The “Look Ahead” Technique: A Novel Way to Engage Medical Students in the Radiology Reading Room

Jennifer Huang, MD, MEd, Brian Bingham, MD, Martin Jordanov, MD

Rationale and Objectives: Engaging medical students during a radiology course can be challenging. We sought a way to actively engage students with live cases, allow them to interact with the picture archiving and communication system workstation, and experience what it is like to be a radiologist.

Materials and Methods: Medical students enrolled in one of three radiology courses between May 2016 and June 2017 were eligible. The “Look Ahead” technique is as follows: a preceptor identifies several nonurgent imaging studies and allows the students to view the images first and make independent observations and conclusions. When ready, the students present their findings, receive feedback, and observe the preceptor generate a final report. Students completed the postcourse survey comparing the “Look Ahead” technique with the current standard (observing a preceptor interpret imaging studies with accompanying teaching points).

Results: Thirty-four (56.7%) of 60 potential respondents completed the postcourse survey. Of these 34, 24 (70.6%) reported at least one reading room case (mean 4.6) in which the technique was employed, with a mean of 2.4 unique preceptors. When compared to the current standard (0 = not to 100 = very interested/engaged/valuable/memorable), the “Look Ahead” technique was associated with increased student-reported interest (92.5 vs 75.1, p < 0.01), engagement (94.0 vs 70.3, p < 0.01), educational value (92.5 vs 73.2, p < 0.01), memorability of the case (88.5 vs 73.2, p < 0.01) and of accompanying teaching points (90.1 vs 76.7, p < 0.01).

Conclusion: The “Look Ahead” technique is a meaningful and engaging teaching method, which students find “interesting,” “valuable,” and “memorable.”

Key Words: Active learning; Radiology education; Situated learning.

© 2020 The Association of University Radiologists. Published by Elsevier Inc. All rights reserved.

INTRODUCTION

The teaching of medicine can be considered through the educational theory of situated learning, first described by Lave and Wenger in 1991 (1). According to this theory, moving from a newcomer to an experienced member of a community of practice involves initial participation in simple, low-risk tasks that are still productive and necessary within the practice. Lave and Wenger coined the term legitimate peripheral participation to describe the role of newcomers to a community (1). Through active engagement and participation in these basic tasks, learners gain insight into the practitioners’ meaningful perspective (2). Over time, learners have the ability to become more and more central to the community, taking on increasing responsibility.

This resembles the kind of learning that medical students currently do for many other skills, including taking a history and physical, presenting to attendings on rounds, and writing notes in the electronic medical record. Each of these tasks is a relatively simple and low-risk accomplishment that allows the student an opportunity to participate in vital practices of the medical field. With appropriate oversight, medical students are even encouraged to participate in what might be considered more difficult or risky procedures, such as suturing in the operating room or intubating patients. These small yet meaningful experiences give students a glimpse of the experienced practitioners’ perspective within the field of medicine, inviting them as members into the community (3).

For many reasons in radiology, including lack of time and compensation for teaching, knowledge of how and what to teach, and other frequent disruptions with an ever-growing work list, students often take on an observer role in the reading room (4). Rather than being asked to take part in the day-to-day practices of a radiologist, students are frequently relegated to a position of passive observation and shadowing.
The experience quickly becomes tedious, forgettable, and easy or boring (5,6).

This is an unfortunate reality because students seek more stimulating and enriching radiology experiences (7–9). Indeed, previous work recognizes the improved academic achievement and student engagement with experiential learning techniques in radiology, such as flipped classroom sessions, online case-based modules, and adaptive case-based programs (10–12).

Importantly, the impact of providing students with the opportunity to interpret current imaging studies in real time, as practicing radiologists do daily, has not been studied. This study seeks to provide a method for actively engaging students with live cases, allowing them to interact with the picture archiving and communication system (PACS) workstation, and more accurately simulating what it is like to be a radiologist.

MATERIALS AND METHODS

All second-, third-, and fourth-year medical students who were enrolled in one of three elective radiology courses at a large academic institution from May 2016 to June 2017 were eligible. The three courses, which are only offered to clinical students, are either 2-week-long or month-long electives.

The investigated “Look Ahead” technique is as follows: prior to completing a final interpretation, a preceptor identifies one or more nonurgent imaging studies, allowing the students in the room to view the images on their own first and to make their own findings and conclusions. At our institution, students could accomplish this task on an unused PACS station (when one was available) or on the students’ laptops or tablets (students were able to connect remotely to our PACS server on their portable devices). When ready, the students present their findings and conclusions to the preceptor, discuss the case and receive feedback from the preceptor, and finally observe the preceptor generate a final report (Fig 1). The technique was used with one or several students, which varied depending on the number of students in the reading room at the time. Ideally, this would take place multiple times throughout the day and throughout the elective, allowing students multiple opportunities to make their own interpretations and learn from their previous attempts. This stands in contrast to the current standard of teaching in the reading room, which is observing a preceptor interpret imaging studies with accompanying teaching points.

In order to facilitate implementation of the “Look Ahead” technique, several faculty members of different subspecialties within the institution’s Department of Radiology who had shown an interest in medical student education were identified. These preceptors received an explanation of the teaching technique and were encouraged to use it when working with medical students in the reading room.

Throughout the radiology rotations, each participating student had the opportunity to experience both the “Look Ahead” technique with the selected faculty members as well as the current standard with other faculty. Each student thus served as his/her own control, comparing the “Look Ahead” technique with the current standard.

At the conclusion of the course, a postcourse survey created through RedCap was emailed to each of the enrolled students. The anonymous and voluntary survey included Likert-type scale and open-response questions that compared the “Look Ahead” technique with the current standard.

All statistical analyses were completed using R version 3.4.0 (15). Wilcoxon rank sum tests were used for analyses of continuous variables. A $p$ value of less than 0.05 was considered statistically significant for all analyses. This study was exempt from Institutional Review Board review at our institution.

RESULTS

Of the 60 potential respondents, 34 (56.7%) completed the postcourse survey. Twenty-four (70.6%) of the 34 participants reported at least one reading room case in which they had the opportunity to employ the “Look Ahead” technique. Among these 24 students, the average number of cases utilizing the technique was 4.6 (minimum 1, maximum 10) and the average number of unique preceptors with whom the technique was employed was 2.4 (minimum 1, maximum 10).

“Look Ahead” Technique

Preceptor

Preceptor identifies 1-3 non-urgent studies

Preceptor continues typical workflow

Students present findings and conclusion to preceptor

Preceptor provides feedback and teaching points

1-4 medical students

Students work through studies at workstation

Diagram depicting the flow and components of the “Look Ahead” technique. The investigated “Look Ahead” technique provides students with an authentic experience simulating one aspect of a radiologist’s daily practice. The approach is as follows: a preceptor identifies and postpones final interpretation of one or more non-urgent imaging studies for a few minutes. The students in the room work together to look through these images and make their own findings and conclusions, while the preceptor continues her typical workflow. When ready, the students present their findings and conclusions to the preceptor, receive feedback regarding their interpretation, and finally observe the preceptor generate a final report.

Figure 1.
When compared to the current standard, the “Look Ahead” technique was associated with increased student-reported interest (92.5 vs 75.1, \( p < 0.01 \); 0 = not to 100 = very interested), engagement with the case (94.0 vs 70.3, \( p < 0.01 \); 0 = not to 100 = very engaged), educational value of the experience (92.5 vs 73.2, \( p < 0.01 \); 0 = not to 100 = very valuable), and memorability of the case (88.5 vs 73.2, \( p < 0.01 \); 0 = not to 100 = very memorable). In addition, the “Look Ahead” technique was associated with significantly increased memorability of the teaching points made by the preceptor, the underlying pathophysiology of the associated disease process, and/or underlying physics of the imaging study (90.1 vs 76.7, \( p < 0.01 \); 0 = not to 100 = very valuable), and memorability of the case (85.2 vs 73.2, \( p < 0.01 \); 0 = not to 100 = very memorable). The results of our study suggest that the “Look Ahead” technique for medical student instruction in the radiology reading room promotes active student engagement and instills educational value. This builds on previous work that recognizes the increased student engagement with active learning techniques in radiology, such as case-based modules and flipped classroom sessions (10–12). However, in contrast to these previously described learning methods, the particular appeal and uniqueness of the “Look Ahead” technique, as described by several students in this study (Table 2), is that the cases are completely new and received before the study being read (13). I think it is great and everyone wins when we do it, breaking this opportunity for legitimate peripheral participation, we allow students access to the practitioners’ perspective and provide a sense of purpose within the community. This meaningful practice further facilitates the learners’ incorporation of new knowledge within preexisting knowledge (4).

Alternate “entry-level tasks” providing engaging experiences have previously been described. Naeger et al suggest that for 60 minutes at the start of every day, students preview chest radiographs for a variety of specific findings, such as lines or pneumothoraces, followed by a short review of the cases. Multiple examples of virtual workstations have been designed to provide medical students with simulated and more engaging experiences of interacting with and interpreting studies (15,16). Several institutions have also allowed upper-level medical students to volunteer as radiology call triage assistants, answering phone calls after hours and discussing nonurgent results with ordering providers (17–21). The “Look Ahead” technique is an additional new method for encouraging students to become a part of the radiology team.

An additional unexplored benefit to the “Look Ahead” technique is that it more clearly delineates faculty time focused on patient care and that dedicated to education. In the traditional method of teaching, with preceptors offering teaching points in the midst of dictating a study, it is often

### Table 1. Student Evaluations in Multiple Categories Comparing the “Look Ahead” Technique with the Current Standard of Observation with Accompanying Teaching Points

<table>
<thead>
<tr>
<th>Category</th>
<th>Current Standard (Review with Teaching)</th>
<th>“Look Ahead”</th>
<th>95% CI</th>
<th>( p ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement with case</td>
<td>70.3*</td>
<td>94.0</td>
<td>((-30.7, -16.7))</td>
<td>(&lt;0.01)</td>
</tr>
<tr>
<td>Interest in case</td>
<td>75.1</td>
<td>92.5</td>
<td>((-23.3, -11.5))</td>
<td>(&lt;0.01)</td>
</tr>
<tr>
<td>Educational value of experience</td>
<td>73.2</td>
<td>92.5</td>
<td>((-25.8, -12.7))</td>
<td>(&lt;0.01)</td>
</tr>
<tr>
<td>Memorability of case</td>
<td>73.2</td>
<td>88.5</td>
<td>((-22.4, -8.2))</td>
<td>(&lt;0.01)</td>
</tr>
<tr>
<td>Memorability of teaching points</td>
<td>76.7</td>
<td>90.1</td>
<td>((-19.4, -7.4))</td>
<td>(&lt;0.01)</td>
</tr>
</tbody>
</table>

* Experiences were scored 0–100, with 0 denoting not interested/engaged/valuable/memorable, 50 denoting neutral, and 100 denoting very interested/engaged/valuable/memorable.

### Table 2. Student Comments Regarding the Utility of the “Look Ahead” Technique as a Learning Approach.

- “The method of reviewing cases on my own/with other medical students, then discussing with the preceptor was fantastic, a great way to learn.”
- “Reviewing independently before discussion with a preceptor is a great way to learn in radiology as a medical student.”
- “The best case scenario is where you get the original chief complaint and the opportunity to look through the patient’s chart at information that arrived prior to the study being read. That is the most realistic scenario.”
- “More interaction is always better and the chance to make mistakes helps me remember across all medical teaching.”
- “Only [two faculty members] presented the opportunity to ‘look ahead’. I think it is great and everyone wins when we do it, but not everyone in the department is on board yet.”

### Discussion

Breaking from the traditional way of teaching can be understandably difficult for some radiologists, particularly with busy caseloads and other frequent disruptions (14). However, taken together, the results of our study suggest that the “Look Ahead” technique for medical student instruction in the radiology reading room promotes active student engagement and instills educational value. This builds on previous work that recognizes the increased student engagement with active learning techniques in radiology, such as case-based modules and flipped classroom sessions (10–12). However, in contrast to these previously described learning methods, the particular appeal and uniqueness of the “Look Ahead” technique, as described by several students in this study (Table 2), is that the cases are completely new and received by students just as the radiologists do on their work lists. In creating this opportunity for legitimate peripheral participation, we allow students access to the practitioners’ perspective and provide a sense of purpose within the community. This meaningful practice further facilitates the learners’ incorporation of new knowledge within preexisting knowledge (4).

Alternate “entry-level tasks” providing engaging experiences have previously been described. Naeger et al suggest that for 60 minutes at the start of every day, students preview chest radiographs for a variety of specific findings, such as lines or pneumothoraces, followed by a short review of the cases. Multiple examples of virtual workstations have been designed to provide medical students with simulated and more engaging experiences of interacting with and interpreting studies (15,16). Several institutions have also allowed upper-level medical students to volunteer as radiology call triage assistants, answering phone calls after hours and discussing nonurgent results with ordering providers (17–21). The “Look Ahead” technique is an additional new method for encouraging students to become a part of the radiology team.

An additional unexplored benefit to the “Look Ahead” technique is that it more clearly delineates faculty time focused on patient care and that dedicated to education. In the traditional method of teaching, with preceptors offering teaching points in the midst of dictating a study, it is often
difficult to identify the particular moments that faculty members allot to education (4). The “Look Ahead” technique provides finite measurable instances in which preceptors are specifically focused on teaching, namely the back-and-forth interactions between the students and preceptor when they review the learner’s findings. The precise benefit of this could be explored in further research soliciting feedback from faculty members who have used the technique.

Despite the potential benefits of this technique, the relatively low average number of cases with unique preceptors with which the “Look Ahead” technique was utilized in our study highlights the need for increased awareness of alternate teaching methods in the reading room. Utilization of this technique and others like it must become more routine and more widespread at the clinical workstation. Just as medical students are expected to present histories and physicals while on the medicine or surgery team, we must get to a point where students on radiology, too, expect that when in the reading room, they will be active members of the team (6). This first requires a change in our own ideas of what it means to be an educator in radiology and a specialty-wide acknowledgement to be devoted to education.

There are several limitations of this study, including the small number of participants. With a relatively low response rate, a response bias may play a role in the significance of our results; namely that participants who chose to respond to the survey may be those students who found the technique more beneficial than those who did not respond. In addition, only those preceptors who had already shown an interest in medical student education were asked to implement the “Look Ahead” technique in this study. There may be an unmeasured difference in the types of preceptors willing to employ the technique compared to other faculty members. Specifically, the preceptors who agreed to employ this novel technique may offer a better educational experience regardless of the teaching techniques utilized. More widespread dissemination of the learning approach would help answer these questions. Students were also asked to recall their experiences at the conclusion of the rotation, which may have affected their responses. Finally, the novelty of the “Look Ahead” technique compared to the more traditional shadowing in the reading room may leave students with a more favorable outlook on the new method.

Although the results of this study suggest significant utility of the “Look Ahead” technique, there is also substantial room for improvement. First, we must seek more opportunities to help our students gain additional experience as potential radiologists. While caring for patients on clinical teams, students write progress notes, just as residents and attendings do on a daily basis. Similarly, medical students in the reading room could write or dictate a formal interpretation for these real-time studies in a simulated software system (ie, “Indication”, “Technique”, “Comparison”, “Findings”, and “Impression”), giving them even more hands-on experience at the workstation.

Second, this study focused only on learner feedback of this teaching technique. It would be important to solicit feedback from faculty members and resident physicians regarding their thoughts on the technique and whether they feel the student is more engaged or whether it is feasible with their caseload.

Third, the impact of the “Look Ahead” technique on students’ ability to review and interpret imaging studies should be studied. Although the demonstrated increase in engagement and interest suggests the educational utility of “Look Ahead,” the impact of this technique on student performance or on career choice is unknown. Should a performance benefit be confirmed, the case for further and more widespread implementation of the “Look Ahead” technique only becomes stronger and the impetus for further refinement more clear.

CONCLUSION

The “Look Ahead” technique is a meaningful and engaging teaching method that gives medical students in the reading room an opportunity to interpret live cases independently and to receive feedback on their performance. This affords students a much closer approximation to what it means to be a practicing radiologist. The initial student response to this novel teaching technique is very positive—students find it more “interesting” and “memorable” than traditional passive observation. Further research is warranted regarding its full benefits and alternative approaches to increase student engagement.

REFERENCES


