JOTE Journal of Occupational Therapy Education

Volume 3 | Issue 3 Original Research Article 1

2019

Student Perspectives on the Immediate Feedback Assessment Technique

Lauren E. Milton
Washington University School of Medicine in St. Louis

Laura E. Landon
Washington University School of Medicine in St. Louis

Student Perspectives on the Immediate Feedback Assessment Technique

Abstract
A retrospective qualitative study was conducted to explore first-year occupational therapy graduate student perspectives on the Immediate Feedback Assessment Technique (IF-AT) which was implemented during a two-semester neuroscience course. The IF-AT system was used during small group application activities six times across a two-semester course sequence. Students discussed multiple-choice questions in small groups, used critical thinking skills and collaboration to select answers, then finally used the IF-AT scratch-off cards to indicate selections. At the conclusion of the second semester, 33 students provided qualitative feedback regarding their experience using the IF-AT. Conventional content analysis was used to capture the student voice as it relates to the use of the IF-AT system in coursework. Use of the IF-AT system created a positive learning experience for students but also revealed areas of limitations to be addressed in future coursework when the IF-AT scratch-off cards are used. Qualitative data from students indicated the technique facilitated active learning through discussion and problem solving while creating a sense of individual responsibility as well. Student-driven suggestions for improvement are included. Advice for instructors seeking implementation of the IF-AT system in occupational therapy coursework is included

Keywords
Immediate feedback, active learning, student assessment, qualitative

Acknowledgements
We would like to thank the Innovations in Education Lab at the Program in Occupational Therapy at Washington University School of Medicine in St. Louis, Missouri, as well as Courtney Weber and Laura Boden for their contributions to this project.

JOTE Journal of Occupational Therapy Education

Volume 3, Issue 3

Student Perspectives on the Immediate Feedback Assessment Technique

Lauren E. Milton OTD, OTR/L and Laura E. Landon OTD, OTR/L

Washington University School of Medicine

United States

ABSTRACT

A retrospective qualitative study was conducted to explore first-year occupational therapy graduate student perspectives on the Immediate Feedback Assessment Technique (IF-AT) which was implemented during a two-semester neuroscience course. The IF-AT system was used during small group application activities six times across a two-semester course sequence. Students discussed multiple-choice questions in small groups, used critical thinking skills and collaboration to select answers, then finally used the IF-AT scratch-off cards to indicate selections. At the conclusion of the second semester, 33 students provided qualitative feedback regarding their experience using the IF-AT. Conventional content analysis was used to capture the student voice as it relates to the use of the IF-AT system in coursework. Use of the IF-AT system created a positive learning experience for students but also revealed areas of limitations to be addressed in future coursework when the IF-AT scratch-off cards are used. Qualitative data from students indicated the technique facilitated active learning through discussion and problem solving while creating a sense of individual responsibility as well. Student-driven suggestions for improvement are included. Advice for instructors seeking implementation of the IF-AT system in occupational therapy coursework is included.

INTRODUCTION

Maximizing student engagement for optimal learning is a "hot button" topic in higher education. While previous generations have shown preference for didactic teaching methods, the millennial generation has shifted learning style preference to an interactive and collaborative approach, or active learning (Hopkins et al., 2018). Simply put by Bonwell and Eison (1991) nearly three decades ago, active learning encourages students to participate in the learning process versus passively listening. Within the classroom, active learning can be achieved through a variety of means, including group discussion, utilizing flipped classroom methodology, engaging students in hands-on learning, and incorporating technology. Active learning encourages students to be dynamic, central figures to the learning process, while

also promoting higher order thinking and student engagement (Lumpkin, Achen, & Dodd, 2015). A study by Lumpkin et al. (2015) evaluated 208 graduate and undergraduate students and found working in small groups enhanced learning. Through a learning environment emphasizing discussion, 89% of subjects reported a positive impact on learning. This finding is supported by another study by Lai and Hong (2012) that revealed out of a sample of 875 students, 90% expressed enjoyment discussing ideas with peers, and of 870 students, 90% expressed a preference for exploration.

Dialogue leads to conceptual understanding of frameworks that actively involve the student in the learning process and serves as a teaching model rooted in the social component of learning (Flores, Matkin, Burbach, Quinn, & Harding, 2012). Evans and Forbes (2012) asserted that opposed to being told what is correct or appropriate, the millennial generation pursues interactivity in learning. Additionally, adult learners crave collaboration and expect frequent and individualized feedback (Schwartz, McDonald, Vahabzadeh, & Cotes, 2018). Due to the demand for active learning within the classroom, educators must be equipped to design and implement interactive learning opportunities that foster critical thinking, facilitate discussion, create a dynamic learning environment, and provide feedback to students as a means to maximize learning. One method of maximizing student engagement to facilitate discussion in the classroom, and thus, facilitate student learning, is employment of principals of team-based learning (TBL).

Team-based Learning

Team-based learning is a well-recognized instructional strategy (Michaelsen, 2002) that shifts the focus of classroom time from conveying course concepts by the instructor to the application of course concepts by student teams. Traditional TBL consists of a three-phase cycle, including independent learning outside of the classroom, followed by an individual readiness assurance test (IRAT), then team readiness assurance test (TRAT), and finally, application of the material (Thompson et al., 2007). Literature suggests that students engaged in TBL demonstrate better exam scores and increased participation (Doshi, 2017), increased problem-solving abilities (Kim, Song, Lindquist, & Kang, 2016), and more enthusiastic, quality discussions (Middleton-Green & Ashelford, 2013). In using the TBL process, Koles, Stolfi, Borges, Nelson, and Parmelee (2010) suggested students be randomly assorted into groups of five to seven that remain consistent throughout the course. One method of not only facilitating the TRAT process, but also providing immediate feedback to students during the TRAT process, is through the use of the Immediate Feedback Assessment Technique (IF-AT; Epstein Educational Enterprises, n.d.), described below. While TBL provides an exceptional platform for student learning, the aim was to delve into the student perceptions of providing immediate feedback to student groups specifically following the TRAT process.

The Immediate Feedback Assessment Technique

Due to the demand for active learning within the classroom, educators must be equipped to integrate active learning activities and provide immediate feedback as a means to maximize student learning. While this poses a challenge to educators, one method of facilitating active student learning while offering immediate feedback is through use of IF-AT (Epstein Educational Enterprises, n.d.). Mauer and Kropp (2015) studied 372 undergraduate students and found students who engaged in a

DOI: 10.26681/jote.2019.030301

course section using the IF-AT system gave significantly higher ratings on seven course evaluation items than students who used an alternate system in their respective course section. In the same study, different course sections were given different conditions of the IF-AT scoring, yet among those conditions there was no significant difference between quiz scores. Students did, however, score significantly higher in sections using the IF-AT system versus the alternate system regardless of how the IF-AT was scored (Mauer & Kropp, 2015). Peck, Werner, and Raleigh (2013) studied 320 senior nursing students who used the IF-AT system as part of TBL and found the use of the IF-AT format was significantly more effective than traditional testing in enhancing learning.

The IF-AT uses a multiple-choice, pre-fabricated answer form with a thin opaque film covering the answer options. IF-AT forms come in 10, 25, or 50 question cards, and instead of using a pencil to fill in a circle, each student scratches off an answer as if scratching a lottery ticket (see Figure 1 for IF-AT sample). The student scratches off the coating of the rectangle corresponding with his/her first-choice answer. If the answer is correct, a star or other symbol appears somewhere within the rectangle indicating he/she found the correct answer. The student's learning is immediately reinforced, the student receives full credit for the answer, and moves on to the next question. If incorrect, the student must re-read the question and remaining answer options and scratch off a second or even third choice until the correct answer is identified. The student will earn partial credit for multiple attempts and learn the correct response for each question while taking the test. One of the keys to the IF-AT system is that students never leave a question without knowing the correct answer (Epstein, n.d.).

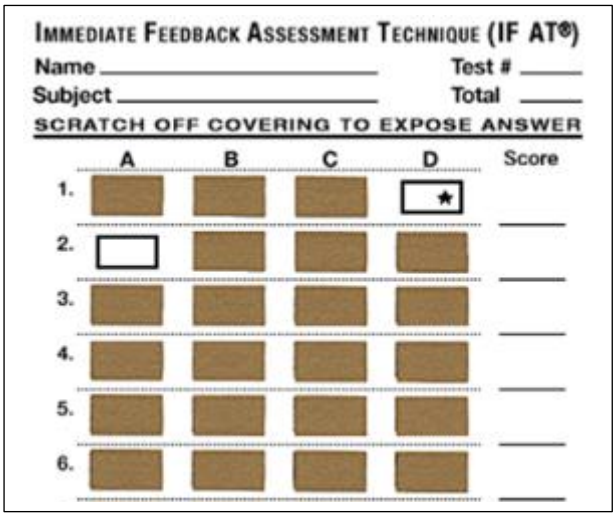

Figure 1. IF-AT multiple-choice answer form.

The IF-AT employs a scratch-off card testing system that transforms traditional multiple-choice testing into an interactive learning opportunity for students. The instructor formats questions to the pre-formatted scratch-off card using the IF-AT key and/or online supports. The IF-AT testing system enables students to be provided with immediate feedback about the accuracy of their answers to each question in a test/quiz/homework assignment as the students are completing each item. The IF-AT system provides immediate affirmative feedback if a student or small group of students answer choice is correct (star appears upon scratching off space), or

corrective feedback if a student or team answer choice is incorrect (space is blank, indicating the response was incorrect). Using the IF-AT system allows students to continue answering a question until they discover the correct answer. This ensures the students' last response is the correct one. Thus, the IF-AT teaches while it assesses, facilitating learning and improving students' retention of the information being tested.

While the IF-AT system may be used with students individually, or a hybrid with students working both individually then in groups, the current study employed the use of the IF-AT system with students in learning teams. Through this model, students discussed, debated, and interacted with each other to accurately, or inaccurately, answer questions. Only when student groups worked through each item to uncover the correct answer did they move onto the next question.

The purpose of this study was to explore the occupational therapy (OT) student perspective of the IF-AT. The researchers were interested in understanding the student voice as it relates to the use of the IF-AT system for facilitating student engagement in group problem solving, critical thinking, and active learning in the classroom.

METHODS

Participants

A convenience sample of 86 first year OT graduate students at a large research institute in the Midwest were asked to participate. Of the 86 first year OT graduate students, 33 participated (a 38% response rate), by completing the Student Feedback Form (Figure 2) and turning it in the instructor of the course following the final team IF-AT experience.

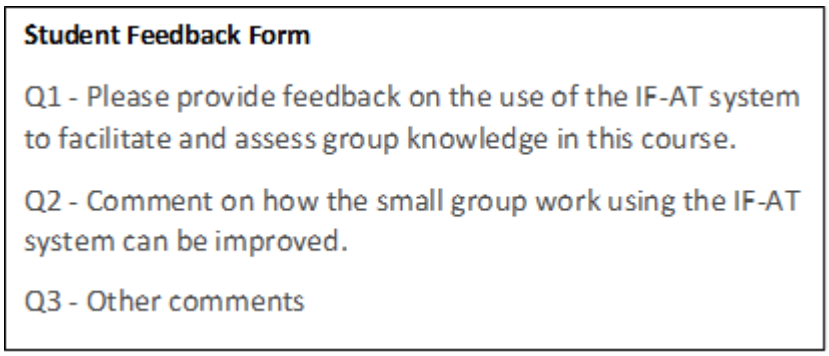

Figure 2. Student feedback form.

Research Design

This study used a retrospective qualitative design. To determine student viewpoints related to the use of the IF-AT, researchers sought to answer the research questions:

- What are student perspectives of the IF-AT?
- What do students report as strengths of the IF-AT?
- What do students report as limitations of the IF-AT?

DOI: 10.26681/jote.2019.030301

Following the university's Institutional Review Board (IRB) approval through an expedited IRB review process, retrospective analysis was conducted by two researchers who are both OTs with different practice specialties and different academic ranks. Conventional content analysis was employed, meaning codes were defined during data analysis and derived from the content itself, not theory or other literature**.** Transcribed data was initially coded and quantified independently by the two researchers to explore the students' perceptions of the experience with the IF-AT. Researchers then determined categories and themes through constant comparative analysis for agreeable categories and resulting themes (Hsieh & Shannon, 2005). Qualitative results were further validated employing theory triangulation (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014).

Materials

Information was collected from an anonymous, voluntary student questionnaire containing three open-ended questions (See Figure 2: student feedback form). The student feedback form, considered informal feedback originally gathered to inform teaching practices for the spring and summer subsequent course sequence, was also intended to provide the instructor additional information on the student learning experience that the university course evaluation system may not necessarily provide.

Procedure

As part of the academic program's didactic coursework, first year OT graduate students enrolled in a two-course sequence in neuroscience that spanned a 16-week spring semester and a 7-week summer semester. The syllabus descriptions related to the courses outline that through the two-course sequence, students will develop a basic understanding of the neural mechanisms that underlie the sensory, motor, cognitive, and affective functions needed for full engagement in activities of daily living, as well as how neural mechanisms are affected by changes in experience, including increases and decreases in stimulation.

During the 16-week spring semester, the course met twice per week whereas during the 7-week summer semester the second course of the sequence met once per week. While most content was delivered via traditional lecture format with assigned pre-readings for each class period, four class periods during the spring semester and two class periods during the summer semester included whole group content review followed by small group application work using the IF-AT scratch-off card system.

During the four designated dates of class during the16-week spring semester and the two designated dates of class during the 7-week summer semester, students were randomly divided by the sort function on excel and assigned to twenty-six learning teams of three students each and two learning teams of four students each. Learning teams stayed the same for the 16-week semester, then were re-shuffled via the sort function on excel for the 7-week summer semester. Learning team size was determined based on available literature regarding small group discussion (Lumpkin et al., 2015), OT student feedback on previous evaluations from other courses regarding preference for group sizes for learning, and the space available for students to work in small groups during the time of the course each semester.

Teams were distributed one large envelope containing the following items: one penny, question packets (see Table 1 below for sample questions), and an IF-AT

scratch-off card. All question items were based on assigned readings and lecture content, and were written by one of the researchers who also served as co-course master of the neuroscience two-course sequence. Each group began working at relatively the same time and, on average, took forty-five to sixty minutes per class period to work through 15 - 20 questions.

The cover page of the question packet contained the following instructions:

Read each question carefully and discuss each question and the associated possible answers as a team. All team members need to weigh in on the possible answer. Once the team arrives at a consensus, scratch off your answer. If a star appears, the answer is correct and full credit is earned. If a star does not appear, the initial attempt was incorrect. As a team, continue to attempt the question until a star appears, regardless of the number of trials. Partial credit may be earned even if the first attempt was incorrect.

1. *Take your time to be sure you are scratching the line of the IF-AT form that you wish to scratch-off! We can't undo a choice that was scratched-off.*
2. *All students should read the question and all answer options slowly and accurately.*
3. *The star for the correct answer can appear anywhere in the box, so scratch off the ENTIRE box.*
4. *"IF-AT" first you don't succeed, try, try again. "IF-AT" first you don't succeed… keep working until you arrive at the correct answer. If you don't, you cannot receive partial credit.*
5. *When finished, place the IF-AT scratch-off card, coin, and ALL question packets in the envelope and return to the instructor. If question packets are missing, points are deducted.*

Table 1

Sample Items from IF-AT Question Packets Based on Lecture Topics

An individual presents with changes in behavior and language. This observation is indicative of what type of neurodegenerative disease associated with AD? A. Huntington's Disease B. Creutzfeldt-Jakob Disease C. Vascular dementia D. Lewy Body dementia E. Frontotemporal dementias
An individual with the following type of aphasia demonstrates good auditory comprehension and intact reading and writing, but slow and labored speech patterns with frequent errors in articulation. A. Global aphasia B. Apraxia C. Wernicke's aphasia D. Broca's aphasia E. None of the above
An individual with the following type of aphasia demonstrates the loss of all language skills, yet may appear to understand more than he/she actually does due to the ability to relate to facial expressions and gestures.

DOI: 10.26681/jote.2019.030301

A. Global aphasia
B. Broca's aphasia
C. Wernicke's aphasia
D. Apraxia
E. None of the above

Which of the following is considered an accurate general principle of aphasia recovery?

A. Expressive language recovers more rapidly than receptive language.
B. Aphasia as a result of a traumatic incident tends to recover more completely than aphasia as a result of a vascular incident.
C. Broca's aphasia has the poorest outcome.
D. Right-handed individuals may experience a varied recovery pattern which strays from general principles of aphasia recovery.
E. None of the above.

Damage to the Primary Motor Cortex, such as due to a CVA, may result in an individual:

A. With deficits in motor movements of the UE
B. With deficits in motor movements of the LE
C. With deficits in motor movements of the face
D. With multiple motor deficits
E. All of the above

At the conclusion of time, all items were placed in the envelope and returned to the instructor. Each question item for each group was graded on the following scale: zero credit earned for four attempts for the group to arrive at the correct answer, quarter credit earned for three attempts for the group to arrive at correct answer, half credit earned for two attempts for the group to arrive at correct answer, and full credit earned by the group for achieving the correct answer on the first attempt. Following conclusion of the sixth and final IF-AT group work experience during the 7-week summer semester, the instructor distributed in-class handwritten questionnaire to students which they had the option to complete in order to inform the course instructor as to their opinion of the use of the IF-AT system.

RESULTS

The researchers identified five primary themes and two sub-themes from the data: receiving instant feedback, engaging in collaborative learning (sub-themes of promotes discussion and facilitates team problem-solving), allowing for increased work time, creating small work teams, holding students individually accountable. Table 2 summarizes these themes and highlights statements of support.

Table 2

Themes, Subthemes, and Supporting Statements

Themes & Subthemes	Participant Statements to Support Themes
Receiving Instant Feedback	"Nice to have the instant feedback and problem solve if the answer was wrong. Forces learning!" "We liked the instant feedback - keep using them! It helps us know if we understand the material since we don't have to wait until tests are graded to see if we are right."
Engaging in Collaborative Learning Sub-themes: • Promotes discussion	"The cards are good, generate good discussion." "It forces us to go through each answer, which means we talk about the concepts in depth."
• Facilitates team problem-solving	"We loved the scratch off cards - it allowed for a lot of collaboration between group members and facilitated discussion which is realistic of a real clinical setting."
Allowing for Increased Work Time	"…allowing for more time to discuss each question." "…[we] find the time constraints difficult to adhere to when there are three people brainstorming and coming to a conclusion." "Small group work can be improved by increasing the time allowed for discussion, as well as increasing clarity of questions."
Creating Small Work Teams	"...having the same group for the whole time was nice (helped build a cohesive team)." "We felt we learned best working as a small group." "It was helpful to work as a team in making "clinical-like" decisions as a group."
Holding Students Individually Accountable	"We liked our group, felt like we were well balanced, but doing a group feedback survey at the end of the semester might be a good idea to make sure all group members are pulling their weight." "IF-AT facilitates group knowledge by keeping us accountable for the information..."

DOI: 10.26681/jote.2019.030301

Theme I: Receiving Instant Feedback
A prevalent participant response regarding use of the IF-AT system was that instant feedback was beneficial to the learning process. Participants unanimously agreed that instant feedback elicited corrective feedback, as students knew immediately if their selected answer was correct or incorrect. Students who did not select the correct answer initially utilized problem-solving and discussion to choose a secondary answer. One participant commented, "It helps us know if we understand the material since we don't have to wait until tests are graded to see if we are right." Instant feedback provides a learning platform that takes the guesswork out of lingering questions and gives students the opportunity to leave the classroom with knowledge of correct answers. While the instructor is on hand and may be accessed if the learning team is truly at a standstill, instant feedback primarily occurs via the IF-AT system followed by group discussion instead of verbal interference from the instructor.

Theme II: Engaging in Collaborative Learning
Participants found the IF-AT process encouraged collaborative learning in the form of teamwork and the ability to deliberate with others. When uncertain of the best answer, students had the opportunity to analyse together to select the most appropriate answer. Within this collaborative learning process, two sub-themes emerged:

Sub-theme: Promotes discussion. Many participants commented positively regarding discussion that occurred due to the nature of the IF-AT process. Traditional testing techniques deny students the opportunity to engage in higher level cognitive thinking through discussion. The IF-AT is grounded in the ability for students to work together, discuss, and rationalize through complex problems. Discussion allows multiple voices and opinions to be heard, giving students the opportunity to formulate conclusions from various standpoints. Discussion allows multiple voices and opinions to be heard, giving students the opportunity to formulate conclusions from various standpoints. Discussion is a vital component to the learning process, as it promotes retention of knowledge and higher-level thinking.

Sub-theme: Facilitates team problem-solving. A common statement among participant responses was the outcome of team problem-solving through IF-AT implementation. Problem-solving, in general, is a critical skill for learners to acquire so that material presented in the classroom can be mentally manipulated to fit various situations. Team problem-solving elevates student learning by incorporating multiple thought processes and knowledge bases.

Theme III: Allowing for Increased Work Time
In this study, participants were given an average of 60 minutes to discuss 10 questions and associated content with their peers. Many participant responses indicated that more time is needed to facilitate effective discussion. Participants felt the collaborative and brainstorming process utilized in the IF-AT process innately requires more time than answering questions individually, as in traditional multiple-choice testing. Additionally, participants noted that questions should be worded concisely and clearly to avoid unnecessary deliberation of what the question is asking.

Theme IV: Creating Small Work Teams
Data revealed the impact of team structure on the student learning process. In general, participants commented on the effectiveness of having a team for collaboration, critical thinking, and discussion. For this study, each group was comprised of three students with two groups having four students, and groups remained consistent throughout the 16-week semester and were then switched for the 7-week summer semester, which yielded various participants responses. One participant stated, "Small groups can be improved if the groups are different for each synthesis. This would ensure that everyone prepares equally because the groups would be unannounced." Conversely, a participant said, "It was nice to have the same members for each synthesis and to keep each other accountable."

An important component of team structure is the number of students within each group. Participants consistently stated that three members per group was an appropriate number and promoted thoughtful discussion. One participant commented, "The group size is also conducive to allowing all voices and options to be heard and valued," indicating that small group sizes are preferred due to a greater opportunity for everyone to give input.

Theme V: Holding Students Individually Accountable
Another theme that appeared within the qualitative data was the promotion of individual accountability due to the nature of the IF-AT. Participants felt a sense of responsibility to study the material prior to being tested since their knowledge could impact the group grade. Additionally, the group testing process quickly revealed if a student did not study the material or could not contribute to group discussion. A few responses indicated the need to have peer review or a group feedback survey for students to express concern if they felt a peer was not providing adequate input.

DISCUSSION
Existing research shows the benefits of using the IF-AT system for learning outcomes, including knowledge retention and increased critical thinking. This study sought to explore the student voice and perceptions of IF-AT use. In general, results from this study indicate positive student experiences with increased student engagement, collaboration, and learning.

Positive feedback included comments such as, "[We] enjoyed working in groups for synthesis and using peers for bouncing ideas off each other to problem solve." This view of discussion through the IF-AT process is consistent with well-established literature examining the team process involved with TBL (Michaelsen, 2002; Middleton-Green & Ashelford, 2013; Sibley & Ostafichuk, 2014) within the higher education classroom. When researching the effectiveness of TBL within a microbiology course, Harakuni, Nagamoti, and Mallapur (2015) found that 68% of students felt active discussion was facilitated among group members. Smith et al. (2009) asserted that peer discussion allowed students who did not initially know an answer to apply concepts learned in discussion to correctly answer similar, subsequent questions. Another student response included, "[The IF-AT] allows for collaborative problem solving and discussion of concepts." Peck, Werner, and Raleigh (2013) found that collaborative learning via the IF-AT process assisted in retention of knowledge and higher test scores due to in-class discussion and immediate knowledge of the answer, versus traditional multiple-choice testing.

DOI: 10.26681/jote.2019.030301

While most feedback proved positive toward use of IF-AT, several recommendations were made regarding implementation and use of the IF-AT within the classroom, including environmental set-up and logistics. Participants in this study received 45 - 60 minutes for 15 - 20 questions following review of content, during a one hour and 50-minute class. Many participants commented that more time should be allotted toward IF-AT to enhance discussion and content analysis. Previous research supports this finding, as indicated by Harakuni et al. (2015) who noted that more time should be allotted toward discussion to further enhance the learning process, per qualitative student responses. This knowledge will allow instructors to allocate more time to discussion, versus traditional lecture presentation of material.

As noted in the findings, team structure played an important role in participant satisfaction of IF-AT implementation. A few participants requested that the instructor notify students of whether group members will remain consistent or will be varied throughout the course. Given this feedback, instructors should clearly explain group logistics to the students at the onset of IF-AT implementation. Results from this study indicated mixed feelings regarding the maintenance of consistent group members during the semesters, though traditional TBL methods suggest groups remain consistent throughout the course (Koles et al., 2010). Additionally, participants appreciated the small group size of three to four students, though traditional TBL methods suggest group sizes of five to seven students (Koles et al., 2010).

In this study, the instructor gave participants partial credit if they were incorrect with answer selection on the first try but were able to determine the correct answer on the second attempt. An overwhelming number of participants commented on the effectiveness and satisfaction of receiving partial credit. A participant stated, "We enjoy receiving partial credit, being able to work through answers by elimination, and know the correct answers at the end of the test." Another participant commented, "We don't like that you can't change your mind," when using the IF-AT system. The ability to receive partial credit helps negate this downfall of the IF-AT process; whereas traditional multiple-choice or online exams typically allow students to change their answer selection, if desired, students using the IF-AT are not able to change answers due to the nature of the scratch-off system. Therefore, careful discussion and group decision-making must occur. A highlight of student recommendations is noted below in Table 3.

Table 3

Student Recommendations

- Create an environment conducive to small group work, including quiet spaces, few distractions, and work areas for research or written work.
- Provide each student a copy of the test or questions so students are not required to share question packets.
- Allow ample time for group discussion.
- Allow students the ability to receive partial credit reduces stress and anxiety of answering questions using the IF-AT.

Regarding the instructor perspective, ample time must be dedicated to IF-AT preparation to ensure accuracy in test questions and answers corresponding to the pre-fabricated scratch-off cards. The researchers recommend enlisting the assistance of an editor to check all questions and answers against the printed key provided by Epstein which is mailed with each pack of IF-AT cards ordered. Errors in test questions or answers disrupts a group's dynamic and flow, and may prevent a group from fully grasping the intended concept. Ample time must be allotted to assemble group packets with necessary materials, including one scratch-off card, one coin, and printed questions for each group member.

Limitations

This study aimed to examine the student perspective on IF-AT use but did not measure knowledge retention or compare students' opinion of IF-AT use to traditional lectures. As this method strays from traditional lecture format, students who prefer and/or expect more traditional ways of content delivery may be reluctant to "buy in" to the process associated with the IF-AT, thus contributing at a level inferior to their learning team peers. While TBL is well supported by evidence and the IF-AT system is established as complementary to the team assessment portion of TBL as well as a stand-alone assessment technique, due to time constraints, the individual testing portion was not completed by the participants, among other key aspects of TBL protocol. Therefore, piloting the use of the IF-AT system during this course was a clear departure from the TBL protocol. While use of this exclusion limited the participants' ability to test their personal knowledge and potentially decreased the level of individual accountability due to some participants relying on group members to select the correct answer. The researchers also acknowledge the learning teams were slightly smaller at three to four students per group versus the recommended five to seven students per group format associated with the TBL protocol. Time constraints also warranted the exclusion of another step of the TBL process which provides a mini-lecture to students following the team assessment process and is based on concepts students struggled with the most. While the current study was a pilot of the use of the IF-AT system in the course, future consideration for implementation of the traditional TBL format with the use of IF-AT as part of the team assessment should be considered.

Future Studies

While this study provides valuable information regarding students' perception of IF-AT use in the classroom, future studies are needed to examine the longitudinal impact of IF-AT on knowledge retention, learning, and professional practice should be examined. Additionally, more research is needed to thoroughly capture the student voice, as well as quantitative student outcomes, regarding use of the IF-AT system to promote learning and retention of learning through assessment, and group-based discussion. Given the onset and advancement of educational technologies in recent decades, future studies should also consider how a system like the IF-AT might interface with technology to benefit or hinder learners.

CONCLUSION AND IMPLICATIONS FOR OT EDUCATION

Aligned with the American Occupational Therapy Association's *Philosophy of Occupational Therapy Education* that states, "Occupational therapy educators use active learning that engages the learner in a collaborative process that builds on prior knowledge and experience and integrates professional academic knowledge,

DOI: 10.26681/jote.2019.030301

experiential learning, clinical reasoning, and self-reflection" (AOTA, 2015, p. 678), active learning has transformed the traditional lecture-style classroom, and much research has been dedicated to the educational benefits of utilizing active learning. Results from this study are consistent with existing research with participants finding the IF-AT to be engaging, collaborative, and beneficial to the learning process, thus a feasible option for occupational educators seeking to transform lecture-style class time to interactive, discussion-based forums that facilitate critical thinking and group problem solving. The *Occupational Therapy Education Research Agenda – Revised* (AOTA, 2018) organizes seven categories for OT Educational research, two of which are signature pedagogies and instructional methods. Findings of this study suggest the importance of capturing the student voice to inform both categories of the *Agenda*, yet serve as a reminder of the necessity of OT educational research to determine best practice in educating the occupational therapists of tomorrow.

References

American Occupational Therapy Association. (2015). Philosophy of occupational therapy education. *American Journal of Occupational Therapy, 69*(Suppl. 3), 6913410053. https://doi.org/10.5014/ajot.2015.696S17

American Occupational Therapy Association. (2018). Occupational therapy education research agenda – revised. *American Journal of Occupational Therapy*, *72*(Suppl, 2), 7212420070p1-7212420070p5. https://doi.org/10.5014/ajot.2018.72S218

Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. 1991 ASHE-ERIC Higher Education Reports, Washington, D.C.

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncology Nursing Forum, 41*(5), 545- 547. https://doi.org/10.1188/14.ONF.545-547.

Doshi, N.P. (2017). Effectiveness of team-based learning methodology in teaching transfusion medicine to medical undergraduates in third semester: A comparative study. *Asian Journal of Transfusion Science*, *11*(2), 87-94. https://doi.org/10.4103/ajts.AJTS_123_16

Epstein Educational Enterprises (n.d.). Retrieved from http://www.epsteineducation.com/home/about/default.aspx

Evans, R. R., & Forbes, L. (2012). Mentoring the 'net generation:' Faculty perspectives in health education. *College Student Journal, 46*(2), 397-404.

Flores, K. L., Matkin, G. S., Burbach, M. E., Quince, C. E., & Harding, H. (2012). Deficient critical thinking skills among college graduates: Implications for leadership. *Educational Philosophy and Theory, 44*(2), 212-230. https://doi.org/10.1111/j.1469-5812.2010.00672.x

Harakuni, S. U., Nagamoti, J. M., & Mallapur, M. D. (2015). Effectiveness of team-based learning in microbiology: A non-randomized control study. *Education for Health*, *28*(1), 41. https://doi.org/10.4103/1357-6283.161849

Hopkins, L., Hampton, B. S., Abbott, J. F., Buery-Joyner, S. D., Craig, L. B., Dalrymple, J. L., ... & Wolf, A. (2018). To the point: Medical education, technology, and the millennial learner. *American Journal of Obstetrics and Gynecology*, *218*(2), 188-192. https://doi.org/10.1016/j.ajog.2017.06.001

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277 – 1288. https://doi.org/10.1177/1049732305276687

Kim, H. R., Song, Y., Lindquist, R., & Kang, H. Y. (2016). Effects of team-based learning on problem-solving, knowledge and clinical performance of Korean nursing students. *Nurse Education Today*, *38*, 115-118. https://doi.org/10.1016/j.nedt.2015.12.003

Koles, P. G., Stolfi, A., Borges, N. J., Nelson, S., & Parmelee, D. X. (2010). The impact of team-based learning on medical students' academic performance. *Academic Medicine*, *85*(11), 1739-1745. https://doi.org/10.1097/ACM.0b013e3181f52bed

Lai, K. W., & Hong, K. S. (2015). Technology use and learning characteristics of students in higher education: Do generational differences exist? *British Journal of Educational Technology, 46*(4), 725-738. https://doi.org/10.1111/bjet.12161

Lumpkin, A., Achen, R. M., & Dodd, R. K. (2015). Student perceptions of active learning. *College Student Journal, 49*(1), 121-133.

Maurer, T. W., & Kropp, J. J. (2015). The impact of the Immediate Feedback Assessment Technique on course evaluations, *Teaching & Learning Inquiry, 3*(1), 31-46. https://doi.org/10.20343/teachlearninqu.3.1.31

Michaelsen, L. K. (2002). Getting started with team learning. In L.K. Michaelsen, A.B. Knight, & L.D. Fink (Eds.). *Team-based learning: A transformative use of small groups in college teaching*. Westport, CT: Greenwood.

Middleton-Green, L., & Ashelford, S. (2013). Using team-based learning in teaching undergraduate pathophysiology for nurses. *Health and Social Care Education*, *2*(2), 53-58. https://doi.org/10.11120/hsce.2013.00031

Peck, S. D., Werner, J. L. S., & Raleigh, D. M. (2013). Improved class preparation and learning through immediate feedback in group testing for undergraduate nursing students. *Nursing Education Perspectives*, *34*(6), 400-404. https://doi.org/10.5480/11-507

Schwartz, A. C., McDonald, W. M., Vahabzadeh, A. B., & Cotes, R. O. (2018). Keeping up with changing times in education: Fostering lifelong learning of millennial learners. *Focus*, *16*(1), 74-79. https://doi.org/10.1176/appi.focus.20170004

Sibley, J., & Ostafichuk, P. (2014). *Getting started with team-based learning*. Sterling, VA: Stylus Publishing.

Smith, M. K., Wood, W. B., Adams, W. K., Wieman, C., Knight, J. K., Guild, N., & Su, T. T. (2009). Why peer discussion improves student performance on in-class concept questions. *Science*, *323*(5910), 122-124. https://doi.org/10.1126/science.1165919

Thompson, B. M., Schneider, V.F., Haidet, P., Levine, R. E., McMahon, K. K., Perkowski, L. C., & Richards, B. F. (2007). Team-based learning. *Medical Education*, *41*, 250-257. https://doi.org/10.1111/j.1365-2929.2006.02684.x

DOI: 10.26681/jote.2019.030301