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Use of Technology and Gamification in Learning Viz a Viz Traditional methods

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Abstract*: The study primarily aims at understanding the learning outcome of using the different methods about a topic. The traditional learning modes in educational institutions tend to focus primarily on lecture method or a pen paper system of imparting knowledge. With the advent of technology newer modes of learning have come in to place with multimedia leading the domain. Gamification has been sparingly used in educational institutions or for imparting knowledge and thus the far fletched advantages of adopting such learning methods haven't been tested or acknowledged at large scale. An attempt has been made by the research to understand the effectiveness of learning outcomes through both a written document and Gamification video. The learning outcome was measured through a quiz, an element of gamification. The outcome of which resulted in proving that gamification proves to have better scores as compared to learning through a traditional method. Sample size of 50 was collected and learning was measure using Quiz. Three set of data was collected for using different methodology. Traditional method, Gamified video and combination method.

The research also establishes the fact learners felt that have both the mode of teaching enforces theories and concepts for learners to have a fairer understanding of the subject matter. The study presents findings on adult learners and post graduate level course. Studies like these need to be explored across time spans and with different topics. The study is relevant as generation of learners is changing and it implies how pedagogy needs to shift to meet the requirement of different types of learners.

***Keywords* : gamification, animation, learning tools, learner**

I. INTRODUCTION

This research aims to identify rewarding learning experiences that will inspire, challenge and engage all young people, equipping them with the essential skills and attitudes for life, learning and work in the 21st Century.

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Interest around the use of games and animation in education is gaining high precedence and following the emergence of new trends like 'gamification', However traditional methods of teaching still tends to prevail in almost all educational institutions. The effects of gamification and animation have been noted and researched by many, however very few studies have been conducted in the Indian context. Thus it will be interesting to note if the research is able to provide similar insights in to the effectiveness of gamification.

Objective

The objective of the study is to analyze if a subject matter can be more effectively taught via gamification as compared to traditional methods of learning like a written document. The objective of the study in a more precise manner has been mentioned below:

- Conduct comparative analysis of the effect on retention of subject matter using gamification as a learning tool versus traditional learning tools.
- Conduct comparative analysis of the effect on recalling of subject matter using gamification as a learning tool versus traditional learning tools.

The study has tried to bring in the element of gamification through use of video and a quiz where in respondents will be marked for their learning. The results of the study will be shared with the respondents post the quiz for them to help validate their understanding and help reinforce their learning. A new topic of study was chosen as subject matter to be taught for this study.

II. REVIEW OF LITERATURE

Literature review was conducted on gamification, use of digital methods in teaching and comparing them with traditional methods of teaching. Interesting studies are conducted in proving effectiveness of animations, digital media of learning and gamification. However authors could not find any study making comparison on impact of methods on learning from the point of view of retention and recalling.

Gamification evolved as recalling and retention of content among learner was being challenging. Subject expert faculty may try effective methods but it did not help all leaners. Today classroom is dynamic and each learner possess different learning style. Many authors have suggested theories of varying learning style of individual.

Dunn, Dunn and Price in 1979 highlighted 18 stimuli in an individual which leads to understanding of the content and its absorption [16].

Litzinger et al 1973 discussed various cognitive , conceptualization and affective differences in individual due which learning pattern may vary [27]. Torrance et al, 1977 related learning to hemispheric categorization of an individual. Due to which individual will perceive and react to information in different way. They categories learners as left dominant brain, right dominant brain or whole brained [33]. Famous theory of experiential learning style proposed by Kolb described learning as process. Each stage had a peculiar learning style and learner's attributes. Each type of learner would like to do different set of action to learn the concept.[20]

Gamification and animation has found its way in the domain of education. Animation is defined as "the technique of photographing successive drawings or positions of puppets or models to create an illusion of movement when the film is shown as a sequence". It is being used in consonance with gamification due to two main reasons, one being that it helps individual create cognitive representation of different concepts, phenomenon and different procedures to be followed. Secondly it helps replace deficiency of the imagination and creativity that a person is devoid of. [2]

Gamification in form of animation comprises of graphics that are able to depict the spatial arrangement of the various aspects of the subject under study and is dynamic in the sense that it changes over time. [5]. In another paper written by Betancourt they defined animation as form where in it comprises of a series of frames which are continuation of and altered version of the frame which tends to appear based on the discretion of the person who designs them. [5][24]. One of the benefits of using animation as medium of learning is that it is able to bring in constant change over a period of time. [26]

A lot of studies have compared animation along with static graphics. Some of the studies have stated that animation has its disadvantages of usage as in case of static graphics as if one has to comprehend what animation has to offer the whole aspect of animation has to be referred to as compared to static graphics which can be analyzed in isolation. [5]

However there are studies that have proved otherwise where they have taken a different take on how animation as a learning mode is far better than static graph. [11] The advantage of animation is dependent on a lot of factors and needs to take into consideration. Animation may prove to be beneficial because it displays aspects both in a dynamic and unequivocal format.

Animation and the pace at which it is displayed is another aspects that needs to be taken into account as it involves the individual learner's level of interaction and also measures the learning outcome. Designers also have the control of defining the pace of the animated scene for individuals. The constant changing of frames is what keeps the learner engaged. A lot of aspects need to be taken into consideration while trying to establish a relation in terms of its effectiveness in learning outcome. Geographical and time difference also aspects that have a direct bearing on the comprehension of the learner as well. [32]

In a study conducted by Leutner it was seen that there was a stark difference in favour of animation over static graphics. The analysis of the different factors resulted in drawing a conclusion where it stated that animation as a mode of learning tends to be more productive in subject matters that were procedural in nature. Any subject that involved the use of heuristic knowledge didn't show effectiveness of using animation. [21].

Some of the indicators that have been aggregated by studies to highlight their effect learning, one the content that is being projected through [5], the delivery medium [29] and individual abilities like the learners prior knowledge and ability to grasp to sync spatial abilities. [23][8]

In a paper, it was written that there are precisely three are 7 basic principles that need to be taken into consideration. These aspects majorly define the learning outcome of the subject that is being to put to animation. The first is multimedia principle which means that animation needs to have text along with narration and if they are used singly will not deliver results in totality. The second is the spatial contiguity principle which is taking into consideration that the text being used in the screen should be brought nearer as compared to the corresponding animation being run in the background. The third aspect that needs to be taken into consideration is the temporal contiguity principle which is that animation and narration of the subject matter needs to be carried out in a simultaneous fashion. The fourth aspect is the coherence principle which is that the animation needs to exclude inessential words or any sound of voice to concentrate on the core of the subject matter and the objective. The fifth aspect is the principle of modality which essentially means that the animation is more effective with narration as compared to onscreen text with animation. The sixth principle that needs to be incorporated is the redundancy principle which disagrees with the combination of animation, narration and onscreen text all together. The final and the most important aspect that defines the effectiveness of animation is the concept of personalization principle. The principle highlights the fact that animation when uses a more conversational form of narration tends to engage the person more rather than having a format where the style is rather formal in nature. [28].

The traditional method of teaching in most educational institutions is the lecture and paper method. With the advent of technology educational institutions are moving towards newer forms of learning methods. Animation and gamification have paved their way in to methods being used to enforce learning in individuals. One of the primary reasons why gamification has paved its way into popularity beyond entertainment is because they can provide a sense of engagement and self-efficacy which real life may find it difficult to deliver. [9]

There are two elements to gamification which needs to be clarified. Game based learning and Gamification are words which are used interchangeable. "Game-based learning uses an actual game to teach knowledge and skills. A learning game is a self-contained unit with a definitive start, game play and ending." [19]. In game based learning the game is defined where learners are involved in set specific activity and in different setups the learning end result could be different.

The learners who are involved in this kind of a setup are aware of the games requirements and the concept of winning and losing in the end.

Gamification differs from game based learning. "Gamification, on the other hand, only uses a few game elements." [19]. The learners in the process are not involved in the end state of the game. The focus lies in the learning process rather than completing the game. There is continuous focus on the various phases in the game and learners are rewarded for completing tasks. This idea of competition essentially builds value for the player/learner and thus engages and motivates the user of the application.

Gamification and animation will enhance the learner's ability to enhance their knowledge. The elements need to be used in the right context and for gamification as a concept to be an effective mode of learning needs to include two very crucial aspects. "The most effective gamification platforms use two learning practices — retrieval practice and spaced retrieval. Combined, these techniques provide a strong foundation to increase learning and retention."

Retrieval practice involves the learner to recall without reading or rewriting the material. It is not a remedy to improve grads or improve scores. It is a method of improving retention amongst learners. In a study that was conducted by Southern University professor Joh Dobson it was seen that "Using a series of very brief retrieval quizzes enhanced retention of previously tested material as much as 40 percent." [13].

Spaced Retrieval is a concept which allows learners to grasp content spaced over a period of time and not all at once. It believes that retention to be long term needs learners to be continuously exposed to learned information grasped previously. "In order to promote long-term retention of knowledge, students should be exposed to previously learned information." [7]

Gamification as a concept has evolved primarily because of the following reasons:

- Gamification and cognitive development: Studies have been conducted to see the cognitive effects of gamification. The learners who use gamification as a mode of learning tend to outperform their counterparts in terms of retention, visual attention [15].
- It is also suited for certain type of cognitive training as it gives the mobility and freedom to the player to be able to make choices and those choices help them get feedback on their learning curve and aid in experiential learning [14].
- To increase long term engagement: Gamification also helps engaging learners. It creates the interest and motivation amongst individuals to develop commitments towards learning. It's a platform that monetizes on the fact that when learning is converted to tasks that need to achieved, the results are long term in the effectiveness of learning.
- Studies have also highlighted that participation motivation increases with involving gamification elements in cognitive learning and training. Games used for delivering cognitive training may be advantageous because they tend to have positive outcomes on memory recalling, help solve problem and develop competencies that work towards developing competencies of having emotional control and change in behavior significantly [6].

There are challenges that one faces when using gamification in web based kind of learning as it is difficult to maintain participant motivation which at time is beyond the control of the teacher to control as the learner may choose to shut the browser at a time when the person feels a disconnect with the subject material [18].

The principle of animation and gamification is based on the core concept of intrinsic motivation. Gaming is intrinsically motivating because by and large it's a voluntary activity. It is a concept that works best when the learner is involved voluntarily and is motivated to participate in the process. The concept would fail when it involves compulsorily punish an individual to get indulged in the process of gamification [30]. Studies across have tried to understand the correlation between effectiveness and animation, however not many studies have able to quantify this aspect. This is because as mentioned earlier in the literature there are many other aspects that need to take into consideration and motivation and interest are dependent on various aspects that need to be studied under controlled environments [24].

Flow theory was proposed by Mihalyi Csikszentmihalyi to describe the experiences of intrinsically motivated people, those who were engaged in an activity chosen for its own sake [10]. Flow is a state of consciousness during which an individual is in control of his actions and completely absorbed in the task at hand. He defined the concept of optimal experiences as those that involved merging of action and awareness, strong concentration on the task at hand, and a loss of awareness of time. During such periods, learners tend to concentrate on the current task and they completely forget about time and the world around them: Theses activities are also characterized by positive emotions. They termed this quality of experience "flow." The origin of flow research has its origin in an aspiration to understand the phenomenon of being intrinsically motivated irrespective of the end outcome or any good that may occur from the end result [10].

The concept talks about the fat that when an individual is in flow state he tends to operate in full capacity and the learning is extremely dynamic. It is primarily because the individual is so involved in the state that the level of involvement tends to dictate the motivation of the individual [12]. When an individual enters a state of flow there is an equilibrium that is met between the action that is required by the individual to display and the opportunities that are available for them [3]. It means that the skills have to be balanced with challenges. If at any point of time the skills will tend to outrun the challenges, motivation will be lost. The same applies when the opposite happens. Thus at times when there is a mismatch then animation or gamification enter into the realm to push the learner to adjust according to his/her environment.

Well established Constructivist theory puts the construction of knowledge in one's mind as the centerpiece of the educational effort. The Constructivist theory states that no sot of knowledge can be passed on from the teacher to a learner by simply passing on knowledge or data. It is required that the teacher is involved in helping the student be motivated enough to be able to grasp the knowledge [34].

Constructivist instruction, however, at least potentially results in meaningful learning and understanding. The learner is encouraged to create the perception and the knowledge of learning through their experience and the interaction between the various elements of learning in the environment that one is part of.

The study of various available literature revealed Gamification is effective way of learning.

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III. RESEARCH METHODOLOGY

The research primarily aims at studying the learning effectiveness of the three modes of learning – written, gamification and a combination of both. The questions that the study tries to address is whether there is an effect on retention and recalling of subject matter using animation and element as a learning tool versus traditional learning tools. The study also tries to study the element of gender. A quiz is added where it is being used both as a measure of quantifying results and also bring in reward system attached to learning. An analysis of primary data is carried out through quiz and feedback to be able to study key aspects for establishing the relationship between retention and learning and animation. Thus the research was purely quantitative in nature and experimental in nature.

Data

Primary data was collected based from students in educational institutions through a convenient sampling method. The sample size was 150 (50 x 3 modes of learning). There was equal distribution of male and female. Secondary data was collected from journals, research papers and articles were also studied to help develop a rapid review of key literature to identify theoretical contributions and evidence.

Data Collection

To study the effect of animation it was required to carry out a comparative analysis of both traditional mode of learning which is the written document as well as the gamified animation video and finally a combination of the two types of learning mode.

- Quiz was conducted to measure learning post the sessions. Quiz was conducted to collect data with 25 set of questions and each question was assigned a point basis which the analysis has been carried out. Quiz was prepared with the help of domain expert practitioners and trainers.
  - First set of data: Written Document
  - Second set of data: Gamified Animation Data
  - Third Set: Written and Gamified Animation
- Interview (To seek Feedback of participants)
- Details of the data collected

Data Tool for analysis: Data tool being used for analysis is IBM SPSS

Following tests were conducted for the purpose of study.

	Written Document	Animation Video	Written + Animation video
Time Duration	10 mins	3min 18secs	
Sample	50 Respondents	50 Respondents	50 Respondents
Sample Breakdown	☐ 25 female ☐ 25 male	☐ 25 female ☐ 25 male	☐ 25 female ☐ 25 male

- ANOVA – for comparison of learning modes
- Independent Sample T test – for comparison between gender

Steps taken to carry out analysis

- The self-study document on subject matter was provided to the sample for their learning and a quiz was conducted. Multiple choice Quiz comprising 25 items was conducted to measure learning
- The session on subject matter was conducted through gamified animation video created on the topic and the same quiz was posed to the sample for answering and measuring learning.
- The third data set was created by getting the same sample to answer the quiz post reading the document first and then watching the animation video.

IV. RESULTS

Univariate ANOVA

Since there were three modes of learning, the objective was to find out the most effective mode. Hence there were three sample sets – written mode, animation mode and written + animation mode which justified the usage of univariate ANOVA.

Hypothesis

HO1: There is no significant difference in the means of the scores across three learning sources

Table 1: Table showing means of sample sets

Descriptives

learning score

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	50	15.8000	1.81827	.25714	15.2833	16.3167	12.00	19.00
2.00	50	19.7800	1.70581	.24124	19.2952	20.2648	16.00	22.00
3.00	50	21.3200	1.84546	.26099	20.7955	21.8445	17.00	24.00
Total	150	18.9667	2.93422	.23958	18.4933	19.4401	12.00	24.00

Table 2: Result of ANOVA

ANOVA

learning score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	811.373	2	405.687	126.492	.000
Within Groups	471.460	147	3.207		
Total	1282.833	149			

Inference

ANOVA test was done using SPSS at $p < 0.05$. The results from Table 1 clearly indicate that there is a significant difference between the effectiveness of learning methods which can be reflected from the mean scores (Table 1). Hence the alternate hypothesis is accepted. Written + animation is found to be the most effective learning method.

Independent Sample T Test

Independent Sample T Test was done to understand whether there was a difference in learning based on gender.

Hypothesis

H02: There is no significant difference in learning ability based on gender

Table 3: Mean scores based on gender

Group Statistics

	gender	N	Mean	Std. Deviation	Std. Error Mean
learning score	1.00	75	19.1867	2.80296	.32366
	2.00	75	18.7467	3.06283	.35366

Table 4 Independent sample t test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
learning score	Equal variances assumed	1.285	.259	.918	148	.360	.44000	.47941	-.50737	1.38737
	Equal variances not assumed			.918	146.852	.360	.44000	.47941	-.50743	1.38743

Inference

Independent sample t test was done at $p < 0.05$. The results clearly indicate that the significance level is greater than 0.05. Hence the null hypothesis is accepted. There is no significant difference in the learning ability based on gender. The same is reflected in the mean scores (Table 3)

Discussion on participants Feedback

Feedback was taken from the participants and list of questions were posed to them to seek the feedback.

- The first question that was posed to the individuals was regarding the content of the subject matter and whether they thought it was enough for developing a good understanding of the subject. The answer to which most people stated that it was interesting for them as both the medium of learning were short and crisp.
- The second question that was put across to them was whether the content in both the medium depicted the same thing in terms of terminology and facts, to which the answer was that the content was same in both mediums.
- The third question that was asked was what could have been done differently in both mediums. The answers were varied on this question and they ranged from having narratives added to the animated video to having a crisper written document. A lot of them also demanded case studies but because the study involved understanding learning outcome purely on subjective theoretical knowledge, this aspect couldn't have been added.
- The fourth question that was posed to the respondents was what mode of learning was more interesting. A very interesting perspective was formed in the analysis which spoke about the fact that though animation was more interesting as a mode of learning, the scores had seen a significant improvement only because a lot of doubts and gaps were filled in through the concept of animation. Thus, it is difficult to quantify whether animation can be purely judged for good scores as the study has not taken in to consideration spatial scale in terms of the time span across which the study would be conducted

V. CONCLUSION

The study aimed at understanding the effect that animation and gamification will have on the understanding of the subject matter chosen. With a sample size with equal number of respondent to study independently the aspect of animation. It was noted that when studied separately, the sample size that played the quiz on the sole premise of watching just the animation managed to excel in their performance by a slight margin as compared to their counterparts. It was also noted that gender effect on learning scores also showed marginal difference in the learning scores.Gamification and animation have entered the domain of the corporate world and is being extensively used for enhancing engagement in individuals Irrespective of the fact whether the concept of games and animation can be more beneficial is a question that needs to be studied more in depth. All the studies have conclusively defined that it is definitely engaging for people to be involved in aspects that have gamification and animation. The domain of study requires to understand the intricacies between game elements and the cognitive thought process of learners. The mind is such a complex thing and gets influenced by factors which at times become difficult to interpret and isolate. But gamification and animation have paved the way for bringing in change in the way we learn and in times to come will dominate the pedagogy across educational domains.

VI. LIMITATIONS

As studies have mentioned that there are limitations in quantifying the benefits of bringing in animation as a mode of learning along with gamification. Also it becomes difficult for the designer to be able to completely carry out study in controlled environments. The possible explanations of a gendered score in the analysis could be purely in terms of the content being studied.

Also the third data set which involved that the same set of respondents get to see both the animation as well as the written document. It is difficult to interpret if the learning was purely based on animation or the learning was based on a combined effect. The feedback taken for the third data set had respondents who claimed that animation helped reinforce the learning. There were finer aspects to the written document that they missed out on and with animation the individuals were able to fill in the gap.

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