Integration of Graphic medicine in teaching
Pharmacology to Optometry students

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Categories: Educational Strategies, Medical Education (General), Teaching and Learning

Abstract

Objective: The study was undertaken to establish student perception and interest in a graphic medicine approach to the teaching and learning of pharmacology in optometry.

Methods: The Graphic-oriented approach to the teaching of pharmacology was introduced periodically to undergraduate students of optometry in semesters five and six. The methodology was accompanied by ‘concept animation’ to translate difficult concepts into comprehensible ideas using handmade diagrams and comic strips. Furthermore, the process was accompanied by learning difficult terminology and definitions of the subject using ‘keywords and phrases’. A questionnaire-based survey was conducted towards the end of the semester to determine student aptitude for and interest in this approach to teaching and learning.

Results: A total of seventy-five students studying pharmacology across two semesters participated in the survey. Survey findings established the effectiveness of the diagrammatic approach to learning the names of drugs among 68% of the students. An overwhelming response of 85% students expressed their propensity for ‘concept animation’ to comprehend the difficult concepts in an easy way.

Conclusion: Graphic medicine has been acknowledged as an important pedagogical instrument for the effective teaching and learning of subjects like pharmacology to allied health sciences students of optometry.

Keywords: Graphic Medicine, Concept Animation

Summary

Basic science courses are non-comfort zones for many allied health science students. An environment nurtured early in the curriculum can facilitate student learning of the fundamental principles of human biosciences. However,
failure to promote this will make basic science subjects disinteresting for most of the students in the later part of their study (McVicar, Andrew & Kemble, 2017). A similar situation was observed among Optometry students studying at the College of Health Sciences, University of Buraimi, Oman. The students are taught General and Ocular Pharmacology in semester I and II of academic year 3. Although some students managed to obtain good scores, in general, the learning experience of the students influenced the perception of the novice registering for the course. This situation persuaded the teacher to initiate the concepts of Graphic medicine and animation for the Pharmacology course to make students more accustomed to and comfortable with the subject requirements. Graphics and comics can be instrumental in delivering the course content in a coherent manner and improves the attitudes of non-science majors toward biology (Hosler & Boomer, 2011).

**Introduction**

Learning can be an effective, long-lasting experience if it is driven by fun-loving approaches and worth-memorizing experiences. Strategies have been developed to refine the metacognitive skills of the students to optimise their independent learning. Teachers may contribute to improving a student's metacognitive expertise in addition of attributing towards the cognitive and affective domain (Ten Cate, Snell, Mann & Vermunt, 2004). Still, a popular visual approach of learning is Graphic medicine which is expressed with the idiom ‘a picture is worth a thousand words’. It is a valuable tool in medicine that uses graphic stories of patient care and education (Green & Myers, 2010). Though it is not widely incorporated in medical education, it has an engaging style to support learning in different contexts.

**Methods**

The critical concepts of pharmacology were taught to students registered in semesters I and II in year 3, using handmade diagrams and comic strips. The graphic elements were periodically introduced during the lectures to communicate challenging concepts as simpler ideas. Furthermore, special emphasis was given to articulating difficult definitions in simple ‘keywords and phrases’; in addition, efforts were made to spell out the names of the commonly used drugs into ‘prefix’, ‘roots’ and ‘suffix’ and graphically relate them to the comic or story. In general, carefully designed text diagrams improve learners' efficiency in a range of text-determined cognitive outcomes (Carney & Levin, 2002).

For instance, the drug ‘Cyclopentolate’ is a commonly used ‘cycloplegic’ in diagnostic optometry. The name of the drug is divided into three component (Cyclo- indicating a bicycle), (Pento- the student riding the bicycle) and (late- means delayed). The story said that Pento will reach school late as his bicycle tyre has been punctured. The narration was shown by a handmade diagram (Figure 1). Moreover, the end of the story facilitated the learning of an important aspect of the drug's pharmacokinetics i.e. the late onset of drug action which is linked with the late arrival of Pento at school as shown in Figure 1.
The same philosophy was used for several drugs to make the students familiar with their names, actions, clinical uses, contraindications, side effects etc. The graphic medicine component supported by concept animation philosophy was presented in the theoretical as well as tutorial classes of general and ocular pharmacology courses across two regular semesters.

Towards the end of the semester, a questionnaire survey was conducted to analyze the qualitative aspects of this approach to effective teaching and learning. The content validity of the questionnaire was established. The students responded to each survey item of the questionnaire on a five-point Likert scale with 1 indicating strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree, and 5 strongly agree.

**Methods**

A total of seventy-five students enrolled in General & Ocular Pharmacology courses for two consecutive semesters participated in the survey. The scales of ‘strongly disagree/disagree’ and ‘strongly agree/agree’ were consolidated for
the convenience of graphical representation. On a five-point Likert scale, 58% of the students acknowledged their difficulty in memorizing the names of drugs; moreover, 42% students also acknowledged the ease of remembering the generic name of the drug, which is an integral requirement of the course.

The subject-related concerns of the students were addressed by graphics and concept animation approaches. The students responded positively to this, they found the diagrammatic approach of learning the names of drugs effective. Moreover, an overwhelming response of 85% (Figure 2) showed student appreciation for ‘concept animation’ to help them understand the difficult concepts in an easy way. Likewise, 76% of the students expressed their preference for ‘keywords and phrases’ over lengthy definitions.

![Figure 2. Graphical representation of the results from the student survey on Graphic medicine and concept animation](image)

**Discussion**

The effective utilization of the underrated medium of Graphic medicine and pathographies can foster learning and teaching about diseases in an innovatively creative way. However, this medium has not been significantly employed in medical education. A teacher can facilitate it to foster a range of cognitive skills among his/her pupils; moreover, it can trigger the metacognitive abilities of the students for self-regulated learning. Pictures complement the text by serving as ‘adjunct aids’ to perceive, understand and remember the information in the text (Carney & Levin, 2002). The current study explored the interest and perception of students learning pharmacology using graphic medicine. In addition, the ideology of graphic medicine was threaded with the process of ‘Concept animation’- a graphic way of
simplifying the complex core concepts of a subject like ‘pharmacology’ using pictures and comics. The notion of ‘concept animation’ reinforced graphic medicine. In addition, this study also demonstrated the ease of learning pharmacology by the use of ‘keywords and phrases’.

Primarily, the hardships that most of the students experienced in learning and memorizing the names of the drugs fuelled the need graphic medicine in pharmacology. This was a key factor in introducing this medium to address the needs of students who found it challenging to memorize the names of the drugs. As the number of drugs taught to them was limited, this encouraged the instructor to use the graphic approach for teaching the most important drugs. The students endorsed this idea and many of them came forward to work with the teacher in developing this innovative approach. Merging visual knowledge with verbal description has positively influenced student reading performance, knowledge retention capacity and creative problem-solving skills (Carney & Levin, 2002; Mayer & Sims, 1994; Gambrell & Jawitz, 1993).

The images used for this purpose were consistent with conventional (representational) and unconventional (transformational) functions of pictures as described by Levin (1981). Representational pictures are the most common type of depiction; they reflect the text in part or whole, whereas transformational pictures have emerged as potent facilitators of student knowledge reconstruction (low cognitive level) and application performance (high cognitive level) (Levin, 1981). Students perform well when the narration is accompanied by animation. Subsequently, the graphic medicine approach was employed to simplify the difficult concepts for consolidation of learning experience via concept animation. Concept animation was well received by the students. The use of comics not only engross students in the knowledge being discussed, it also evolves the analytical and critical thinking skills of the students (Versaci, 2001). Furthermore, the learning process was strengthened by transforming difficult terminologies and definitions into easy to recall key words and phrases.

This study provided a perspective of utilizing graphic medicine to reinforce effective learning. The observational and interpretive capabilities of students are augmented by reading graphic stories and animation (Green & Myers, 2010). Moreover, graphic medicine helped the student to minimize the chance of spelling mistakes while writing the name of the drug. The blending of all the above-mentioned components in the questionnaire was supportive of the idea of honing students cognitive and metacognitive skills toward a positive learning environment, to nurture their interest for the subject and to facilitate an effective independent way of learning.

However, this study has its limitations as the perceptions were not transformed into a quantitative conclusion to measure the impact of this approach on student evaluation. Future studies should be directed to establish ‘How graphic medicine can improve student performance in formative and summative assessment?’ Nevertheless, the effectiveness of graphic medicine could also be explored in other basic sciences subjects with different sets of students in a more structured way.

**Conclusion**

The sound synchronization of graphics and concept animation facilitated student interest, concentration and learning potential of a bioscience-related subject, pharmacology, in a positive manner. The medium provided a complementary support to the problem faced by most of the students learning pharmacology. The medium has been perceived as an effective pedagogical tool to motivate students towards a life-long, fun loving, independent way of learning.
Glossary

Graphic Medicine: The use of comics or photographs or graphic stories with the purpose of health care and education is known as Graphic medicine. It has a role in patient care and medical education (Green & Myers, 2010).

Concept animation: A graphical approach of simplifying complex core concepts with the help of pictures and comics

Representational picture: The literal depiction or overlap of text information in part or whole (Levin, 1981).

Transformational picture: Pictorial representations that facilitate student learning from text by 'keywords illustration';

Moreover, it prompts higher-order cognitive application tasks (Carney & Levin, 2002; Levin, 1981).

Take Home Messages

The sound combination of graphic medicine and concept animation can function as an effective metacognitive strategy to enhance the learning experience of students.

Notes On Contributors

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Acknowledgements

I would like to acknowledge all my optometry students for being a constant source of inspiration to make graphic medicine a worthwhile experience for learning pharmacology.

I would like to convey special regards to one of my students Ms. Ghaliya Rashid Said Al Buriki for her endeavors.

Special mention to Professor Graeme Henderson from the University of Bristol, UK for his constructive comments and proofreading.

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Appendices

Declaration of Interest

The author has declared that there are no conflicts of interest.