

## ORIGINAL RESEARCH

## Crossword Puzzles: Review and Implication in Urogynecology Education

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### Abstract

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Modern pedagogic methodologies have been strengthened due to the availability of innovative technologies spawned by the revolution in information technology in the last three decades. Instead of insipid and drab methods of teaching, technical subjects can be taught in a more participative manner in the classroom using such tools. This article reviews previous research on incorporation of crossword puzzles as teaching enhancements in a variety of teaching environments and examines its efficacy in urogynecology education. Based on the successful outcomes, a similar pattern of crossword puzzles has been designed and is intended for a study to evaluate its impact on a student population undergoing training in urogynecological physiotherapy.

Strategically planned and administered crossword puzzles during the discourse of a prescribed curriculum have been discovered to be an effective method for better comprehension by students. Since crossword

puzzles have been used successfully in many different disciplines, it is expected that they will be helpful as a teaching aid in urogynecology education too.

Though these crossword puzzles have a scope for being a teaching/learning aid, they cannot inculcate higher-order thinking skills in students. However, they work as excellent tools in revising already studied contents. Thus, these puzzles should not be perceived as a replacement to traditional teaching methods, rather they should be used only as supplementary teaching methods, for uses, such as association of concepts and retention of facts. Execution of the study proposed in this paper, as well as future studies will be able to derive an authoritative implementation guide.

**Keywords:** Cervical disorders, Crossword puzzles, Urogynecology, Menstrual disorders, Millennials, Pedagogy.

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### Background

Crossword puzzles are an entertaining means of stimulating the mind and besides their entertainment potential have successfully been utilized to reinforce the intricacies of an art or science during, in-between, or after a didactic discourse to break the monotony of the learning process. Past studies and experimentations have yielded enough data to substantiate the usability of this technique as a modern pedagogic tool. Retention of the intricacies of the subject being mastered is better when such methodologies are used instead of the traditional, lecture based discourses.<sup>1</sup>

### Introduction

Numerous pedagogical techniques have been tried and tested during the evolution of teaching methods until the standards practiced in present school and university education acquired a certain degree of commonality. The universally practiced technique of teaching involves classroom delivery of lectures, library consultation; personal reading by students, discussion and reinforcement of garnered knowledge through quizzes, tests and research.<sup>2</sup> Retention of knowledge gained is subject to individual intellectual and cognitive ability of the student, the way the material is presented by the instructor, and the

degree of complexity of the subject being studied. Some subjects like arts and languages need thorough reading, grasp and rumination after reading while technical subjects like mathematics, physics and medicine need consistent practice and rigorous consistency and attention on part of the student endeavoring to master a particular nuance of the topic being covered in the curriculum.

Modern technology has spun myriad tools for the instructor, as well as the student in which the subject matter can be presented and retained better, in the form of audio visual and multimedia presentations, electronic books and notes, and ingenious modalities of lecture delivery in which all faculties of the student are attracted towards the crux of the matter being discussed by the teacher with umpteen methodologies. Studying medicine and physiotherapy not only requires thorough reading of the illustrated texts and voluminous books, but also practical incursions into the field being studied. Studying voluminous textbooks being an onerous task, the subject matter can be mastered better through less common innovative methods, such as quizzes, jigsaw and crossword puzzles, which can acquire status of an entertaining way of learning among students working towards a common goal of mastering a difficult art. Of these, crossword puzzle is a

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mode, which has been previously tried and tested as a means of learning and has great potential as a novel pedagogic tool. In this article, we explore previous research in the efficacy of incorporation of crossword puzzles as teaching enhancements in a variety of teaching environments with emphasis as teaching aid in urogynecology education. The study does not need an Approval of the Ethical/Institutional Review Board.

## Objective

This article reviews previous research in the efficacy of incorporation of crossword puzzles as teaching enhancements in a variety of teaching environments.

## Crossword Puzzles as Pedagogic Aids-past Studies

Crossword puzzles emerged as word guessing games in which the words needed to be put in boxes in vertical and horizontal positions with some common letters being used in both directions for two words. The idea originated in Egypt and was published in Brazil in the year 1925 for the first time.<sup>3</sup> Initially used for entertainment purposes, the idea was soon recognized as a pedagogic tool as technical words learnt during a course could be incorporated into crossword puzzles to evaluate comprehension among students. This took away the boredom of a didactic 'lectures-only' classroom teaching as the students could participate in the learning process in a more collaborative manner. The advent of information technology further strengthened the idea of incorporating crosswords as a mode of learning as such puzzles could be created by a teacher with just a few clicks of the mouse. This has been well-illustrated in the teaching of organic chemistry wherein the students could better comprehend the complexities of molecular structures of organic and inorganic compounds by constructing them in three dimensional models on their computers with the aid of software such as 'Hot Potatoes' developed by University of Victoria, Canada.<sup>3</sup> With this and other related software, students and teachers can create their own puzzles and quizzes, which automatically inform the person subjected to the quiz whether the right direction during learning is followed or not. Chemistry students can fill in information in the form of elements in the molecular structure to generate a three-dimensional visualization of the molecule, and comprehend the actual spatial structural details as a result. In the absence of such aids, a didactic theoretical explanation by the teacher, or the plain monotony of a written textual reference book might be more difficult to comprehend by the average student.

The idea of crossword as a teaching tool has been very well-utilized by Kersula<sup>4</sup> to enhance the education of concerned subjects in nuances related to childbirth and its complications. In Lamaze childbirth education classes, prospective parents learn about the complications of labor, childbirth and lactation in a cooperative activity in which they solve puzzles to

test their knowledge of the evidence based practices concerned with the phenomenon. Kersula's<sup>4</sup> exercise prepares participants in a better way than mere looking at textual content or listening to a theoretical lecture on the subject as they become socially involved in the learning process, which now assumes a more participative nature. Garnered knowledge is therefore retained in a better manner as the entertaining and participative nature of the content leaves a deeper impression on the observer's psyche. Thus, when students are involved in an active, rather than passive learning process, it is but natural to expect that they learn better.<sup>5,6</sup>

Incorporating crossword puzzles as tools of learning were very well-incorporated into the curriculum at South University School of Medicine where students opined that the technique allowed them to learn the intricacies of anti-ulcer drugs in a better manner.<sup>1</sup> Pharmacology and medicinal chemistry were the aspects covered in crossword puzzles, which elicited an appreciative response of 90% of the students subjected to the new methodology of teaching. All curriculums at the school were delivered in the form of sequential modules pertaining to a particular disease in which the students progressed from preliminary to sequential knowledge on the topic through didactic instruction. The gastrointestinal sequential integrated course was chosen for the experiment in which three lectures were shortlisted to be accompanied by an equal number of crossword puzzles built using a free online resource.<sup>1,7,8</sup> Two groups of students from different batches were chosen and subjected to the same methods of teaching utilizing the crossword puzzles for the pertinent lectures and opinions gathered later indicated that both groups preferred the crossword method as it enabled them to learn and retain the content better due to the participative, entertaining and less stressful nature of the exercise. Opinions were gathered in the form of surveys in which the students were required to respond according to a Likert scale based questionnaire. The involved student enjoyed the learning process through crosswords claiming that it allowed them to focus on pertinent aspects, which enabled them to score better in the exams related to the topic. Another interesting aspect emanating from this study was that as the student batches surveyed belonged to the years 2008–2009, they were representative of a population of students identified as 'Millenials', i.e., those born between 1980–1991.<sup>1</sup> This, and probably the later generation of students have been exposed to various forms of multimedia and the internet and are likely to opt for learning activities, which are participatory in nature as they prefer to assemble information from multiple resources.<sup>1</sup>

Yet another pilot study was conducted to evaluate the efficacy of incorporation of the crossword technique to master the intricacies of interpretation of electrocardiograms (EKG) by medical internists at Michigan State University, who were discovered to be deficient in the art of diagnosing when normal

pedagogical techniques of instruction were employed.<sup>9</sup> The foci of interest were the ability to diagnose various cardiac conditions such as sinus rhythm, atrial tachycardia, atrial flutter, hyperkalemia, etc., which were discovered to be suboptimal with the regular method of instruction at the medical school. The crossword puzzle was constructed keeping in mind 18 basic diagnostic pieces related to EKG and four groups of less than 10 students in each group were subjected to different combination of regimens of instruction in which crosswords were incorporated at different stages during instruction. Although statistically significant differences between the groups were not discernible in the study due to the small sample size, a definite trend for improvement was noticed in students who incorporated the crossword puzzle methodology during instruction indicating a need for further research in this area in a larger sample size of students.

### **Application in Urogynecology Physiotherapy Instruction**

Taking clues from the literature,<sup>1,5,7,9</sup> on the applicability of crossword puzzles in disciplines other than those studied previously, crossword puzzles can be developed for their application in urogynecology physiotherapy education too. A study to assess the effectiveness of such puzzles should overcome the limitations of previous studies. For example, these studies should account for confounders and mediators and the Hawthorne effect. If possible, these studies should incorporate a randomized design with a control group.

Based on these definitive hints of success of incorporation of crossword methodologies in instruction, appropriately structured crosswords were prepared for use in instructional programs meant for students of urogynecology physiotherapy (Review Anatomy; Review Gynecological Diseases; Review Urinary Incontinence; Urogynecology). The students need to participate in solving the prepared crosswords during regular instruction and at the end of the course, will be subjected to a questionnaire aimed at evaluating the success of the novel mode of instruction (Survey). The crosswords address pertinent areas of urogynecology and related physiotherapeutic techniques and the students need to choose the correct technical term or phrase in order to complete the crossword in a pre-specified time frame. Conditions related to incontinence, urethral disorders in males/females, menopause, terms, such as continence/incontinence and associated medications, are covered in one crossword (Figure 1). The integral theory of continence and anatomical terminologies are covered in another, female urogenital disorders like cervical cancer, risks due to Human Papilloma Virus (HPV), menstrual disorders are covered in another crossword puzzle and male disorders and anatomical terminologies in yet another. The prepared crosswords are intended to be used for the full duration of the curriculum to be administered after which the participating students will be subject to a prepared questionnaire based on

Likert scale pattern to evaluate the compliance and the effectiveness of this unique and entertaining mode of instruction, which is liable to rouse more interest in the current generation of students. The questionnaire will then be evaluated utilizing appropriate statistical tools to analyze the effectiveness of crossword puzzles as an aid to learning.

### **Discussion and Conclusion**

As demonstrated in past research,<sup>2,5,6,7,8</sup> any subject can be presented to a student audience either in the traditional didactic and insipid manner or the teaching process can be made more participative by incorporating alternative means of instruction, which are available aplenty with the advent of modern tools of information technology, which include hardware like computers, smartphones and tablets and specially structured software as the one discussed above for chemistry students. Software can be altered or tailor-made keeping in mind the content and the nature of the subject being taught. Universities and institutions have already made many tools available for use freely among the student and teaching community as exemplified by the 'Hot Potatoes' software. Such tools can be utilized to enhance retention, as well as make the process of education more interesting for students in any field of medicine and physiotherapy.

Furthermore, since crossword puzzles have been used successfully in many different disciplines, it is expected that they will be helpful as a teaching aid in urogynecology education too, as also affirmed by Jaramillo et al.<sup>10</sup>

Crosswords as teaching aids have been found to be helpful in acquiring new vocabulary or technical terminology, imparting the ability to distinguish between similar terms, correctly spelling these terms, making inferences, drawing conclusions, evaluating options, and developing logical thinking.<sup>10</sup>

Unlike many novel methodologies of teaching, crossword puzzles are known to many students; as a result, they need not be explained in detail to the class, thus saving teaching time. Also, the need to spell each term of the puzzle accurately can be correlated with increased care in studying. A review points out that crossword puzzles can aid identification of areas where students' understanding is weak or strong, while at the same time, increasing their interest in the topic taught.<sup>11</sup>

Though the extant literature has studies with limitations, these studies point out interesting aspects worth considering in future research. One such limitation is the problem of confounders. It is possible that demographic factors such as age (or the grade/year of study) and gender, or factors, such as learning style, baseline level of intelligence or subject matter skill could confound the measurement of change in academic scores brought about by the incorporation of crossword puzzles in the teaching methodology. Such confounders and

mediators should be postulated and studied in future studies.

Though not a confounder, an interesting aspect that might be hypothesized to work in the implementation of such novel tools is the propensity of students administered the crossword puzzles to involve themselves in more intensive studying than they would otherwise. In other words, students working with a tool such as crossword puzzles might expect, or desire, a positive result out of their novel learning experience, and in turn study harder to bring about that result. Though such a phenomenon, if in place, would result in positive outcomes, it should not be directly attributed to the use of crossword puzzles. Thus, the mechanisms by which academic grades improve upon using crossword puzzles should be studied. This is similar to the Hawthorne effect, which is the effect on results of the study, of the students' knowledge that they are being tested, and the halo effect, i.e., the tendency to respond positively (or negatively) to a situation.

Another factor to consider is that such tools may not work consistently for everyone. While some may benefit from the use of crossword puzzles, some might not. Gaikwad and Tankhiwale<sup>12</sup> discuss that certain students in their study perceived the crossword puzzles to be too easy. This should serve as a pointer towards customizing these puzzles to better suit individual learning needs. As crosswords can be customized according to individual learning styles, they can also be published online such that students can access them anywhere according to their convenience; one such example is discussed by Seçken.<sup>13</sup>

One method crosswords can be made more effective is, as suggested in the study by Davis et al.,<sup>11</sup> by allowing students to develop such crosswords for their classmates, thus forcing them to carefully research their study material. One such example can be found in the study by Martinez and Parra<sup>14</sup> where they point out that constructing such a tool stimulates a deeper learning approach than simply solving the tool.

An important aspect to be noted, as can be found in the design of crossword puzzles in the study by Gaikwad and Tankhiwale<sup>12</sup> is that such puzzles should preferably involve terms, which belong to the must-know section of the syllabus, and which have already been taught using didactic methods.

Determining whether crosswords are indeed helpful as aids in learning would require that a control group be included in studies. This group should receive teaching using the routine methods. A study involving such a control group found significant difference between the experimental and control groups in kindergarten children.<sup>15</sup>

If feasible, it would be rewarding to incorporate a randomized controlled design in the study on crossword puzzles as teaching aids. It would also be fascinating to study how the complexity of crosswords affects outcomes.

While it has been found from various studies, as well as it is hypothesized in the present implementation in urogynecology education, that crossword puzzles are an effective aid if incorporated in supplementation of routine teaching methods, it would also be worthwhile to study if crossword puzzles are better supplements than other non-conventional methods. Similar non-conventional techniques include, but are not limited to word search puzzles, bingo, Jeopardy, and word scrambles.

Though these crossword puzzles have a scope for being a teaching/learning aid, the scope of their potential should be kept in mind. Crosswords cannot, for example, inculcate higher-order thinking skills in students. They can, however, work as excellent tools in revising what has already been studied. Thus, these puzzles should not be perceived as a replacement to traditional teaching methods, but rather be used only as supplementary teaching methods, for uses, such as association of concepts and retention of facts.

Interestingly, in the study by Davis et al.,<sup>11</sup> a decrease in exam scores was found when crossword puzzles were used. The authors suggest that this might be due to two reasons: one, because of the entertaining nature of crossword puzzles, students might not have taken them seriously. The second reason speculated is that the students must have completed the puzzles at the cost of the time allotted for regular studies.

Though substantial evidence is available at hand for the effective implementation of crossword puzzles as teaching aids, the execution of the study proposed in this paper, as well as future studies will be able to derive an authoritative implementation guide.

## End Note

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### List of Abbreviation

HPV: Human Papilloma Virus

**Conflicts of Interest:** None declared



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