Impact of Teaching Urea Cycle with “Animated Video” Verses “OHP Method”: perception of 1st Year BDS Students

Impacto do ensino do Ciclo da Ureia por meio do “vídeo animado” versus o método de retroprojeter: percepção dos estudantes do primeiro ano de Bacharelado em odontologia

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Abstract

During the study of dentistry, Biochemistry is given less priority by most of the dental students, as they think that it has little role in their dental practices later. Instilling due value of learning Biochemistry among the students and making them attend biochemistry lectures during their study is a challenging task among the teachers. This research was conducted to observe whether the interest of the students in learning biochemistry can be enhanced if new technologies such as animated videos are used. While traditional method of teaching with Over Head Projector was also conducted to compare the result. Urea cycle from biochemistry was selected as a topic for this research. The result has been quite encouraging among the students as they found biochemistry as interesting a subject than before.

Keywords: Biochemistry Education; urea cycle; animated video; Over Head Projector; dental students.

Resumo

Durante o curso de odontologia, a bioquímica é considerada de menor prioridade pela maioria dos estudantes, pois supõem que ela terá um papel pequeno nas suas práticas dentárias posteriormente. Instilar o devido valor de aprender bioquímica entre os alunos e fazê-los participar de aulas de bioquímica é uma tarefa desafiadora entre os professores. Esta pesquisa foi conduzida para observar se o interesse dos estudantes em aprender bioquímica pode ser aprimorado se novas tecnologias, como vídeos animados, forem usadas. O método tradicional de ensino com retroprojeter, também foi realizado para fins de comparação dos resultados. O ciclo de ureia foi selecionado como o tópico bioquímico para esta pesquisa. O resultado foi bastante encorajador entre os estudantes, pois eles verificaram que a bioquímica tornou-se uma disciplina mais interessante do que antes.

Keywords: Educação em Bioquímica, ciclo de ureia, vídeo animado, retroprojeter, estudantes de odontologia.

Record activity performed

Title	Impact of Teaching Urea Cycle with “Animated Video” Verses “OHP Method”: Perception of 1st Year BDS Students
Related disciplines	Biochemistry education (teaching and learning), dental studies
Target audience	Biochemistry students and teachers
Educational objectives	Assessment of the impact of the learners towards two different methods of teaching.
Justification of use	To motivate dental students to consider biochemistry a worthwhile subject while studying dentistry.
Materials used	OHP slides, online animated video, questionnaire
Total participants	65
Estimated duration	Two months

1 Introduction

Biochemistry is one of the important subjects and it forms the basis of all life sciences including clinical sciences. It is also related to human health and diseases [1-3] and is crucial for understanding the medical and clinical concepts in the medical and dentistry studies. However, during the graduation courses in dentistry, biochemistry is learned not as seriously as it should have been [2]. Most of the students have a view that biochemistry plays little role in clinical practices [4].

Teachers, therefore, can play an important role in inculcating interest for this subject among the students. However, they have to take use of several modern teaching technologies to promote interest. To instill an interest for learning biochemistry, several authors [5-7] have recommended classical learning method, aided with modern technologies and learning software tools. Several reports have come up in recent times that show that the e-learning resources have been amply used along with conventional lectures that have yielded good response by the students [2]. These promising results of online biochemistry bridge course in dental hygiene programmes have been documented [8] and studied for furthering the interest for learning biochemistry.

In the biochemistry programme, generally studied in the 1st year of bachelor degree of dental surgery (BDS), metabolism of biomolecules poses a great challenge to the students for learning and understanding. Further, the details in metabolic pathways pose yet a great challenge to the students [9]. Hence, difficulties in understanding of the subject and its nuances belittle the interest of the students and at the same time they may end up with a poor idea towards the subject. Hopefully numerous studies [10-14] by various scholars have attempted to make the metabolism topic quite interesting and student-friendly coupled with traditional teaching methods and new teaching methodologies.

Influenced by such studies, this study has been undertaken to assess the 1st Year BDS students' perception on learning urea cycle taught by animated video (A/V) verses classical overhead projector (OHP) method.

2 Methods and materials

2.1 Study design/enrolment

This cross-sectional study was conducted at M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, India and the 1st Year BDS students of academic year 2015-16 participated in this experimental study.

They were informed about the study and consent was taken prior to the enrolment. The 1st year BDS students were considered for this study as biochemistry is taught in the 1st year during the BDS course.

A brief session was held to provide necessary information to the students regarding this study. Their queries were answered to their satisfaction. They were also assured that the study results would only be used for the research purpose and not for their academic evaluation or assessment.

2.2 Teaching methodologies

A topic from the syllabus of the 1st year BDS course, i.e. urea cycle was taught in the classical OHP method followed by the A/V method to all the students on the same day.

As the didactic mode of lecture is the regular mode of teaching, the OHP method was taken up first. This also helped to avoid biasness in perception to the topic covered by both the methods.

2.2.1 Classical lecture method

It was didactic mode of lecture delivery using the OHP method. However, the topic content on the OHP sheets was same as that on the A/V slides, except the way of presentation. This was done to avoid content biasness during topic delivery.

2.2.2 A/V method

The same topic was covered in the A/V method. The A/V was prepared on www.wiley.com. This A/V was displayed to the entire class using an LCD projector. The topic was covered by the same facilitator for both the teaching methods to ensure that a fair delivery method was conducted to avoid any biasness.

2.3 Pilot

As this was the first such study at our institute, a pilot run was done to find the feasibility of this study. A feedback (questionnaire) comprising of the questions to be asked was drafted and given to five staff members of the institute for validation. Comments

suggested by them were incorporated and the feedback form was accordingly modified. This feedback was given to the 2nd year BDS students (N=10) of the same institute who were informed about the study and were asked to complete the feedback. However, they were not informed about the future use of the feedback and were not part of the study as well. Hence, the final feedback was used for the assessment.

2.4 Feedback gathering

The feedback from each participant was taken separately for both the teaching methods to know their learning experience. The feedback included 10 questions. The first nine questions were rated using a five-point Likert scale. The responses were modified according to the need of the questions. The 10th question was open ended. The participants had the freedom to express the characteristics they liked about the methods used. Responses to the 10th question were presented as simple frequencies.

2.5 Feedback analysis

The statistical analysis was performed using the software SPSS statistics on Windows (version 19, IBM corp). The statistical test MANOVA (Multivariate analysis of variance) was employed to compare the participants' perceptions about the two teaching methods. The p value <0.05 was considered to be statistically significant.

2.6 Ethical consideration

Students' participation in this research study was entirely voluntary and an informed consent was obtained from each participant prior to the enrolment. They were briefed about the study and were assured that the information provided by them will be kept confidential and the obtained data/feedback will be exclusively used for research activities. Furthermore, they were given the right to withdraw from this study at any point of time without giving any explanation.

3 Results

A total of 65 students (N=65) participated in the study and completed the questionnaire.

The learning perception was based on the students’ feedback and the teaching outcomes (except 10th question) are shown as mean values ($\pm$ SD) in Table 1. The results of the study show that the topic covered by the A/V method is perceived better ($p < 0.05$) as compared to the OHP method in terms of learning perceptions, except “ease of sharing information”, for which the mean values for both the methods could not reach statistical significance ($p = 0.849$).

TABLE 1: Comparison of mean scores of learning perceptions			
Learning perception s	OHP method	A/V method	Significance (p -value)
First reaction	3.40 $\pm$ 0.84	3.93 $\pm$ 0.82	<0.005
Interest generated	2.83 $\pm$ 0.78	3.66 $\pm$ 0.92	<0.005
Ability to focus	3.00 $\pm$ 1.0	3.70 $\pm$ 0.89	<0.005
Able to understand better	2.69 $\pm$ 0.78	3.23 $\pm$ 0.76	<0.005
Helpful to recall	2.60 $\pm$ 0.98	3.30 $\pm$ 0.84	<0.005
Useful for other topics	2.83 $\pm$ 1.05	3.66 $\pm$ 0.98	<0.005
Helpful in saving time	2.84 $\pm$ 1.10	3.55 $\pm$ 0.93	<0.005
Ease of sharing informaton	3.16 $\pm$ 0.87	3.20 $\pm$ 0.95	0.849
Helpful in future studies	2.63 $\pm$ 0.87	3.30 $\pm$ 0.86	<0.005
Values are mean $\pm$ SD. p-values are obtained by MANOVA. p-value $\leq$ 0.05 is considered to be significant.			

Major responses for an open-ended question (10th question of the feedback) are shown in Figure 1. The major responses (Characteristic score ≥ 2) are taken into consideration. The response characteristics with number ≤ 1 are excluded. If the response score for a particular characteristic is 1 for one method and is ≤ 2 for the other method, it is included for the comparison. It is seen from Figure 1 that the A/V method is favored over the OHP method in terms of numbers (frequencies) obtained for various response characteristics. The response characteristic; “ease of making notes” was favored by majority of the students, for the OHP method (number score; 19 v/s 1 in favor of the OHP method).

Figure 1: Responses to study pattern: OHP method versus A/V methods (Q. 10)

4 Discussion

Inculcating interest for studying biochemistry among the dental students is a challenging task for the facilitators (teachers) and at the same time a difficult task for the learners (students). Teachers are reluctant to use new advanced methods of teaching over the traditional (black board, OHP) methods. They justify their actions by arguing that they have to cover the entire syllabus on schedule for each academic year. On the other hand, students pay little importance to the subject as they think that it has little role in their future clinical practice [4].

Given this fact, teachers' role becomes important in developing interest for this subject among the students. Nevertheless, teachers can explore modern teaching technologies for the students and advance the importance of the subject. Even higher education regulatory authorities are realizing this need and are recommending necessary steps. According to the Medical Council of India (MCI), reforms in undergraduate medical teaching are the need of the hour [15]. Catching up with the new guidelines and recommendations of MCI, due importance is being given to ensuring quality education, developing professionalism [16] in medical field, incorporating better and improved teaching skills in health education professionals [2,17] and other areas in addition to faculty development [17].

Added to the efforts, reorientation of teaching biochemistry has emerged as an issue on national level in India and has been a point of discussion on various platforms [17]. Revised MCI curriculum (1996) has made learning biochemistry an integral part of medical education, especially dentistry. On the other hand, students have evolved in their learning style in terms of usage of e-media. As a result, they tend to adopt self-learning, experimental learning, reflective learning, and so on. However, majority of the senior teaching staff, are not well versed with these advanced technologies as routinely employed by the students [17]. This creates a gap between the learners and the facilitators. Hence a phase-wise teaching and incorporation of teaching skills in health education is recommended [2, 17].

Although the students of this era have access to a vast sea of knowledge via Internet, a teacher's skill has an important role to play for correct and relevant knowledge sharing in medical education, including dentistry. A teacher can play a vital role in improving interest for learning and make a subject interesting [1]. If they teach a subject with modern e-learning methods along with classical teaching methods, a promising improvement could be obtained, as seen in this study. The results of this study show that the A/V method has been proved to be a better method of learning than the classical OHP method for a metabolism topic, i.e. urea cycle. The learning perception was favoured by the students for various reasons such as first reaction to the teaching, interest generated, better concentration and understanding and so on. They believed that the A/V method has proved to be more helpful in learning the subject in shortest time and they could recall the information more after the study was over because they could grasp the topic well. Not only that, the students recommended the application of the same method for other topics also. Hence the A/V method has promises to become the method for their future studies (Table 1).

“[Although the majority of dental students will enter general practice and relatively few will be engaged in specialist practice and research, a sound understanding of biochemistry is essential for all of them]”. J. A. Beeley [18].

Biochemistry as a subject is difficult to learn because of various reasons [9, 19]. They find it “hard” to study and it is generally considered “the king of boring” subjects among others [13]. In the biochemistry syllabus, routinely studied in dental curriculum, metabolism of biomolecules constitutes a major share. This makes the learning more miserable as metabolism contains a significant number of biochemical pathways that are generally conveyed through traditional methods [11, 14, 20]. The students have little option but to learn without much discussion about the role metabolism plays in the overall

functioning of a cell [21]. This makes them struggle to engage themselves for learning [14] and as a result, they find biochemistry a difficult subject [20].

“[The student is frequently overwhelmed by a large amount of factual information which is not presented in an integrated framework]”. F. Vella [19].

Ultimately, the students feel that metabolism needs to be memorized to score marks in their exams/assessments [20]. Various authors [10-14] have tried to address this issue faced by the students. Incorporation of learning strategy [10], alternative approach [11], web-based formative assessments [12], “low tech and high brain” 9-hour exam on metabolism approach [13], and creative multimedia teaching strategy [14] have been found to be helpful. They have showed positive response by the students in learning metabolism. Following the same effort of making biochemistry easy to learn, the results of the present study also show favourable response of the students towards the use of the A/V method in learning urea cycle compared to the traditional OHP method. Some of the students’ quotes in response to the open-ended question (Q. 10) for the A/V method were as follows:

- Visual presentation was more appealing and we could grasp it faster.
- The presentation could deal with the subject in a better way.
- As the reactions were in animated form, we found it interesting and easy to understand.
- We found this way of teaching better and comparatively easy to understand.
- It made us curious to learn about new things.
- This method helped us to concentrate more.
- It made our perception clearer towards the topic, etc.

A well-organized lecture remains one of the most effective ways to integrate and organize information from multiple sources on complex topics [22] and could be delivered using various means as didactic lectures, OHP method, A/V aids like power point presentations (PPT) and animations. Classical/traditional lecture method has several drawbacks such as lack of students’ interest, little chance of active engagement of the students, and little scope of using higher order analytical skills like analysing, synthesis, evaluation etc. However, if classical lectures are supplemented with other teaching-learning techniques, students’ participation in learning process may improve [23]. As seen in this study that the students have favoured the A/V mode over the OHP mode, at least for this particular topic.

Therefore, a combination of traditional lectures with advanced/modern teaching techniques such as small group discussion (SGD) [23], problem-based learning (PBL) [24, 25], and case-based learning (CBL) [26] has been reported to be beneficial to the students in terms of understanding and development of higher order analytical skills. Furthermore, the A/V modes, which include PPT and animations, are gaining importance as teaching methods in the field of education. In the 1960s, a need was felt for use of the A/V aids in higher scientific education including medicine [27]. Since then the A/V aids have been used in imparting education in medical and dental fields. Various studies [22, 28, 29] have documented the application of the A/V modes of teaching. Use of the A/V aids during lecture was favoured by the students [22, 28, 29] and helped them to recall the maximum information [22, 28] possible and stimulated them for further learning [29]. Furthermore, implementation of web-based learning in biochemistry showed a promising result in dental hygiene course [8] and supplementation of traditional methods and/or use of newer teaching methodologies showed promising outcomes in learning metabolism [10-14].

As the information imparted through the A/V modes is basically based on “hearing” and “visual” senses, this makes learning experience more effective [30]. This teaching methodology proves to motivate the students for further learning and more involvement. This could be the reason for favourable response shown in the above studies (as mentioned in the beginning of this section) and a similar favourable response obtained in the present study. It has to be noted that the students have favoured a combination of classical lecture and the A/V method rather than employment of any single methodology [22, 29, 31]. Combining the methods of teaching through lectures and animated presentation has high satisfactory index [31] and e-resource learning has made biochemistry interesting with better motivation and understanding [2].

Although the A/V method was perceived better in the present study for all the learning perceptions; however, when the question was asked about ease of sharing information in the form of classroom notes, the main difference in response could not reach to a statistical significance ($p=0.849$). Furthermore, in the open-ended question, a relatively high response 19 vs. 1 was given in favour of the OHP method. This could be attributed to the fact that some students may not favour computer-assisted learning (CAL) as a potential vehicle of teaching and learning over classical lectures [15]. Some of the students' quotes for the OHP methods for this particular response characteristic (ease of making notes) were as follows:

- This method (OHP) is helpful in making classroom notes easier.
- This method is classical and needs no time to adjust.
- Reduces workload in the form of class running notes.
- Studying from these notes is comparatively easier, as they are ready at hand any time we require.
- It is similar to reading books, so we do not feel any difference between classroom teaching and self-study.
- The notes on the sheets are easy to understand and are exam oriented.
- The summarized notes are very helpful because we get ready-made notes.
- Written notes on the sheets are good, no need to open the textbook!

One of the most routinely employed classical methods in dental education of 1st year subjects at our institute is the use of the OHP projector to project the printed or hand-written OHP sheets to deliver the topics. Moreover, the OHP method has the following advantages:

- Easy in imparting lectures for a facilitator.
- A lot of information can be put on one page.
- Little investment on technology for the institute.
- Long stability of the OHP sheets.
- Ease of photocopying and obtaining notes for learner.

It also has certain drawbacks such as:

- Teaching with the OHP projector is monotonous.
- Photos or pictures cannot be shown in colour.
- Animation is not possible.
- Lack of good handwriting/presentation may decrease interest and concentration of the students.
- Large volume of information on a single sheet may overburden the load of learning for the students.

According to the current system of education in India at 10+2 level, the students are habituated to learning in an individualized case-based environment. Further, private tuitions and coaching classes supplement them with ready-to-use printed notes [15]. This makes the learners dependent on classroom teaching and notes given during the lecture

delivery. They also depend on printed books to gather knowledge about the topic. The easiest way for them is to get the study material from the facilitator and photocopy it. Because the content has been developed by the facilitators and is presented during the lectures, students find it more familiar during their self-studies afterwards. This may explain the response obtained in this study for the perception on “ease of sharing notes”, as most of the students admitted in our institute had the similar background of education at 10+2 level as mentioned above. It is also evident from the above quotes that the students give more stress on easy and readymade notes obtained through the OHP method.

The didactic/classical/traditional lectures are important in covering the topic and sensitizing the students with the content of the topic. However, if the traditional ways of teaching/education are supplemented with other teaching-learning methods such as A/V aids, e-learning resources etc., and the purpose of learning will be achieved better and will be in line with the goal of medical/dental education. The results of the present study may help the students in decreasing the need of learning through classroom notes and enhance their interest in the subject. They can learn the subject well, improve their confidence, and perform better in the exams. Further, the “dry and volatile” biochemistry subject may become “interesting and permeable” for both the learners and the facilitators.

5 Conclusion

As a result of this experimental study, we conclude that the A/V method is the preferred method for learning urea cycle than the OHP method. This method has generated interest among the students for this topic. However, the same students preferred the OHP method for ease of making notes as well. The result of this study will surely help in motivating the facilitators to incorporate new technological aids in teaching biochemistry and achieving more participation of the students.

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