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Original Research Article

3D animation based multimedia improves learning in medical students

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ABSTRACT

Multimedia and 3-D animation is an emerging field to enhance deeper understanding and spatial knowledge in medical education. This interesting technology could be used in both horizontal and vertical integration of medical education. By using 3-D software we model, render and compile medical topics by integrating anatomy, biochemistry and physiology along with applied aspect, which are being used for enhancing the understanding of both undergraduate and post graduate students. By using one of such topic on Patho-physiology of jaundice, we have shown that group who was taught with 3-D animation technology has performed better than the group who was taught with routine power point presentation (p- 0.006). Feedback from students also showed that 3-D animation is useful learning aid and improves their spatial ability. 3-D animation appears to be promising upcoming tool in medical education.

1. Introduction

3D Animation has come a long way in recent years. Research shows that when Video is combined with animation, this synergistic pairing can vastly extend the visual capability of 2D images or live-action video. With 3D animation, the view can often seen inside, in and around any anatomical or cellular structure. Through 3D animation, we can reveal not only the spatial relationships of anatomy but also how that anatomy functions.

Animation can have both hospital, institutional, and pharmaceutical applications. Animators in the medical field can apply their skills to many tasks, including:

1. Demonstration of how pharmaceutical drugs work in the bloodstream and body;
2. Interactive models of the human body on both macroscopic and microscopic, interior and exterior scales.[1]
3. Interpretation of patient data into 3D visual images.[2]
4. Creation of instructional materials for medical students.[3]
5. Demonstration of surgical techniques in virtual representation.[2,4]

The 3- D software, which two decades ago were the sole domain of the large Hollywood film studios, have now filtered their way through to 3-D CGI artists working in medical animation.[5] McGhee J. describes 3-D computer artist's approach to the creation of three-dimensional computer-generated imagery (CGI) derived from clinical scan data. Interpretation of scientific imagery, such as magnetic resonance imaging (MRI), is restricted to the eye of the trained medical practitioner in a clinical or scientific context. In his research work, MRI data are visualized and interpreted by a 3-D computer artist using the tools of the digital animator to navigate image complexity and widen interaction.[6] Keedy AW et al compared whether interactive three-dimensional presentation depicting liver and biliary anatomy is more effective for teaching medical students than a traditional textbook format presentation of the same material. In the post-test satisfaction survey the 3D group expressed a statistically significantly higher

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overall satisfaction rating compared to students in the 2D control group [4.5 versus 3.7 out of 5, P = 0.02].[7]

Few studies has studied the response in short term and long term retention ability and spatial ability after using 3-D animation technology and also there is paucity of literature on its role on integration of medical education.

2. Materials and Methods

Study was conducted at Era's Lucknow medical college on 1st year undergraduate MBBS students after obtaining institutional ethical clearance. Study was done to compare the effect of method of teaching in medical student. Students were divided into two groups by using table of random numbers. Surprise test was conducted after randomly dividing students on integrated topic (Pathophysiology of jaundice) which was taught one month back by power point presentation. After surprise test of two groups, one group was taught with 3-D Animation & other group was taught with the use of power point presentation. Topic was taught by same teacher and for similar duration of time. After teaching both groups were again tested by same set of questions (20 questions covering anatomy, physiology, biochemistry and applied aspects). Question paper was checked by different teachers and data analyzed by different teacher.

We routinely use multimedia and 3-D animation for teaching medical students. We have dedicated 3-D animation department having trained staff for modeling, rendering and compiling medical topics, guided by faculty from both basic and clinical science. Integration of basic and clinical science is used to compile medical topics starting from gross level to molecular detail and made freely available for medical students. We used the topic pathophysiology of jaundice which incorporated anatomical, physiological and biochemical as pects along with its clinical significance.

3. Results

Study was conducted on 142 1st year MBBS students (92 females and 50 males), which were divided into two groups by table of random numbers. Surprise MCQ test consisting twenty questions covering both basic and applied aspects, was conducted on medical topic "Pathophysiology of jaundice" after dividing students into two groups and there was no significant difference in marks between two groups (6.01± 2.72 vs 6.03± 2.38; p- 0.97, Figure 1). After teaching with 3-D animation to one group and by Powerpoint presentation to another group, post-test on same questions showed significant difference between two groups (p- 0.006, Table 1) which showed 3-D animation group performed better than control group. There was no significant difference while comparing male students with that of female students. Feed-back from students also showed that by using 3-D animation they have got better spatial clarity and it can be used as useful learning aid (Table 2).

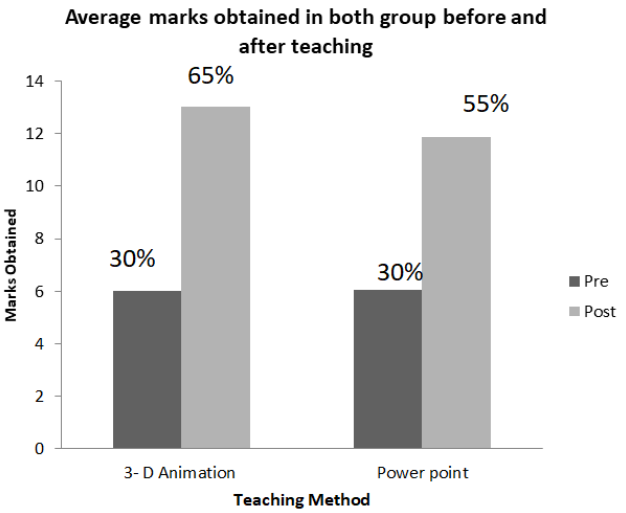

Fig. 1: Average marks obtained by both groups

4. Result (marks obtained in mean ±sd)

5. Discussion

Emerging role of multimedia and 3- D animation in medical education is being noticed in medical community and few studies also demonstrated beneficial effect in students in both short term and long term retention of medical concepts.[8] Embryological development with the help of 3-D animation could be understood in a better manner, which is also tested positively in one of the study by Marsh K. R. who also showed that it is better in long term retention.[4] A study showed that a person retains only 10–15% of what is read, 10 – 20% of that which is heard, and 20–30% of what is seen, but when audio and video materials are presented side by side the retention of knowledge increases to 40–50%.[9] Animation also gives opportunity for interactive learning environment and also improves deep processing and 3-D perception among students.[6]

In our study we have shown that short term retention is enhanced when previous studied topic is again taught with the help of 3-D animation and may also enhance strengthening of neural pathway involved in memory consolidation, though not studied in our study. Feedback from students also shows that 3-D animation may be used as useful learning aid and increases spatial ability.

Another benefit of animation was seen that integration of medical topic both of basic and clinical discipline can be easily done by using this technology.

Table 1: Average marks obtained by both groups

Group	Result (marks obtained in mean ±SD)	Significance (p value)
Animation group before teaching	6.01 ± 2.71	0.972
Power point group before teaching	6.03± 2.38	
Animation group after teaching	13.01± 2.46	0.006
Power point group after teaching	11.86± 2.53	

Table 2: Feedback from students

Question	Fully agree	Agree	Somewhat agree	Disagree
Useful learning aid				
Animation group	15.16%%	56.70%	27.43%	1.70%
Powerpoint group	10.14%	55.42%	29.09%	5.35%
Improvement of spatial ability				
Animation group	20.51%	52.70%	24.08%	2.70%
Powerpoint group	15.94%	47.83%	31.88%	4.35%

6. Conclusion

After doing this study we conclude that 3-D medical animation can be useful tool for medical education if used along with conventional teaching.

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8. Source of funding

None.

9. Conflict of interest

None.

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