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Creation and Implementation of a Flipped Jigsaw Activity to Stimulate Interest in Biochemistry Among Medical Students

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ABSTRACT

Learner-centered pedagogical methods that are based on clinical application of basic science concepts through active learning and problem solving are shown to be effective for improving knowledge retention. As the clinical relevance of biochemistry is not always apparent to health-profession students, effective teaching of medical biochemistry should highlight the implications of biochemical concepts in pathology, minimize memorization, and make the concepts memorable for long-term retention.

Here, we report the creation and successful implementation of a flipped jigsaw activity that was developed to stimulate interest in learning biochemistry among medical students. The activity combined the elements of a flipped classroom for learning concepts followed by a jigsaw activity to retrieve these concepts by solving clinical cases, answering case-based questions, and creating concept maps. The students' reception of the activity was very positive. They commented that the activity provided them an opportunity to review and synthesize information, helped to gauge their learning by applying this information and work with peers. Students' improved performance especially for answering the comprehension-based questions correctly in the post-quiz as well as the depth of information included in the post-quiz concept maps suggested that the activity helped them to understand how different clinical scenarios develop owing to deviations in basic biochemical pathways.

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INTRODUCTION

Our pre-clinical curriculum includes lectures, laboratories, and active learning (problem-based-learning) exercises with approximately equal time allocated to each modality. In addition, students have self-directed learning time. Most of the biochemistry is taught in the fall semester of the first year as part of the Fundamentals course. Here we report the design, structure and student reception of an interactive session created to teach certain aspects of biochemistry in this course. Our goal for creating this session was to encourage active learning, interaction with peers and foster a positive attitude towards biochemistry by emphasizing its clinical significance. We envisioned that the session will allow the students to conceptualize and critically assess biochemical concepts and apply these within the context of pathology, which is lacking in the traditional didactic approaches as mentioned above. The session included two components, learning of concepts and retrieving and application of the information learned through solving of clinical cases, and answering case-based questions and creating concept maps. The session combined elements of two pedagogical modalities that are used in traditional undergraduate and graduate education, flipped classroom and jigsaw. We chose lysosomal storage diseases (LSDs) as a topic for this activity.

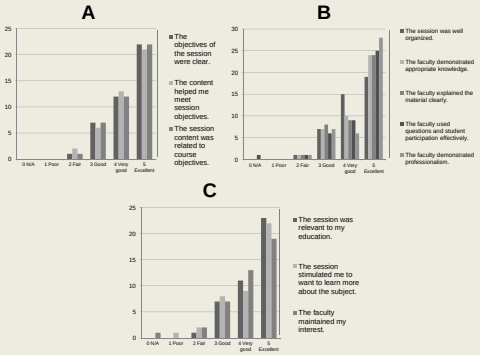
METHODS AND MATERIALS

Before the session: Each disease was assigned a color. Color and group assignments and review questions and cases were posted in the course website a week before the session. The students were asked to read the cases and prepare answers to the review questions assigned to their color.

Mono-color session: Students took the pre quiz as a group. Colored materials with the case questions were distributed. Groups prepared concise answers to the review questions and the case questions assigned to their color.

Rainbow session: Students then formed rainbow groups. Each student presented his/her materials to their group. During the session they were asked to make sure that their group achieves mastery over the four diseases. This is important as peer-teaching is pivotal aspect of this session. The students took the post quiz as a group. Faculty facilitators were going around asking questions and providing help as needed during both sessions.

RESULTS



Quantitative representation of the students' evaluation data of the flipped jigsaw with respect to (A) learning objectives, (B) organization and facilitation, and (C) relevancy and motivation.

Statistical analysis of students' performance in pre- and post-quizzes

Quiz	Score	Frequency	Row percent
Post	Incorrect	19	10.7955
	Correct	157	89.2045
	Total	176	100
Pre	Incorrect	74	42.0455
	Correct	102	57.9545
	Total	176	100
Total	Incorrect	93	
	Correct	259	
	Total	352	

Post: Pre: P value: <.0001

Post quiz

Type of question	Score	Frequency	Row percent
Comprehension	Incorrect	19	21.5909
	Correct	69	78.4091
	Total	88	100
Fact-based	Incorrect	0	-
	Correct	88	100
	Total	88	100
Total	Incorrect	19	
	Correct	157	
	Total	176	

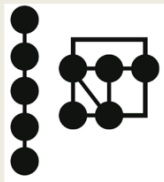
Post Comp: Post Fact: P value: <.0001

Pre quiz

Type of question	Score	Frequency	Row percent
Comprehension	Incorrect	54	61.3636
	Correct	34	38.6364
	Total	88	100
Fact-based	Incorrect	20	22.7273
	Correct	68	77.2727
	Total	88	100
Total	Incorrect	74	
	Correct	102	
	Total	176	

Pre Comp: Pre Fact: P value: <.0001

(N=88)



Majority of groups drew the concepts maps in the form of chain (left hand side) in the pre-quiz, while majority of groups drew them in the form of complex net (right hand side) in the post-quiz.

DISCUSSION

Consistent with the current focus on peer-teaching or peer-assisted learning in medical education, the flipped jigsaw activity is strongly dependent on team-work as well as individual contributions to achieve optimal outcomes. As peer-teaching involves cognitive development as well as social collegiality, it plays an important role in enhancing knowledge acquisition and comprehension.

As this activity allows for both individual learning as well as team-work, it may contribute to lessening of stress among students as it accommodates different learning styles. Quizzes are taken as a group, which may further contribute to the creation of a reduced stress environment, where students can focus on thinking critically about the concepts rather than worrying about performance in the quizzes. The activity also ensures active participation from each student.

Main aspects liked by the students were (i) the session helped them to learn and understand the material, (ii) they appreciated collaborative learning and (ii) they found the session to be engaging.

As evidenced from the students' reception of the activity and their performance in the quizzes, the activity demonstrated clinical relevance of biochemistry by promoting critical thinking and enhancement of comprehension about the concepts learned in the context of clinical disorders, allowed review, and deeper understanding of the biochemical concepts, and encouraged peer teaching and team work among students.

ACKNOWLEDGEMENTS

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