

# The jigsaw technique of peer teaching and learning: An efficient and enjoyable teaching strategy in medicine

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## Abstract

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**Background:** The jigsaw method is a peer teaching method that has great potential as a tool to learn a large amount of information in a short period of time. We present data on the use of the jigsaw technique in a graduate medical education setting.

**Methods:** Forty-one pediatric residents participated in a jigsaw session on otitis media. Residents became an expert on one of four articles and taught their topic to other residents in their jigsaw group. Residents were asked to rate on a scale of 1 (least) to 5 (most) how educational and enjoyable the jigsaw session was. They were also given a multiple choice exam testing their knowledge of otitis media.

**Results:** Residents rated the jigsaw session high for both educational value ( $4.68 \pm 0.57$ ) and how enjoyable it was ( $4.54 \pm 0.67$ ). Exam scores improved from the pre- ( $0.59 \pm 0.18$ ) to post-session exam ( $0.78 \pm 0.15$ ,  $t(32)=-5.25$ ,  $p < 0.001$ ), showing that residents had increased knowledge of otitis media.

**Conclusions:** The jigsaw method is an educational and enjoyable method of peer teaching for pediatric residents. We plan to incorporate the jigsaw method at our institution into our undergraduate and graduate medical education programs.

**Keywords:** teaching and learning and peer teaching.

## Article

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## Background

Recent trends in medical education curricula converge on the notion that alternatives to the traditional lecture-based teaching format must be pursued to encourage active learning among trainees. Early clinical exposure has been encouraged, with the pre-clinical phase taught in integrated organ system blocks over a twelve to eighteen month period. In some cases, medical schools are moving towards a 3-year program (Emanuel & Fuchs, 2012). At the same time, advancements in biomedical research have led to an exponential expansion of medical knowledge, making it unrealistic to cover knowledge about physiology, pathophysiology and treatment for all medical diseases. Recently several new medical schools have been established in the US and enrollment in existing medical schools has expanded considerably in an attempt to meet the growing demand for physicians (Association of American Medical Colleges, 2006). Finally, faculty members are being stretched thin with heavy clinical responsibilities making it difficult to find adequate time for teaching (Barchi & Lowery, 2000; Deci & Ryan, 1985).

A recent report by the Carnegie Foundation for the Advancement of Teaching concluded that “Medical training is inflexible, overly long, and not learner-centered.” (Irby, Cooke, & O'Brien, 2010, p. 223) Adult learning and self-determination theories concur, recommending that adult learners be given the opportunity to engage in a more autonomous, self-directed learning style (Knowles, 1984). In an attempt to shift from a teacher to learner-centered paradigm, peer teaching has been widely incorporated into the medical school curriculum (Moore-West, Hennessy, Meilman, & O'Donnell, 1990). Research shows that peer teachers had higher United States Medical Licensing Examination (USMLE) Step 1 scores, USMLE Step 2 scores, and final medical school GPA than students who did not engage in peer teaching (Knobe et al., 2010; Nnodim, 1997; J. G. Wong, Waldrep, & Smith, 2007; J. W. Youdas, Hoffarth, Kohlwey, Kramer, & Petro, 2008; J.W. Youdas, Krause, Hellyer, Hollman, & Rindfleisch, 2007). There are also additional benefits to peer teaching, including improved communication, teaching and leadership skills (Johnson, 2002; Krych et al., 2005; Ten Cate & Durning, 2007).

Team based learning (TBL) is a method of peer learning that has been widely used in medical education. TBL is a highly structured group learning method that requires four essential elements: heterogeneous groups, accountability, feedback, and assignments (Michaelsen & Sweet, 2008). Permanent groups are formed at the beginning of the semester and are required to work together to apply knowledge that they previously learned on their own to solve a problem. TBL is an ideal method when there is a common topic that all students need to learn and come together to apply that knowledge to an important problem solving exercise. It requires 1 to 2 faculty facilitators even for a large group, and utilizes both intra- and intergroup learning. In contrast, the jigsaw technique (Aronson, Stephan, Sikes, Blaney, & Snapp, 1978) is a learning method that requires individual students to become an “expert” on one aspect of a lesson through independent learning and group discussion, and then must return to their “jigsaw” group to teach the other members of the group about their assigned topic. In that sense, the jigsaw technique is ideal when students need to learn a large amount of information but don't necessarily need to learn every aspect of the topic in depth. The jigsaw technique also requires only 1 to 2 faculty facilitators, but utilizes only intergroup learning (see Table 1 for a comparison).

Evidence for the use of the jigsaw technique in the medical school setting is quite limited. One study used the jigsaw approach in place of a traditional journal club (Willett, Kim, & Gochfeld, 2013). Students rated the utility of the approach as 3.53 on a 5-point scale and had several positive comments. Alternatively, the time commitment (i.e., pre-class preparation) was cited as a negative feature of the approach. Buhr and colleagues (2014) discussed the use of a jigsaw method to teach medical students about long-term care. Again, students reported a positive experience with the jigsaw method. Furthermore, students performed better on a knowledge test compared to students in previous years. Finally, a descriptive letter to the editor was published describing the implementation of the jigsaw method to teach medical students prescribing skills (Sim et al., 2014).

Multiple factors in the current climate of curriculum reform call for a need for more efficient, student-centered learning. In this paper we present the jigsaw technique of peer teaching with a detailed description of the steps involved and our early experiences with it.

## Methods

### Description of the jigsaw technique

The jigsaw technique uses a linear series of steps to achieve learning objectives (Aronson et al., 1978). Figure 1 presents the steps associated with the jigsaw technique. First, students are divided into small groups of approximately 5-6 individuals (i.e., jigsaw groups). The lesson is divided into 5 or 6 segments (or key articles) and each student in the jigsaw group is assigned to one topic or article. This can take place before the jigsaw session, or in our approach, at the beginning of the jigsaw session. The students become familiar with their topic and then they meet in a small group of other students who have the same topic (expert groups). The expert group allows all of the students to discuss the key points amongst themselves and clarify their understanding of the concepts regarding the common topic they all read. They then rejoin their jigsaw groups to present their topic. Each of the student in the jigsaw has expertise on one of the topics and every topic gets taught by a peer to all members of the jigsaw group. Presence of a small group facilitator will ensure smooth transition between topic and facilitate healthy group processes.

### Our experience with the jigsaw technique

We used the jigsaw method in our pediatric residency program at Stony Brook School of Medicine as an alternative approach to a traditional lecture format to teach the diagnosis and management of otitis media. Our objective was to assess the educational value of the jigsaw method in teaching residents this material. The jigsaw technique was one component of a three hour module, which also included a presentation of otoscopic images, a hands-on session and a pre/post exam. We selected four articles which together reviewed the diagnosis and management of otitis media, the diagnosis and management of otitis media with effusion, the use of pneumatic otoscopy, and the basics of tympanometry. The workshop facilitator annotated the articles via underscoring to facilitate residents' identification of the salient features of each article. Residents were randomly assigned to one of four groups corresponding to each of the four articles to be discussed. Each group initially spent ten minutes reading their article, followed by fifteen minutes discussing its main points with the expert group members. The students reported back to their jigsaw group, each containing one expert for each article. Each expert spent five minutes teaching their new group members the information contained in the article they had reviewed. The moderator for the session was available for questions as needed. Following the jigsaw portion, the facilitator reviewed the material covered with all the participants in a large group setting and allowed time for questions and further clarification. The total amount of time spent in the article review was one hour and fifteen minutes. After the jigsaw there was an experiential learning component consisting of a brief lecture reviewing the epidemiology, diagnosis, treatment, and prevention of otitis media, pneumatic otoscopic image viewing, hands-on pneumatic otoscopy practice, and hands-on tympanometry practice. At the conclusion of the session, residents were asked to complete a questionnaire regarding their experience with each method of teaching in the module. Data were statistically evaluated using IBM SPSS Statistics (SPSS Inc., Chicago, Illinois, USA, Version 22.0). Data are presented as a mean  $\pm$  standard deviation. Within-subject comparisons for the pre- and post-test scores were performed using a paired *t*-test. Scores were analyzed as a percentage to make them comparable. The Institutional Review Board of Stony Brook University approved this study.

## Results

A total of forty-one pediatric residents participated in two iterations of the teaching module in March and October of 2007. On a scale of 1-5 (1 being the least educational/enjoyable and 5 being the most educational/enjoyable), the residents rated the educational value of the module's jigsaw portion an average of 4.68 ( $\pm 0.57$ ) and the enjoyable value an average of 4.54 ( $\pm 0.67$ ). Individual comments regarding the jigsaw session include: "We wish this could be used for many resident lectures" and "Wonderful to break up medium of learning...small groups and hands-on." Similar positive comments were provided for the entire module. To test whether residents were engaged enough to improve on their knowledge of the topic, we examined the pre- and post-session exam scores. Indeed, exam scores improved from the pre- ( $0.59 \pm 0.18$ ) to post-session exam ( $0.78 \pm 0.15$ ,  $t(32)=-5.25$ ,  $p < 0.001$ ), showing that residents knowledge increased as a result of the session.

## Discussion

To our knowledge, this is the first report of using the jigsaw teaching strategy in graduate medical education. Our results support the notion that the jigsaw method of peer teaching is an educational and enjoyable way to learn the diagnosis and treatment of acute otitis media. The survey comments reveal that our residents are interested in a variety of teaching styles apart from the traditional lecture format, and suggest that workshops such as the one described herein will be well-received by learners. There is also evidence that resident's knowledge increased as a result of the session. Although limited to pediatric residents in one institution, our study results agree with others who have found peer learning to be a useful method of teaching various topics in medical education (Buhr et al., 2014; Willett et al., 2013; C. K. Wong & Driscoll, 2008).

One of the consistent criticism of the jigsaw technique in the literature is that the jigsaw technique is time consuming because it requires pre-classroom preparation. Due to time limitations in resident schedules, we annotated the articles and had residents read their articles during class time. Allowing learners to review their assigned topic ahead of time before the session starts (a "flipped classroom" approach) would be optimal to facilitate deeper and individualized understanding of the topic such that the single topic group discussions would be more nuanced and helpful in developing topic expertise.

The jigsaw methods brings a new education tool to the medical curriculum, allowing for peer discussion of a large amount of material in a short period of time. Furthermore, students are given the opportunity to become an "expert" in one of the areas and are challenged to teach their topic to other students who have no prior knowledge of that topic. We believe with the recent national emphasis on inter-professional learning, this technique would be ideal as each of the professions can be assigned a reading that matches their profession on the same topic so that each student becomes a topic expert in their field but still learns the inter-professional aspects of the topic in their jigsaw group discussions. Based on our early experiences with the jigsaw technique, we are now incorporating this technique as a key instructional strategy in the clinical phases of our medical school curriculum for the "Translation Pillars" - a feature created with the goal of integrating current basic science advances into clinical scenarios after learners have acquired some clinical experiences. Future application of the jigsaw technique could focus on professional team learning in interdisciplinary groups (Buhr et al., 2014) which would be highly beneficial for fostering career development skills in medical students and residents. We believe that the jigsaw teaching technique will add yet another helpful student centered strategy to our existing repertoire of strategies to promote active learning and to flipping the classrooms in the medical school setting.

### **Notes on Contributors**

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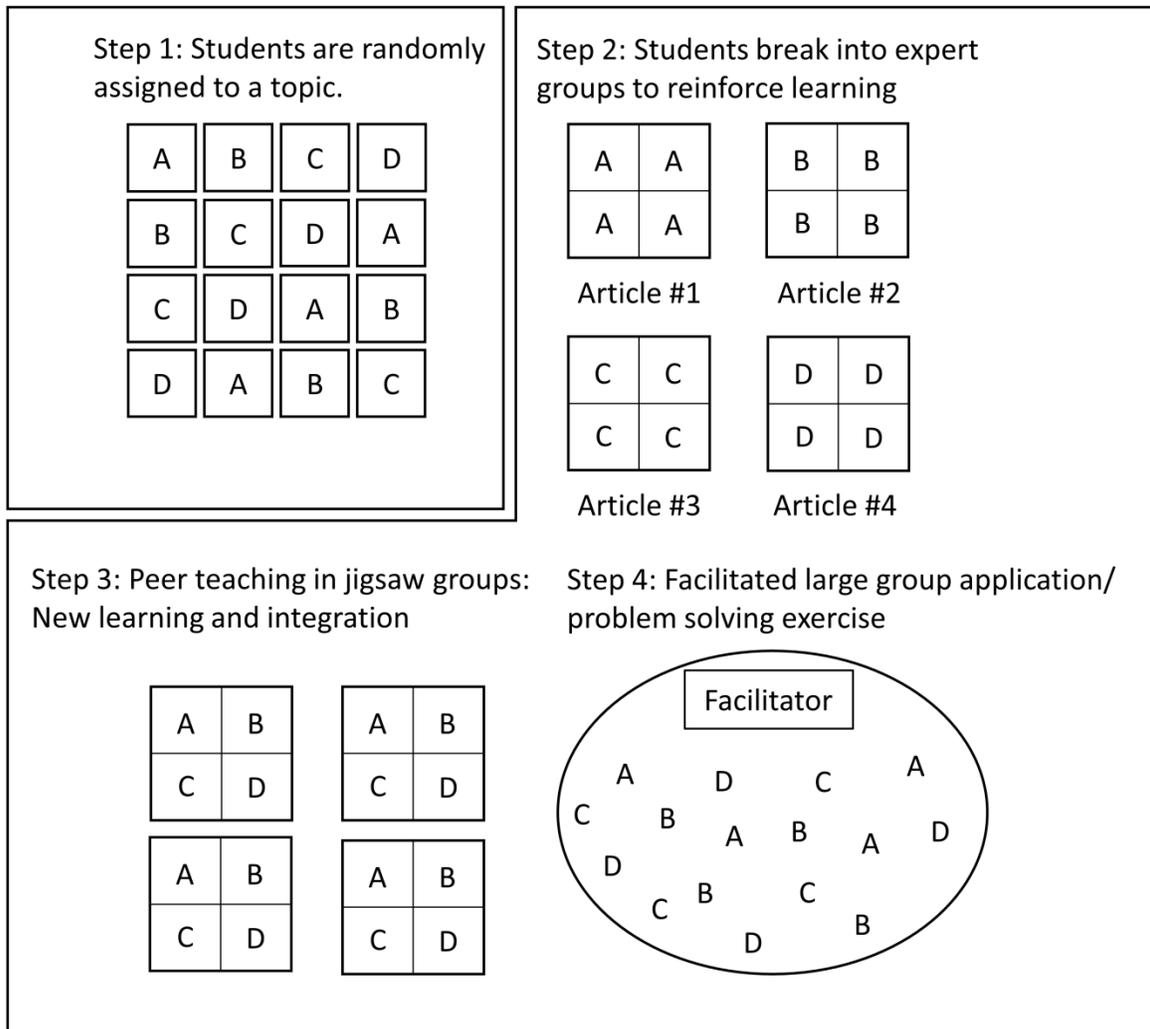
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**Table 1:** Comparison of Jigsaw method with team-based learning

	<b>Team-based learning</b>	<b>Jigsaw Learning</b>
<b>Pre-participation requirement</b>	Requires preparation before class	May or may not require preparation before class
<b>Flipped classroom requirement</b>	Yes	No, but can use a flipped classroom
<b>Number of facilitators</b>	One or more	One or more
<b>Small group size</b>	Optimum group size is 5-7, with heterogeneous groups	Optimum group size is 5-7, with heterogeneous groups
<b>Faculty: Student Ratio</b>	Small	Small
<b>Amount of material covered</b>	Small	Large
<b>Depth/Breadth of material covered</b>	Deep understanding of a specific concept required to apply problem solving skills	Facilitate the development of conceptual understanding; could be used for problem solving but not required
<b>Application Exercise</b>	Required component	Optional component
<b>Assessment</b>	IRAT and GRAT are integral components of TBL	No structured assessment
<b>Nature of group</b>	Ideally single profession	Ideal for inter-professional learning
<b>Group participation</b>	Multiple small groups learning the same material simultaneously	An individual within a group becomes an “expert” on their learning topic and teaches the “jigsaw” group.
<b>Group Learning</b>	Intra- and Inter-group	Intra-group
<b>Group Composition</b>	Same group of students	Groups alternate between expert and jigsaw

### Figure Legend

Figure 1. Steps involved in the design and delivery of a jigsaw teaching session. Step 1 is separated from the other steps because it can be done before the jigsaw session or as an in class reading assignment at the beginning of the session. All other steps take place in the classroom. For the random assignment, all “A” students receive topic A, all “B” students receive topic B, all “C” students receive topic C and all “D” students receive topic D. Steps 2 – 4 are performed during the jigsaw.



## References

- Aronson, E., Stephan, C., Sikes, J., Blaney, N., & Snapp, M. (1978). *The Jigsaw Classroom*. Beverly Hills, California: Sage Publications.
- Association of American Medical Colleges. (2006). AAMC Statement on the Physician Workforce. Retrieved May 14, 2015, from <https://www.aamc.org/download/55458/data>
- Barchi, R. L., & Lowery, B. J. (2000). Scholarship in the medical faculty from the university perspective: retaining academic values. *Acad Med*, 75(9), 899-905.  
<http://dx.doi.org/10.1097/00001888-200009000-00011>
- Buhr, G. T., Heflin, M. T., White, H. K., & Pinheiro, S. O. (2014). Using the Jigsaw Cooperative Learning Method to Teach Medical Students About Long-Term and Postacute Care. *Journal of the American Medical Directors Association*, 15, 429-434.  
<http://dx.doi.org/10.1016/j.jamda.2014.01.015>
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.  
<http://dx.doi.org/10.1007/978-1-4899-2271-7>
- Emanuel, E. J., & Fuchs, V. R. (2012). Shortening medical training by 30%. *JAMA*, 307(11), 1143-1144.  
<http://dx.doi.org/10.1001/jama.2012.292>
- Irby, D. M., Cooke, M., & O'Brien, B. C. (2010). Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *Acad Med*, 85(2), 220-227.  
<http://dx.doi.org/10.1097/ACM.0b013e3181c88449>
- Johnson, J. H. (2002). Importance of dissection in learning anatomy: personal dissection versus peer teaching. *Clin Anat*, 15(1), 38-44. doi: 10.1002/ca.1090  
<http://dx.doi.org/10.1002/ca.1090>
- Knobe, M., Munker, R., Sellei, R. M., Holschen, M., Mooij, S. C., Schmidt-Rohlfing, B., . . . Pape, H. C. (2010). Peer teaching: a randomised controlled trial using student-teachers to teach musculoskeletal ultrasound. *Med Educ*, 44(2), 148-155. <http://dx.doi.org/10.1111/j.1365-2923.2009.03557.x>
- Knowles, M. S. (1984). *Andragogy in Action: Applying Modern Principles of Adult Learning*. San Francisco, California: Jossey-Bass.
- Krych, A. J., March, C. N., Bryan, R. E., Peake, B. J., Pawlina, W., & Carmichael, S. W. (2005). Reciprocal peer teaching: students teaching students in the gross anatomy laboratory. *Clin Anat*, 18(4), 296-301.  
<http://dx.doi.org/10.1002/ca.20090>
- Michaelsen, L. K., & Sweet, M. (2008). Creating effective team assignments. In L. K. Michaelsen, D. X. Parmelee, K. K. McMahon & R. E. Levine (Eds.), *Team-Based Learning for Health Professions Education*. Sterling, Virginia: Stylus Publishing.
- Moore-West, M., Hennessy, S. A., Meilman, P. W., & O'Donnell, J. F. (1990). The presence of student-based peer advising, peer tutoring, and performance evaluation programs among U.S. medical schools. *Acad Med*, 65(10), 660-661.  
<http://dx.doi.org/10.1097/00001888-199010000-00018>
- Nnodim, J. O. (1997). A controlled trial of peer-teaching in practical gross anatomy. *Clin Anat*, 10(2), 112-117. [http://dx.doi.org/10.1002/\(SICI\)1098-2353\(1997\)10:2<112::AID-CA7>3.0.CO;2-X](http://dx.doi.org/10.1002/(SICI)1098-2353(1997)10:2<112::AID-CA7>3.0.CO;2-X)

Sim, S. M., Foong, C. C., Tan, C. H., Lai, P. S., Chua, S. S., & Mohazmi, M. (2014). The use of jigsaw learning technique in teaching medical students prescribing skills. *Med Teach*, 36(2), 182.  
<http://dx.doi.org/10.3109/0142159X.2013.848977>

Ten Cate, O., & Durning, S. (2007). Peer teaching in medical education: twelve reasons to move from theory to practice. *Med Teach*, 29(6), 591-599. <http://dx.doi.org/10.1080/01421590701606799>

Willett, L. R., Kim, S., & Gochfeld, M. (2013). Enlivening journal clubs using a modified 'jigsaw' method. *Medical Education*, 47, 1119-1146. <http://dx.doi.org/10.1111/medu.12342>

Wong, C. K., & Driscoll, M. (2008). A modified jigsaw method: an active learning strategy to develop the cognitive and affective domains through curricular review. *Journal of Physical Therapy Education*, 21(3), 15-23.

Wong, J. G., Waldrep, T. D., & Smith, T. G. (2007). Formal peer-teaching in medical school improves academic performance: the MUSC supplemental instructor program. *Teaching and Learning in Medicine*, 19(3), 216-220. <http://dx.doi.org/10.1080/10401330701364551>

Youdas, J. W., Hoffarth, B. L., Kohlwey, S. R., Kramer, C. M., & Petro, J. L. (2008). Peer teaching among physical therapy students during human gross anatomy: perceptions of peer teachers and students. *Anat Sci Educ*, 1(5), 199-206. <http://dx.doi.org/10.1002/ase.44>

Youdas, J. W., Krause, D. A., Hellyer, N. J., Hollman, J. H., & Rindfleisch, A. B. (2007). Perceived usefulness of reciprocal peer teaching among doctor of physical therapy students in the gross anatomy laboratory. *Journal of Physical Therapy Education*, 21(2), 30.