

# Effectiveness of Animation Videos as an Auxiliary Tool to Conventional Lectures for Teaching Paediatric Surgery – An Interventional Study, Kozhikode, Kerala

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## ABSTRACT

### BACKGROUND

At present, concepts of basic paediatric surgical disorders by undergraduate medical students is limited, which is likely due to deficiencies of traditional teaching methods. This therefore results in delay in identifying situations that mandate initial management and timely referrals. The primary objective of this study is to determine the efficacy of animation videos in conjunction with conventional lectures while teaching paediatric surgical disorders.

### METHODS

This is an interventional study involving 60 final year MBBS students at a tertiary care institution. They were divided into two comparable groups of 30 each. One group (Group A) was educated using animation videos and conventional lectures that included three crucial topics in paediatric surgery - malrotation, intussusception and cleft lip/palate. The other group (Group B) was taught the same topic by means of conventional techniques alone (power point, pictures and usage of black board). The same teacher took these sessions (six exposures, 3 each in two groups) for both the groups, on consecutive days. After conclusion of the session, two sets of assessments (multiple choice questions) were provided to students, one soon after class and another two weeks later. Appropriate statistical methods were employed to compare scores obtained by them and their feedback through a questionnaire.

### RESULTS

On immediate evaluation, Group A (N = 30) achieved a mean score of  $21.8 \pm 1.1$  in comparison to  $17.8 \pm 1.3$  achieved by Group B. On statistical analysis with independent t test, the positive difference was statistically significant ( $P < 0.0001$ ). At 2 weeks' evaluation, Group A achieved a mean score of  $20.5 \pm 1.3$ , and Group B  $17.9 \pm 1.5$ . This difference was also found to be significant ( $P = 0.006$ ). On assessing feedback questionnaire responses, majority of students found the video assisted teaching method with animation video practical and valuable.

### CONCLUSIONS

The teaching method using animation videos in conjunction with conventional lecture is more effective in paediatric surgery than teaching with conventional lectures alone. The students have also shown a favourable perception towards this method of teaching.

### KEYWORDS

Animation Videos, Conventional Lecture, Teaching, Paediatric Surgical Disorders

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**BACKGROUND**

At present, comprehension of vital concepts on basic paediatric surgical disorders by many undergraduate medical students is found to be limited. This is likely due to the deficiencies of traditional teaching methods.<sup>1</sup> Consequently, this results in delay of identifying situations that mandate correct initial management with timely referral to a higher center when necessary. Improved understanding of concepts leads to better treatment and referral protocols.<sup>2</sup> It has been our constant endeavour to enhance understanding through improvised teaching techniques so that they are easier to grasp, better retained, useful in their examinations and finally utilize them in their future clinical practice and teach others.<sup>2,3</sup>

Technology and related applications have increasingly been integrated within most facets of modern life, enhancing communication, streamlining key performance indicators and facilitating improved achievements. The medical and healthcare sectors have also greatly benefitted, with improvements in medical imaging, surgical procedures, and diagnostic technologies. Indeed, another technological beneficiary is the medical education sector, particularly in the years of undergraduate education. One such widely used application is video-augmented learning for medical students. In the present circumstances, with COVID-19 raging in many parts of the world, the need for physical distancing has become paramount. This has resulted in a dramatic rise in remote teaching and learning that has occurred throughout medical training, with an increased focus on developing high-quality online educational resources. Video-centred learning resources were already a major element of medical education prior to COVID-19 pandemic, but the need for developing synchronous and asynchronous web-based teaching materials and the increased role of videos has never been higher among medical learners.

**Objectives**

The primary objective of this study was to determine the efficacy of animation videos in conjunction with conventional lectures while teaching paediatric surgical disorders. Secondly, the perception of students regarding this new method of teaching, with respect to this discipline, is also assessed.

**METHODS**

This is an interventional prospective study done at a tertiary referral institution (Government Medical College, Kozhikode, Kerala), over a period of two months (December 2019 to January 2020). This study was approved by the Institutional ethics committee (GMCKKD / RP 2019 / IEC / 261). Sixty final year undergraduate medical (MBBS) students of the college who were posted at the Department of Paediatric Surgery were involved in the study. Appropriate consent was

obtained from each of them. There were divided into two groups (Group A and Group B) of 30 students each, randomly as per roll numbers (using random number generator). The students were of the same batch and were deemed to have comparable academic performance and levels of exposure. Three randomly chosen crucial topics in paediatric surgery like malrotation, intussusception and cleft lip & palate were then taught to them through hourly sessions. The same teacher conducted these sessions for both the groups. Sessions for both groups were conducted on consecutive days.

One group (Group A) was educated using animation videos along with conventional lectures. These videos were not available for download elsewhere. The videos included animated information for pathogenesis and how to investigate each of them. The other group (Group B) was taught the same topic with conventional lecture techniques by means of power point, pictures, and usage of black board. The clinical information given to both the groups were however the same. After the conclusion of the session for both groups, two sets of assessments [multiple choice questions (MCQs) with keys] were provided to students, one soon after class and another two weeks later, to assess the effectiveness of a particular teaching method. Same set of questions were given to both, and care was taken to ensure secrecy of questions before they sat for the assessment.

In total, there were six exposures (3 each in two groups). Cross over of the groups was done for alternative topic for elimination of bias. Perception of students towards new method was also appraised via a feedback questionnaire (Likert scale). We compared the scores obtained by students of each group, on immediate assessment as well as assessment after 2 weeks.

**Statistical Analysis**

Data was tabulated and analysed using latest statistical package for social sciences (SPSS) software. Independent t test was used for comparison for MCQ test results and non-parametric tests for feedback questionnaire. The retaining capacity was also determined by applying paired samples t-test for change in scores over 2 weeks' time, for both groups. The flow chart and the schematic representation of the research methodology are shown in Figure 1.

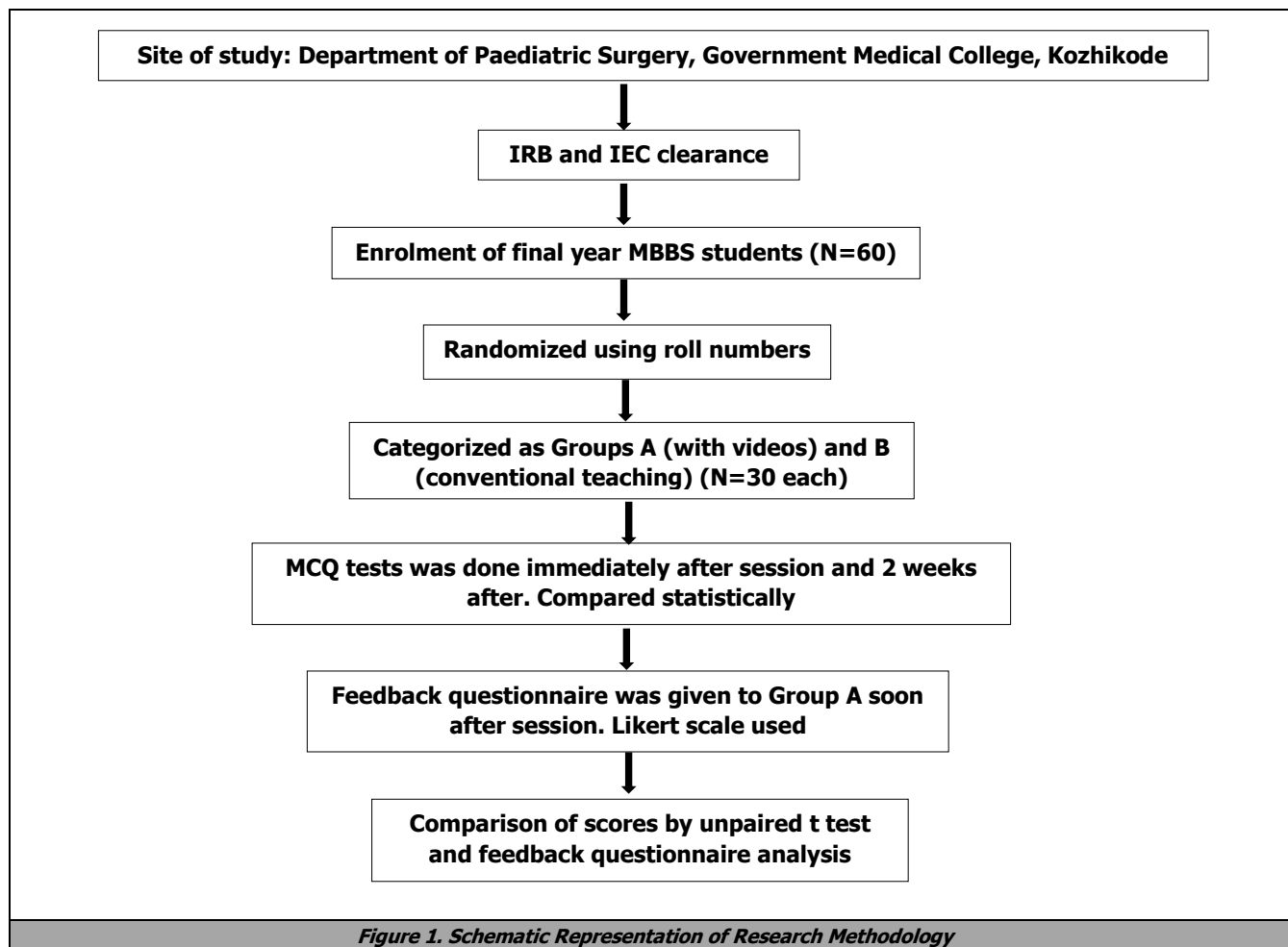
**RESULTS**

Among the 60 consenting medical students who participated in the study, 30 were categorized as Group A and were taught using animation video along with conventional lectures. The Group B (N = 30) was taught with conventional teaching methods alone (vide above). The mean scores (out of a total of 25) and SD, and the timing of evaluation are shown in Table 1. During immediate evaluation (soon after the teaching session) Group A (N = 30) was able to achieve a better mean score of  $21.8 \pm 1.1$  in comparison with Group B who managed a mean score of  $17.8 \pm 1.3$ . When statistically compared with independent t test, it was found

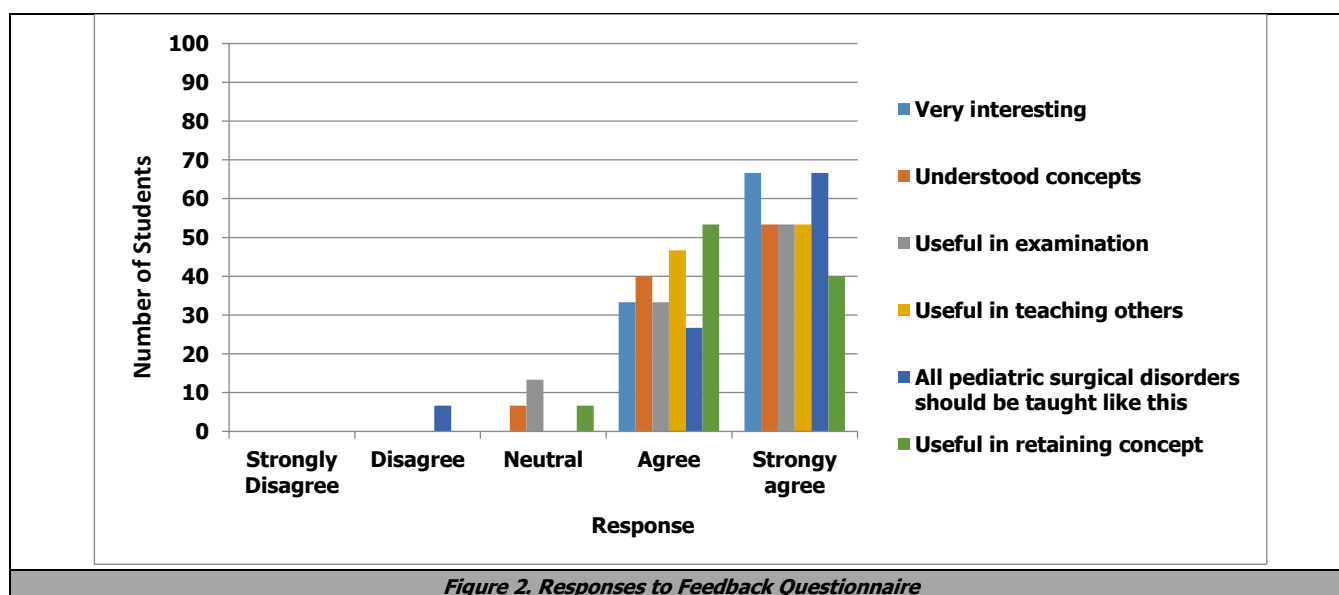
to be significant with a P value < 0.0001. Similarly, when evaluation was done after 2 weeks, Group A students scored a mean of 20.5 ± 1.3 while Group B fared behind with a mean score of 17.9 ± 1.5. Again, it was statistically significant (P = 0.006). Using paired samples t-test, the mean of paired differences between two groups were compared. The mean of paired differences for Group A was 1.28 ± 4.3 (P = 0.11), while it was -0.03 ± 3.8 for Group B (P = 0.962).

Timing of Evaluation	Group	Number of Students	Mean Score (out of Total Score of 25)	SD	P Value
Immediately after session	A	30	21.8	1.1	< 0.0001
	B	30	17.8	1.3	
Two weeks after session	A	30	20.5	1.3	
	B	30	17.9	1.5	

**Table 1. Mean Scores of Students in Both Groups Including the Timing of Evaluation**



**Figure 1. Schematic Representation of Research Methodology**



**Figure 2. Responses to Feedback Questionnaire**

This shows that there was no significant difference in mean of differences in scores immediately after session and after 2 weeks in both groups. On the feedback evaluation questionnaire issued soon after the sessions, all students agreed or strongly agreed that video assisted was very useful teaching methodology. They were also positive about aspects like understanding of core concepts, retaining the information given and their utility in examination. They also found it useful in teaching others. Majority even believed that all paediatric surgical disorders are to be taught using such videos. Table 2 and Figure 2 depict the numerical data on the responses to the feedback questionnaire.

Sl. No.	Outcomes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Very interesting	Nil	Nil	Nil	33.33%	66.67%
2	Understood concepts	Nil	Nil	6.67%	40%	53.33%
3	Useful in examination	Nil	Nil	13.33%	33.33%	53.33%
4	Useful in teaching others	Nil	Nil	Nil	46.67%	53.33%
5	All paediatric surgical disorders should be taught like this	Nil	6.67%	Nil	26.67%	66.67%
6	Useful in retaining concept	Nil	Nil	6.67%	53.33%	40%

**Table 2. Responses to the Feedback Questionnaire**

## DISCUSSION

Approaches to procedural education for medical trainees have undergone major changes in recent years, due to shifts in institutional priorities and technological advancements. Reduced learning opportunities and decreased case numbers have created an educational gap affecting all surgical specialties, including paediatric surgery. Online and video-centred medical education tools have helped bridge this gap by providing enhanced access to training and continuing learning opportunities. Online videos offer exceptional accessibility to learn at each user's unique pace with choice of content and learning style. The ability to continually update videos as new evidence emerge offers online video library users exposure to the most current information.<sup>1,2</sup>

From our experience in medical teaching, we find that an undergraduate medical student often finds paediatric surgical disorders difficult to understand and practice. Therefore, timely initial management and referral of these conditions are often hampered resulting in increased morbidity and mortality, in otherwise correctable or treatable cases. It is desirable that all the under graduates have a clear-cut concept about basic paediatric surgical diagnoses and their management. It is known that there is enhanced academic level among students receiving visual media like animations, during theory classes. It has also been shown that video demonstration is one of the best teaching tools for teaching undergraduates.<sup>1,2</sup> These videos usually augment their idea about the subject and the information is retained in their memory longer. Additionally, most students themselves prefer traditional teaching that are enhanced with interesting animation videos as they provide viewers opportunities to apply knowledge which is more effective in developing durable learning, as opposed to videos that only

passively transfer information to learners. Combining interactive questions into videos and asking learners to pause the video to answer questions or work through problems before continuing is one effective means of converting a video from a purely passive experience into one in which the viewer has some accountability for the content and topics.<sup>1,2,3</sup>

Padmavathi R et al. has demonstrated that videos during presentation is an easily adaptable method of teaching by medical undergraduate teachers.<sup>2</sup> Video assisted learning employs both auditory and visual stimulation and helps students to learn and reproduce the knowledge imparted to them.<sup>2,3</sup> After viewing animation videos, the learner can approach the matter more critically and better overall outcomes could be expected.<sup>3</sup> Such visual media are also very powerful teaching and learning tools that could influence the formation of skills, knowledge and attitude.<sup>4</sup> Further, video based learning is acceptable to learners with various learning and communication styles. In summary, as in many other disciplines, medical education is also well supported when video-based learning is encouraged as it shows a greater advantage over traditional methods.<sup>2,3,4</sup>

There are a myriad paediatric surgical problems that may be encountered by a primary care physician in the community.<sup>5</sup> Due to their poor understanding of these, they may not be recognized in a timely manner at the primary care level. However, if these problems could be identified at the outset, it is possible to institute early management and avoid dangerous consequences. In children, the satisfactory results have a profound effect due to the longevity and early diagnosis and treatment of surgical problems leads to better future of those children.<sup>5</sup> In contemporary practice, students are taught paediatric surgical topics as per a set curriculum formulated by the Medical Council of India, which includes a series of conventional lectures. But, due to complexity of some of these problems, it is not easy to grasp the concepts related, especially with teaching of topics like intussusception, malrotation and cleft lip/palate. Therefore, this sub-optimal learning often leads to delayed diagnosis and referral at the community level where they might eventually practice. Consequentially, this leads to enhanced morbidity and mortality in our paediatric population. It has been our constant endeavour through research work to support better learning methods that leads to better understanding.

When we scanned the available literature, a lot of published research work have demonstrated better efficacy of video-enhanced conventional lecture teaching method in some branches of medicine.<sup>6,7,8,9</sup> Nongmeikapam M et al. have reported benefits in undergraduate teaching psychiatry by blending videos with animation versus traditional didactic lecture alone, especially in the Indian context.<sup>8</sup> This benefit has also been replicated in other disciplines such as anatomy, neuro-anatomy, radiology.<sup>8,9,10</sup>

Similarly, improved performance was nevertheless shown to happen in certain paediatric procedures, if trained using video demonstrations. A case in point is where Srivastava G et al. has shown educational video improves technique in performance of paediatric lumbar punctures.<sup>11</sup> Likewise, a randomized controlled study for using audio-

visual patient information intervention on informed consent and recruitment to cancer clinical trials has been researched.<sup>12</sup> When such methods were utilized among medical students for undergraduate teaching, Battulga B et al. has shown positive effect where students learnt 2 dimensional images augmented with 3 dimensional animation graphics.<sup>13</sup> In other words, teaching with animation videos is more efficient than teaching from textbook or mere PowerPoint slides.

On similar lines, it was found that animated stories of medical errors can be used as a good medium for teaching.<sup>14</sup> Storytelling as well as seeing animation videos is always powerful form of communication that could be used to enhance the quality of medical education. Previously students had to realize their mistakes by actually committing them.

Now by these various methods, they can clear all their doubts pre-emptively before committing those potential mistakes, perhaps avoiding them totally.<sup>14</sup> The main shortcoming with modern undergraduate medical education is the time limitation factor, a lot of subjects to master within a minimum time period.

Some, on account of their lack of good communication skills, may find it difficult in grasping core concepts within the available number of months in a particular discipline. By watching the animation videos, these students are taken into atmosphere of direct imaging, where the language skills do not matter. An important aspect here is that our brain remembers the concepts which are directly seen, more than what we hear or read. Herein, we attempted to use the same logic methods for theory learning for a few difficult topics in paediatric surgery, using targeted animation videos.

Ever since the COVID-19 outbreak rapidly transitioned into a pandemic, we are facing exceptional times. Like in many other areas, this pandemic has disrupted medical teaching and will change many things and make it difficult to go back to the past.

The term "new normal" has been coined.<sup>15</sup> This pandemic made traditional lectures disappear and most lectures are currently delivered online. While there is still no substitute for clinical clerkship, which is the core curriculum of medical schools, virtual clinical learning, virtual care, and other innovations are being proposed as a complement to the clinical clerkship, but the implication is still a relatively limited learning experience.

Medical teaching is changing rapidly with COVID-19 and we are only at the beginning. This pandemic may forever change how future medical undergraduates are educated. Further research is needed to maximize the benefits of online education that includes video-based learning methods and that they should compensate for any shortcomings.<sup>16</sup> Video based learning has never been more meaningful than the present.

Through the current study, we were able to demonstrate clearly that, animation videos had a distinct advantage when used in conjunction with conventional lectures, as reflected in the scores of the undergraduate students. Their feedback was also encouraging and most agreed or strongly agreed that it was very useful, easier to reproduce and teach others, helpful in their examination recollection and most

importantly grasping the concept. They also agreed that all paediatric surgical topics should be taught using this technique. As an additional advantage, it has kindled their interest in pursuing post-graduation course in paediatric surgery, which is beneficial for the community at large with more paediatric surgeons available.

### Limitations of the Study

First, our study was performed at a single institution. As each medical school has different situations and circumstances, our methods and results may not be generalizable to other institutions. Second, as we used exam scores that were not standardized for difficulty level, accurate comparison of academic achievement with the method of teaching was not possible. Our test was based on MCQs that evaluates student's academic achievement focused on cognitive domain. To assess student's achievement related to psychomotor or affective domain, it would have been necessary to use other assessment tools. As the topics were focused on paediatric surgical specialty specific content, it could potentially restrict translation of our results to other medical specialties. Finally, the duration of study was just 2 months, when long term retention of knowledge would have been the ideal final goal.

## CONCLUSIONS

The teaching method with animation videos along with conventional lecture is more effective than teaching with conventional lectures alone, in the scenario of teaching paediatric surgical disorders. Students have shown favourable perception towards this method of teaching with animation videos along with conventional lecture. Animation videos are beneficial and may be more often used along with conventional lectures for routine teaching of paediatric surgical topics. Viewing of these animation videos appears to increase both the student's knowledge base and confidence levels.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

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