd BDS as the subject of oral pathology is taught during this academic curriculum calendar. The exclusion criteria was 1 st and 4 th BDS students as this subject is excluded in the academic curriculum calendar. A verbal consent from all the participants was taken. The total sample was divided into 2 groups using "toss a coin" method of randomization. Participants with "head side" of coin were designated as control group and one with the "tail side" of coin group were designated as experimental group. The control groups were exposed to PowerPoint presentation method and the experimental groups were exposed to TAO game based learning software. The topic selected was "Odontogenic

cyst". Both groups were initially taught by traditional power point method on the selected topic that included total 6 sessions of one hour each. (Figure 1) Thereafter, pretest questionnaires consisting of 15 close ended questions on the topic, as formulated, validated and approved by the experts, was distributed among the study participants. The pattern of questions included were MCQ type as well as few Memory based questions & Extended Text (BAQ/SAQ), thus fitting into the criteria of blue print of question paper setting during examination. The control group was then instructed to do self-study on the same topic whereas the experimental group was exposed to the TAO game based learning software.

Figure 1: Flowchart



TAO software: The experimental group was again subdivided into 4 groups. A 45-minutes time allotment was restricted for each group for the purpose of convenience. Each participant

from the subgroup visited the game site by using the login ID & password. Various icons such as Items, test takers, authoring, interactions (common interactions, graphic interactions & custom interactions) were displayed on right upper bottom of the page and on top of the page. The students were demonstrated about how to use all these icons by researcher 1(R1). Students were instructed to formulate their own question – answer sessions using 1st sub-interaction named **"Choice**" wherein MCQ could be formulated. Similarly, 2nd sub-interaction named "**Order**" wherein question can be asked in a sequential manner. The 3rd sub-interaction named as " **Associate"** that is similar to having a pair in answers. Thus, answers should be selected which associates with each other. The 4th sub-interaction named "**Match"** which is similar to match the following pairs. The 5th sub-interaction is "**Slider** & 6th sub-interaction is "**Extended text**" for writing a brief answer i.e paragraphs can be written in answer section (BAQ/SAQ). In the same way, **Graphic interactions** with sub interactions such as **Hot spot, Order, Associate and Custom interactions** were used. The document saved was previewed by clicking the authoring icon. Double blinding was done and the scores obtained in pre/post test were subjected to statistical analysis.

Results:

A total 120 students participated in the study of which 44 males and 76 females with the average age of 19- 21 years. (The control group -M: 22; F:38 and experimental group M:22; F:38) Paired t test was done to compare between control and experimental group of 2nd year & 3 rd year students. No significant difference between pre-test of control (5.8 ± 1.8) and experimental (5 ± 2) group of 2nd year students. Mean post-test knowledge of experimental group students (7.4 ± 2.6) was significantly higher than mean post-test knowledge of control group students (5.1 ± 2.3) (p=0.002) shown in table 1 (Figure 2). Pre-test knowledge of experimental group of 3rd year students (7.9 ± 1.9) was significantly lower than mean post-test knowledge of control group students (9.2 ± 1.8) (p=0.006). No significant difference between post-test of control (8.4 ± 2.7) and experimental group (9.3 ± 1.9) of 3rd year students. (Table 2) (Figure 3). Unpaired t test was done to compare between of 2ndand 3rd year students satisfaction by applying Likert's Scale. Mean satisfaction of 2nd year students (4.3) was significantly higher than mean satisfaction of 3rdyear students (3.9) (p=0.009) (Table 3) (Figure 4).

Table 1: Illustrates paired t test between control and experimental group of 2nd year students.

2nd year	Mean ± Std. Dev.		Paired t statistic	p value
	Pre test	Post test		
Control group	5.8 ± 1.8	5.1 ± 2.3	1.3	0.2
Study group	5 ± 2	7.4 ± 2.6	3.4	**0.002**
Unpaired t statistic	1.4	3.3		
p value	0.2	**0.002**		

Figure 2: 2nd year

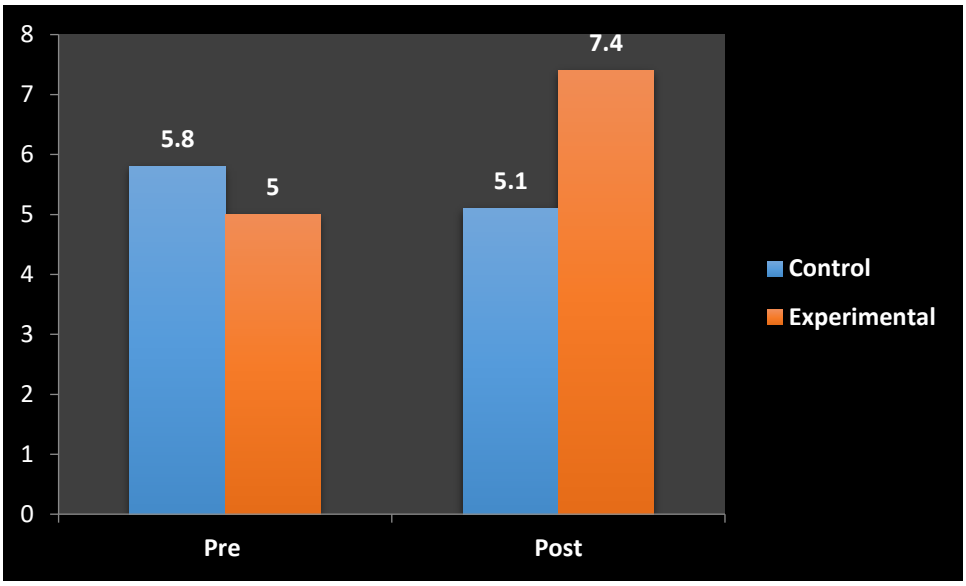


Table 2: Illustrates paired t test between control and study group of 3rd year students.

3rdyear	Mean ± Std. Dev.		Paired t statistic	p value
	Pre test	Post test		
Control group	9.2 ± 1.8	8.4 ± 2.7	0.08	1.7
Study group	7.9 ± 1.9	9.3 ± 1.9	4.6	**<0.001**
Unpaired t statistic	2.8	1.8		
p value	**0.006**	0.07		

Figure 3: 3rd year

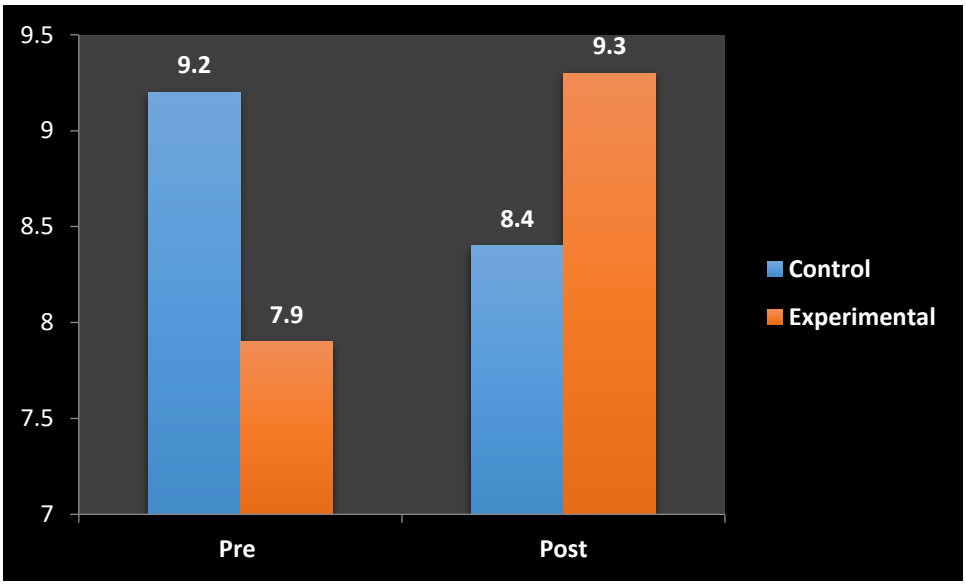
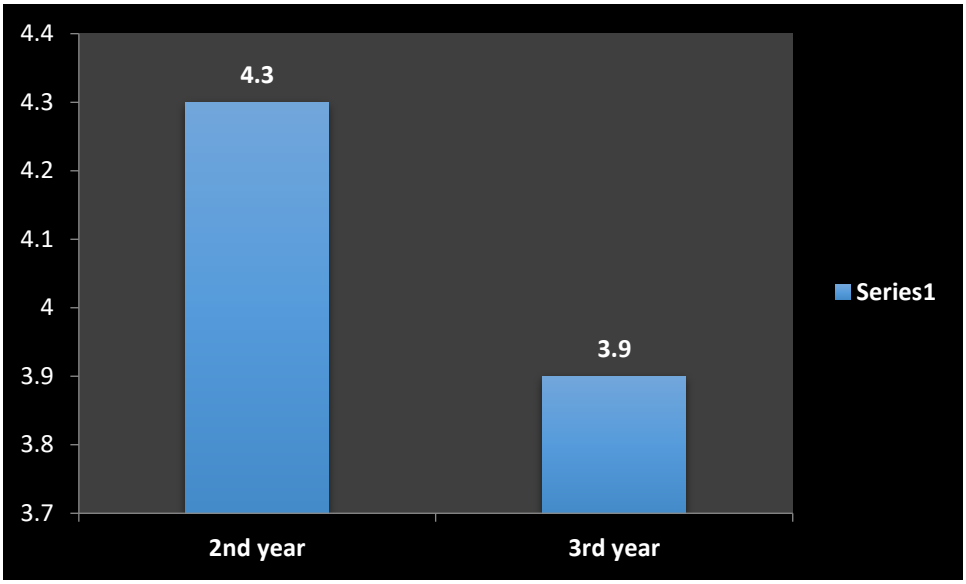


Table 3: Illustrates the feedback analysis of 2nd year & 3rd year students by applying Likert's scale.

Mean ± Std. Dev.		Unpaired t statistic	p value
2nd year	3rd year		
4.3 ± 0.6	3.9 ± 0.4	2.7	**0.009**

Figure 4. Students perception and satisfaction



Discussion

Digital technological era has impacted the modern generation who demand learning with more fun and innovative way. Dental education is rapidly evolving and students enter this profession with high level of technological literacy & hence expect variety in curriculum teaching. Games are considered to be attractive and best tool for engaging learners to actively participate in learning activities.[5-7] Games do something that traditional teaching methods don't do.[3] They are different from conventional traditional method where the former focuses on information transmission & memory whereas later focus on triggering the students learning motivation skills by increasing the abstract thinking process and cognitive skills, thus fostering the high order thinking ability.[4, 8-11] The educational effect of games can be explained by the following perspectives: behaviourism which prioritizes knowledge transmission, cognitivism in which learners not only absorb information but also transform information, Humanism based on a person-centred learning on values and intentions and constructivism that highlights knowledge construction through problem-solving and interaction in the social world.[12] In 1982, Carroll et al inferred that computer games are able to boost motivation as they create an adventurous & challenging environment where students can not only have better learning academic achievements but also learn happily.[11] In addition, library in any institute are also in need of finding new innovative ways to engage and increase students involvement in library websites and operations.[3] Sukovic, Litting, and England in 2011, stated "engagement through serious games and plays is proposed as a way of dealing with discrepancies between library traditional roles and contemporary demands,

enabling experimentation and exploration of future roles.[13] Therefore, teachers in the present era have to overcome these challenges and encourage students to improve their academic performance skills in subjects. Academic performance scores to relevant content-based sessions were consistent with other studies documented in literature. In our study, the post test scores of experimental group was significantly higher with the mean of 7.4% for 2nd year students & 9.3% for 3rd year students indicating improved performance when compared to pre test scores. This was similar to studies conducted by Rani Kanthan et al [1] who conducted a cohort study on 114 medical students in Canada with two types of specially designed content relevant digital games and the results revealed P< .001 , thus concluding that games can be used as additional, e-learning/learning recourse for teaching in undergraduate medical education. In 2012,Chinq-Hsue Cheng et al [2] conducted a quasi-experimental study design among 64 students in Shu-Te University Taiwan. 30 students (M:F = 20:10) were exposed to traditional face to face teaching and 33 students (M:F = 27:6) were exposed to 3D role play game. Results showed GBL have significant difference in Pre-test (Mean=72.14) and post-test (Mean=82.24) concluding the average motivation was 3.81>3 with high learning motivation. Studies done by Jui-Mei YIEN et al, Boeker et al, Cendan J et al & Stirling A et al also showed similar findings.[4,14-16] However, in the present study, the perception and attitude of students satisfaction using the software by applying Likert's Scale showed variations i.e Mean satisfaction of 2nd year students (4.3) was significantly higher than mean satisfaction of 3rdyear students (3.9) (p=0.009). This could be explained as per Marc Prensky statement where he categorized students into three types: the first type as self-motivated student who wants to do well and will succeed regardless of the teaching strategies used, the second type as students who recognize the benefits of knowledge and will push themselves to overcome obstacles to reach this end, and third type as students who ''tune out'' the professors.[17] Further hypothesis could be that this type of learning methodology is been classified as behavioral change gamification process that is based upon 2 most important theories – self determination theory as proposed by Ryan and Deci in 2000 and flow theory as proposed by Csikszentmihaily in 1990. Self determination theory is based on basic principle of psychological needs i.e autonomy, competence and relatedness. The individual's tendency to do his/her activities freely is Autonomy whereas the individual's ability to do a task is Competence. Relatedness could be defined as a form of social influences; it is the urge to interact with others. The flow theory as defined by Brühlmann (2013) is considered as the optimal experience, a state of mind and body with absorption and enjoyment; so, when everything comes together and we feel totally focused and involved in the task, we experience flow". The flow or zone shows a player's state between anxiety and boredom; it could satisfy the motivational level for the player.[18,19] The difference in perception and students' satisfaction scores in the present study could be explained due to difference in individuals autonomy, competency and relatedness as well as the flow level of the involved participants. We encountered certain limitations during the study. All type of interactions was not used completely due to the complexity involved during usage. After feeding certain number of questions, the page setup goes automatically back to first question, making the user frustrated to pull the page down repeatedly. Absence of instruction page on how to use the software was time consuming to demonstrate the steps for each participant. Lack of inbuilt mobile application and requirement of high-speed internet connectivity led to inconvenience due to which few participants quit the project.

Conclusion:

This study implemented a game based learning system in the subject of oral pathology as a new innovative approach in teaching methodology. Academic performance scores were improved and the findings of the study were quite positive. Future studies involving other subjects in dentistry can be undertaken.

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