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INSTRUCTIONAL DESIGN AND ASSESSMENT

Using the Jigsaw Technique to Teach Clinical Controversy in a Clinical Skills Course

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Objective. To evaluate the effectiveness and student perception of the jigsaw technique to engage students in a clinical controversy exercise and to assess student engagement level during each step of the process.

Design. Students were assigned individual readings pertaining to the controversy surrounding the drug oxybutynin switching from prescription to nonprescription. They met with an expert group and teaching groups during mandatory laboratory time and worked together to formulate a recommendation on the appropriateness of nonprescription conversion for a drug.

Assessment. A quiz taken individually was used to measure effectiveness. Student perception and level of engagement was assessed using surveys.

Conclusion. The jigsaw technique was successful in teaching the concepts involved in the clinical controversy. Group members rated themselves and fellow participants' level of engagement as high during both the expert group and teaching group sessions. Most students reported they learned about the same or more with the jigsaw technique compared to another cooperative learning technique used in the curriculum.

Keywords: jigsaw, clinical controversy

INTRODUCTION

According to the Accreditation Council for Pharmaceutical Education (ACPE) Standards, one of the responsibilities of colleges and schools of pharmacy is to develop students' critical-thinking and problem-solving skills and enable students to "transition from dependent to active, self-directed, lifelong learners."[1] Guideline 11.1 notes that students should be encouraged to assist in providing education to others.[1] The outcomes listed by the Center for Advancement of Pharmacy Education (CAPE) include components addressing problem-solving, education, and interprofessional collaboration.[2] An educational technique faculty members may find helpful in achieving these outcomes is the jigsaw technique.

The jigsaw technique combines problem-based learning with cooperative learning. Figure 1 is a pictorial representation of the process. Initially, a theme is defined, which consists of multiple "pieces" of information or skills. Students need to understand all aspects (ie, all pieces) in order to completely answer a question or master the material. Students work with 2 different groups to accomplish this task—a teaching group and an expert group.

After the theme is determined by the instructor, students are randomly divided into small groups referred to as teaching groups. Each student in the teaching group is assigned different reading material prior to the start of class that focuses on one piece of the jigsaw puzzle—this is the material on which the student will become an expert. Next, students are rearranged and meet with other students assigned the same reading material; this group of students who all have the same piece of the puzzle is called the expert group. Expert groups work together to understand the information and decide how best to present it to their teaching groups. Finally, the teaching groups reconvene and each member teaches others about their piece of the puzzle until all experts have presented their material.[3]

Although the jigsaw technique has been used in other areas of education, including elementary,[4] and nursing education,[5,6] there are only a few studies that describe its successful use within pharmacy education.[7,8] At one institution, the technique was used to engage students when analyzing tertiary drug information resources, and most students found it to be a useful learning experience.[8]

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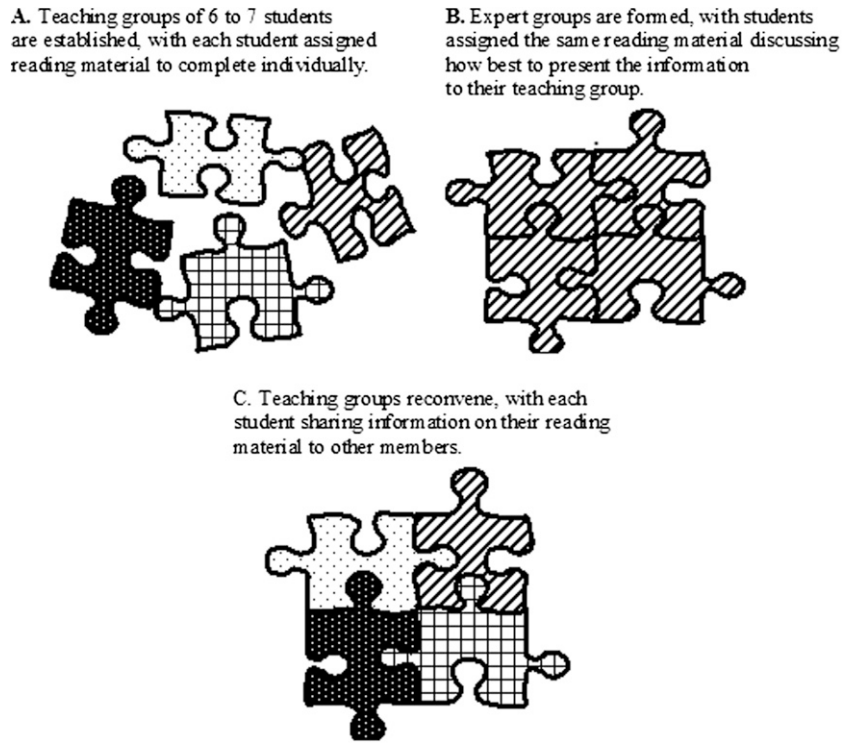

Figure 1. Jigsaw Technique.

At another institution, where the technique was used to teach pharmacokinetic principles, formative and summative assessments revealed that students learned the material to the same extent compared to previous years, when a traditional lecture was used to deliver the same content.[7] However, students felt they learned less with this method and preferred lecture. In that study, students were encouraged to work together with their expert groups outside of the classroom before the day of the intervention. Students who had unfavorable opinions toward group work reported difficulty in getting group members to meet.[7] Buhr et al used the jigsaw technique to teach medical students about the roles of personnel at long-term and postacute care facilities.[9] Although most students reported they learned at least a moderate amount by using this technique—which was confirmed by a postactivity test—feedback was mixed. Some reported liking the experience, whereas others thought teacher-centered approaches would be less time intensive.[9]

Although studies to date suggest the jigsaw method is effective in teaching a wide variety of topics, students' perceptions appear to be mixed, and it remains unclear if this is because of students' anxiety related to other group members being appropriately engaged in the process. It is also unclear how student perceptions of the jigsaw method compare to other team-based learning strategies used at schools of pharmacy. As a result, we conducted an analysis of the effectiveness and student perceptions of the jigsaw technique to teach clinical controversy in a clinical skills course. As part of this analysis, student engagement was assessed at each stage of the jigsaw process, and students were asked to compare the jigsaw method to another team-based learning strategy used within the curriculum called clinical controversy. We chose to use the jigsaw technique because it is a highly interactive learning strategy that allows interdependent learning among students. Moreover, hearing other students' thoughts and perspectives may particularly help students form opinions about controversial issues.

In a typical clinical controversy workshop, students working in assigned groups are given access to clinical trials in advance of the workshop. A list of questions is provided to help facilitate evaluation of the literature during preparation time. The deliverable consists of communicating a recommendation for the given controversy while applying and referring to literature to support the recommendation. In contrast to the jigsaw technique, students have access to all the literature ahead of time and are expected to review it independently.

DESIGN

At the Midwestern University Chicago College of Pharmacy, where the jigsaw technique was used, the average graduating class size is about 200 students, and

group work is an integral part of the curriculum. To avoid the barrier identified by Persky et al regarding difficulty in finding time to get groups together,[7] students in the expert groups worked together during mandatory laboratory time. The goals of the activity were for students to work interdependently to learn about an issue, to communicate what they learned, to apply what they learned to a current controversial issue, and to formulate a recommendation based on their collective analysis of the evidence.

The objectives of the study were to evaluate: (1) student perception of and opinion about the jigsaw technique; (2) the level of student engagement during each step of the jigsaw process; and (3) the effectiveness of this teaching method on student learning. The study was approved by the university's institutional review board.

Clinical Skills in Pharmacy Practice is a required course in the third professional year of the professional pharmacy program. The course is 3-credit hours, consisting of 2-credit lecture hours and 1-credit laboratory hour weekly. The latter is 2 hours and 20 minutes. All students enrolled were eligible to participate in this study. The focus of the laboratory was to have students evaluate the literature regarding a prescription-to-nonprescription product switch for the oxybutynin transdermal system for women and make a recommendation for this "controversy" based on evidence reviewed by the group. The topic was chosen because it was a controversial issue at the time of the study, as oxybutynin had recently been approved for nonprescription use.

After identifying the clinical controversy, we determined how many pieces there would be in the puzzle. For students to make a recommendation on the appropriateness of the nonprescription status, readings needed to represent the disease, drug, and regulatory facets. Selected readings complemented one another and material didn't duplicate. Each reading was considered challenging but comprehensible to students. Teaching groups of 5 to 7 students were randomly assigned. Each member of the teaching group was assigned a different reading. Six different readings were assigned: literature on diagnosis and treatment guidelines for overactive bladder (OAB);[10] literature on quality of life for OAB sufferers;[11] a consumer research study on label comprehension;[12] a consumer research study on actual use;[13] trials on the efficacy of oxybutnin for OAB;[14] and an article on regulatory issues with prescription-to-nonprescription product switches.[15]

One week prior to the laboratory, students in the teaching groups were able to view their assigned prelaboratory reading material on Blackboard (Blackboard, Inc., Washington, DC). Students received basic instructions, and questions specific to their reading material. On the laboratory day, an investigator described the jigsaw method in detail, including a verbal and visual depiction. Students were seated in their teaching groups, and then were encouraged to voluntarily form expert groups with others who had completed the same reading material. Students sat in a circle for the activity.

The expert groups collectively discussed what they learned for 20 minutes. Facilitators circulated among the groups to help students stay on task. In the second step, students returned to their original teaching group and, for the next 60 minutes, taught each other about their specific reading material. It was each student's decision how to present the information, including whether the reading-specific study questions were shared. The teaching group ultimately came to a consensus on whether they would support the nonprescription conversion or not.

At the end of the workshop, each student completed a 12-question quiz. Ten questions were knowledge-based and collectively covered all of the pieces of the jigsaw puzzle. Each piece had at least one question about that content on the quiz. Question 8 was application-based, which required students to integrate information from all of the sources and apply it to a mini-patient case. Question 7 was not covered in any of the readings but was discussed during lecture on the topic. Question 12 required students to evaluate all of the information and use it to synthesize an opinion on the prescription-to-nonprescription switch. Although most questions were from a single source, questions 6 and 9 drew from 2 different pieces. The quiz questions were reviewed by the 6 small-group facilitators who assisted with the laboratory to ensure they represented a fair assessment of the concepts learned. The facilitators thought the questions were appropriate, and no changes were made to the original questions.

All students who consented to participate also were administered a multi-part survey of largely fill-in-the blank and multiple-choice questions. Survey questions assessed students' perceptions and opinions of the jigsaw learning technique and learning experience in the following domains: effectiveness, benefits and advantages, barriers and limitations, level of engagement, and recommendations for future use of the tool. Part 1 of the survey was administered after the expert group meeting. Students had approximately 10 minutes to respond to 5 questions asking about prior experience with the technique, preparation for the current activity, and performance feedback for themselves and their group members. Part 2 of the survey was administered after the teaching groups disbanded. Approximately 20 minutes were allotted to answer 11 questions on perceptions of the technique and performance feedback for the

individual respondent and their group members. Two questions asked for gender and age. Students were also asked to compare the jigsaw technique to the clinical controversy format, which is used in pharmacotherapeutic workshops at the institution. Five extra credit points (representing 1.5% of the total points in the course) were given to each student who enrolled in the study and completed the survey. Both the survey and quiz were collected at the conclusion of the laboratory. Descriptive statistics were used to summarize the data. Chi-square and Fisher exact test were used, as appropriate, to compare the percentage of students rated at an A level by themselves, by their teaching group, and by their expert group members and to compare expert group scores to overall scores on quiz questions.

EVALUATION AND ASSESSMENT

One hundred ninety-three students were present at the laboratory and completed the postlaboratory quiz; 192 (99.5%) completed the postlaboratory survey. Forty-eight percent of the respondents were male and 52%) were female. Fifty-nine percent fell into the age range of 20-25 years. Of the 192 students who completed the survey, most (n=182, 95%) did not have previous experience with the jigsaw technique.

The average score on the postlaboratory quiz was 10.5/12 (88%, range 58%-100%), suggesting the technique was successful in teaching the concepts. Although students were given credit regardless of their answer to question 12, 66% (n=127) indicated they would recommend against the nonprescription switch after spending time with their expert and teaching groups. This trend was consistent when expert groups were analyzed (Figure 2); all expert groups had more students recommend against than for the nonprescription switch. This trend seemed to be stronger for students randomized to expert group E (consumer use studies) and F (OAB treatment guidelines.)

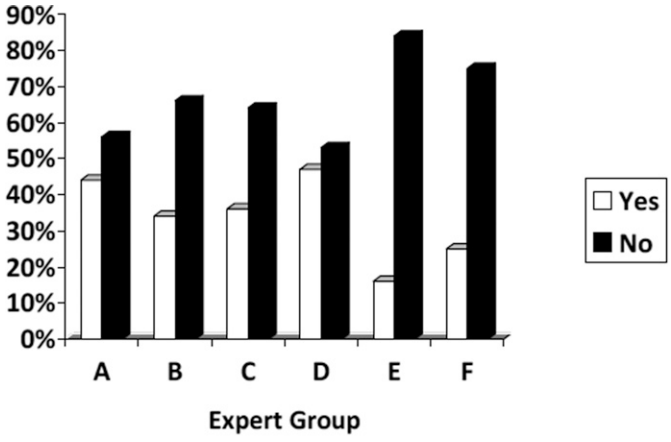

Figure 2. Student Recommendation for Nonprescription Switch Based on Expert Group.

There was at least one question for each of the reading material puzzle pieces on the quiz. Figure 3 shows the percentage of students who answered the questions specific to their reading material correctly (ie, expert group), and the percentage of students overall who answered that question correctly. There was no expert group for question 7 on the quiz as this material came from lecture material. For most questions, students performed equally well whether they were assigned to read material on which the question was based or whether they learned this material from their peers in the teaching group segment of the workshop. The only exceptions were questions 1 and 4; students who were assigned the pieces covered in those questions did better than the group overall, suggesting those concepts weren't discussed as thoroughly in the teaching group sections.

Figure 4 includes the amount of time students reported it took to get through the reading material. Seventy-nine percent (n=151) indicated 1 hour was needed to prepare, although some required 2 hours (n=33, 17%), one reported more than 3 hours, and 3% (n=6) reported they did not complete the reading material prior to the laboratory. The time needed to assemble the activity was approximately 6 hours. While the laboratory instructor knew about OAB, he/she had never used the jigsaw technique before. Compared to a clinical controversy workshop, the preparation time for the laboratory was more intensive, partly because the reading material in the latter was more extensive In addition, students' questions specifically for the reading material in the jigsaw technique required time and effort to design.

Students were asked to assign themselves a letter grade based on their level of engagement as a member of their expert and teaching groups. Students used letter grades of A, B, C, or F. The D grade is not used at the institution. Although the grades were not defined for the students, a 10-point scale is typically used at this institution, with 90% and above corresponding to an A, 80-89% corresponding to a B, etc. The students also were asked to rate their fellow expert and teaching group members using the same scale (Figure 5). With regard to their contribution and level of engagement, 69% gave themselves an A. Students were more likely to assign an A to other group members than to themselves: expert group participants (87% vs 69%, $p=0.003$) and teaching group (95% vs 69%, $p=0.0001$). One potential explanation was that while students may not have felt confident in their ability to communicate information effectively in groups, others may not have noticed this lack of confidence. No students gave themselves or their group members an F, and a small

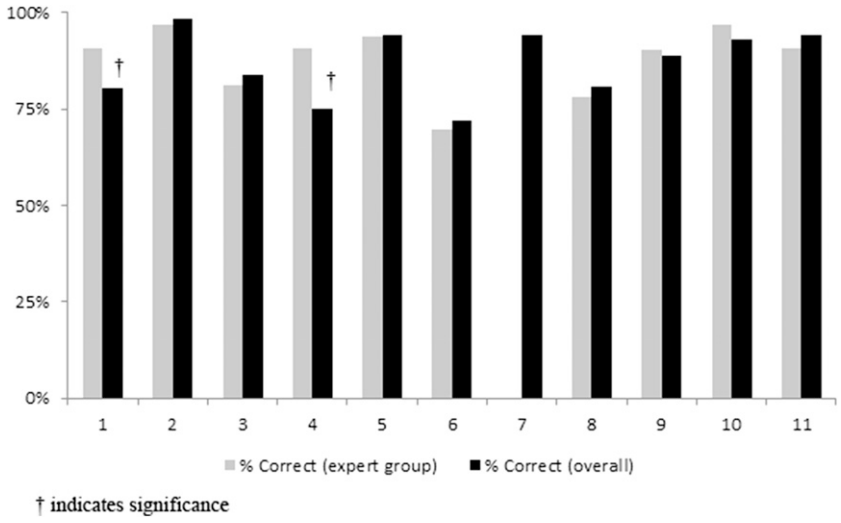

Figure 3. Percentage of Students Answering Questions Correctly.

percentage gave themselves (5%) or their group members (1%) a C.

Compared to the clinical controversy method, 90% of students felt they learned about the same or more with the jigsaw method. Forty-five percent reported they learned about the same, and 45% said they learned more with the jigsaw technique. Figure 6 indicates students' preferred method for learning in terms of ability to enhance understanding of the concepts learned, apply the information learned, stimulate interest in the topic, encourage feedback, and develop communication skills. More students preferred the jigsaw technique for all categories assessed. The jigsaw technique seemed to be most preferred (by 74%) to help develop communication skills. Seventy-six percent of students indicated they would like to see more of the jigsaw technique used in the pharmacy curriculum.

Students were asked 2 open-ended questions about perceived advantages and disadvantages of using the jigsaw technique to learn new concepts. Response themes regarding advantages included reduced workload, efficiency, and ability to hear multiple viewpoints. Thirty-nine survey respondents (20%), expressed that individual workload was reduced because the reading material was divided among the teaching group members. In addition, 29 (15%) noted that sharing the work in groups saved time when studying extensive subject matter. Thirty-nine students reported they appreciated how different perspectives were shared among expert group members. Students also described how learning from their peers created a comfortable work environment that presented the opportunity to work with different students (4%, n=7).

The main disadvantage, according to responses, was the reliance on other students to contribute fairly. Fifty-two percent of the respondents documented concern about

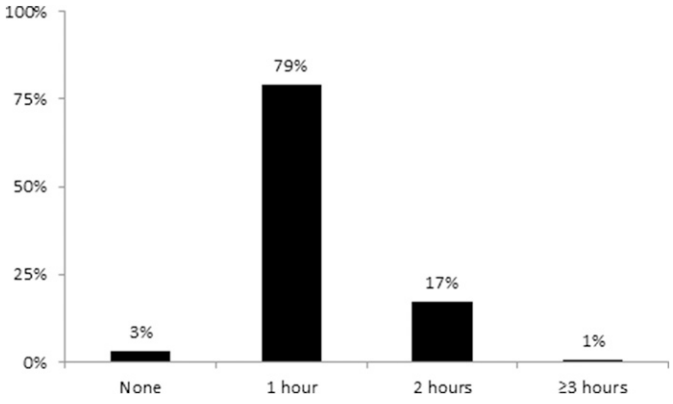

Figure 4. Reported Time Spent Preparing for Activity.

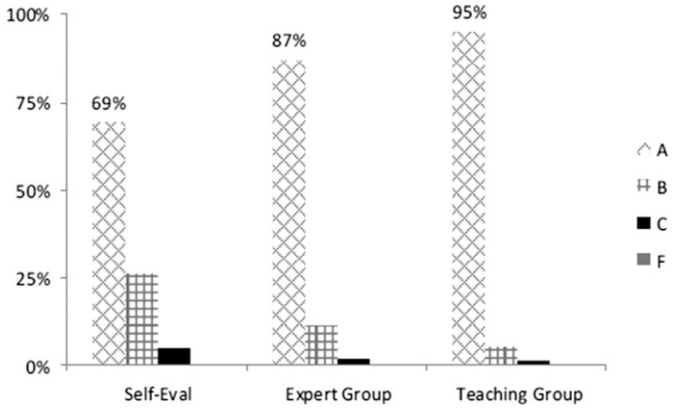

Figure 5. Student-Assessed Level of Engagement During the Jigsaw Process.

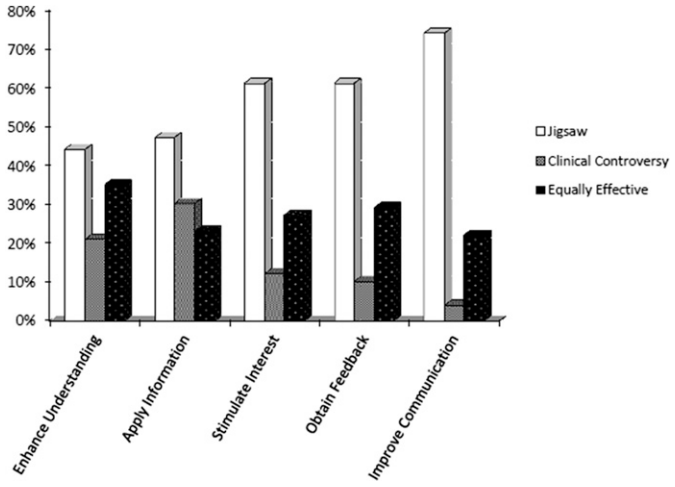

Figure 6. Student Preferences for Learning the Effectiveness of Jigsaw vs. Clinical Controversy.

receiving an accurate and/or complete interpretation of their reading material. For example, they expressed concern about personal opinions or knowledge deficits interfering with their peers' level of understanding. As such, 9% would have preferred to have access to all reading material. Another disadvantage reported by 13 students (7%) described varying communication skills among students.

DISCUSSION

The purpose of this study was to analyze the effectiveness and student perceptions of the jigsaw technique to teach about a clinical controversy in a clinical skills course. In particular, the authors wished to assess students' engagement level at each stage of the jigsaw process and compare student perceptions of the method to another team-based learning strategy used within the curriculum called clinical controversy.

Based on performance on the mandatory quiz, the jigsaw method appeared to be an effective teaching technique. Previously published studies found similar results, but also noted mixed student opinions on the method.[7,8] Student opinion of the jigsaw technique in our study was positive, with most preferring to see more of it in the curriculum. Perhaps this attitude is related to institutional culture. At our university, group work is an integral part of the curriculum, and students had much exposure to it prior to taking the clinical skills course in their third professional year. Perhaps the results would have been less favorable if the jigsaw technique were used in the first or second year of the program or at institutions where group work is not as integrated into the curriculum. In addition, to avoid the problem identified in previous studies of students finding it difficult to meet outside of the classroom, class laboratory time was designated for both the expert group session and the teaching group session. This may be another reason why results were more favorable in this study.

Group members rated their own and fellow participants' engagement levels highly during both the expert group session and the teaching group session. Although, students were more likely to rate others than themselves at an A level, this may have been related to students' lack of confidence in their own ability to communicate, or it may have reflected students' high level of expectations for their own performance. More students were rated as performing at an A level by their peers when they were in their teaching groups compared to when they were in their expert groups, suggesting that engagement level may have improved after spending time with the expert group.

There were several limitations to this study. One was the lack of control group. Having another set of students learn the material using a traditional instructional method would have allowed more direct comparisons. A second limitation of this study was that, while the jigsaw method was assessed, the scores did not contribute to course grades. However, students were not aware of this until after the activity was completed. This was considered a rational decision considering that the concept was new to both faculty members and students. The extra-credit for participating may have encouraged students to participate and thus introduce bias into the sample, but the number of points was a small portion of the final grade (1.5%) and should not have been perceived as coercive. While questions were provided for reading material, it is uncertain if students took advantage of this guide. Other limitations include the questionable reliability of students' self-evaluation and peer assessment scores, although other studies found students' self-reported grades were similar to faculty grades, or that students' self-assessment of communication skills was lower than that of faculty members.[16,17]

Ultimately, the authors sought to learn if students would vote to make oxybutynin transdermal patch nonprescription. The multiple-choice question, with the option of being in favor or against the switch, was simplistic and did not require students to justify their choice. Finally, effects of this technique on long-term learning were not assessed, as there were no questions about this topic on the final examination.

The jigsaw technique may be useful in teaching concepts that require integration of different types of material or in situations where students' perspectives may affect their interpretation and application of data (ie, interprofessional education). In fact, previous literature describes the successful use of the jigsaw technique to teach medical students about other roles in the nursing home

environment.[9] The jigsaw technique also may be an effective way to transition students from being passive to active learners and to foster communication skills needed to teach others about a given topic. Pharmacy students, in particular, could benefit from this skill, since honing their ability to teach their peers may be helpful in preparing them to teach other health care professionals.

SUMMARY

Overall, use of the jigsaw technique appeared to be a successful technique to engage students while learning about a clinical controversy. Students gained knowledge of the issue by completing their prelaboratory reading assignment individually, discussing it with their expert group, and teaching it to their teaching group. Their comprehension was assessed by their ability to convey this information clearly to their expert and teaching group members and use it to formulate an opinion about the clincial controversy.

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