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# Satisfying Program-Level Outcomes by Integrating Primary Literature into the Online Classroom

George Patchoros and Grace Wenzler

*Department of Engineering, Physics, and Technology, Bronx Community College, Bronx, New York*

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Because of the coronavirus pandemic, there has been a paradigm shift from traditional classroom instruction to remote online modalities. To provide the most current and relevant information on nuclear medicine technology to students without access to traditional resources on a college campus, it has become imperative that primary literature within the field be made readily accessible. Nuclear medicine technology students at Bronx Community College are being taught to use the *Journal of Nuclear Medicine Technology* as the basis for their required presentations, which span the curriculum. Guided by instructors who are armed with a rubric ultimately used as a formative assessment tool, the students are required to explore current articles from the *Journal of Nuclear Medicine Technology* and ultimately present their findings to their cohort. By design, this article-share project has successfully been implemented as a principal metric in satisfying the program accreditation requirements of the Joint Review Committee on Nuclear Medicine Technology while also being conducive to increasing oral presentation skills and cohort socialization.

**Key Words:** program outcomes; formative assessment; online; primary literature; distance learning

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**A**s a general concept, education can be defined as “the process of receiving or giving systematic instruction” (1). However, for this process to be effective, there are many variables that must be addressed. Traditionally, instructors would deliver a steady stream of information to their students through face-to-face interaction within the walls of a classroom. This traditional style of education was conducted solely as a synchronous form of instruction. Although having little flexibility, this system of learning has been widely used, successfully, for many years. However, classroom dynamics are changing. Nuclear medicine technology (NMT) programs around the nation are finding themselves having to adjust to the new modality of distance learning. With distance learning, cognitive development will no longer be confined solely to the walls of a classroom. Specific locations and times will play less of a role in didactic courses.

Whether the transition to distance learning be a natural evolution dictated by expanding technology, or quickly forced on us because of a global pandemic, the establishment of the online classroom will still need to satisfy the accrediting standards of the

Joint Review Committee on Nuclear Medicine Technology (JRCNMT). As outlined in the *Accreditation Standards for Nuclear Medicine Technologist Education* (2), “instructional faculty must demonstrate effectiveness in teaching courses, supervising laboratory experiences, evaluating student achievement, and developing curriculum. Faculty must also participate in program policy and procedure formulation and the assessment of program effectiveness.” Accreditation standard B1.1 further asserts that “the sponsor must provide sufficient resources to ensure achievement of the program’s mission and expected outcomes.” These standards are required to be upheld regardless of the modality of instruction.

Lack of resources such as laboratory materials and equipment becomes an immediate obstacle to satisfying program requirements in the online classroom. It stands to reason that since students would no longer have access to the usual classroom resources, new types of resources that can be used to satisfy program-level outcomes must be procured.

Nuclear medicine educators who now find themselves having to adapt to an online modality of instruction must be able to share all available resources with students. As a benefit of the free-trial student membership in the Society of Nuclear Medicine and Molecular Imaging (SNMMI), the *Journal of Nuclear Medicine Technology* (*JNMT*) lends itself as a valuable resource for students both inside and outside the classroom because of its accessibility and the relevance of its subject matter.

At Bronx Community College, we have developed projects within our didactic courses based on the integration of SNMMI membership and, specifically, the use of *JNMT* as a source for primary literature (i.e., publication of a scientist’s original research, as opposed to secondary or tertiary sources that summarize or condense primary sources). The implementation of these resources not only helps students understand the subject matter but also, when executed properly, aids in formative and summative assessments of the NMT program, as outlined by the program-level outcomes established by the JRCNMT.

*JNMT* has several benefits that serve students both inside and outside the classroom. As nuclear medicine educators, we feel it is imperative to share the tools available to students in the free-trial membership in the SNMMI. At Bronx Community College, we have developed projects useful in integrating the SNMMI, and specifically *JNMT*, into the classroom that can be completed both in person or in an online classroom setting.

## NMT PROGRAM OVERVIEW

Our NMT program is designed to be completed over 2 y, with the first year consisting of didactic courses and the second year combining didactic courses in the evening and a clinical internship earlier in the day. We introduce *JNMT* into the classroom early

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For correspondence or reprints, contact Grace Wenzler (grace.tursi@bcc.cuny.edu).  
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within the program, and we help students register for SNMMI membership before the first day of class. The NMT program holds an orientation session for incoming students before the beginning of the semester, in which copies of *JNMT* are passed around to the students and they are shown the published information on how to become an SNMMI member. In addition, the program director navigates first-year students through the SNMMI website on the first day of class, demonstrating key tools at the students' disposal. These include article access, scholarship and grant opportunities, information for upcoming events, and job postings. As educators within the program, we feel it is important to introduce these resources to the students early, as they can apply for scholarships and grants that are appropriate, as well as discover the latest and most relevant topics within the nuclear medicine field. For these reasons, we insist that students register for SNMMI membership on entry into the program.

## ARTICLE-SHARE PRESENTATIONS

To generate discussions of current events in NMT, educate students about relevant topics within the field, and cultivate ideas for potential research projects, we have begun to implement an article-share activity.

### First Year

For first-year students, the article-share project begins during the first class (NMT 81, Orientation to Nuclear Medicine) with demonstrating how to navigate the SNMMI website and identify articles within the *JNMT* website. This quick navigation demonstration shows how to search for articles on current industry trends or find published works based on key words. The program director then chooses and shares one such article with the students via a PowerPoint (Microsoft) presentation, highlighting key points from the article and how this news has the potential to impact our field. Moving forward, the students are required to explore the SNMMI website at their own pace throughout the semester, selecting at least 2 articles of interest and posting them on Blackboard, the discussion board feature of our learning management system. The instructor chooses one of these student-selected articles each week and shares it in a presentation at the beginning of class. The articles that are of interest to the students but were not selected for class presentations are shared with the students on Blackboard (in the content section under a separate folder that students can access). This procedure allows students to browse through additional articles of interest at their leisure, and as the journals can be accessed online via the SNMMI website (for which the students have free membership), easily transitioned into the distance-learning teaching format that later had to be adopted because of coronavirus disease 2019 (COVID-19) restrictions. An unforeseen but welcome outcome of the article-share project that we discovered when it was first introduced was that in large part, this was the first time these students were required to use a document from the primary literature as a resource in their course of study. The ultimate presentation of these student-chosen articles by the instructor promotes classroom discussion, enhances the scope of study, and aids in fostering a sense of collaboration among the students.

The article-share presentation is a brief, 5- to 7-min, talk that highlights key points made within the article while allowing for a short discussion period afterward. Instructors who have made such presentations unanimously felt it an excellent way to increase class participation and spark areas of interest within the student groups. An example from *The Journal of Nuclear Medicine* (JNM) that

one instructor used in the first-year class was, "Small-Animal  $^{18}\text{F}$ -FDG PET for Research on *Octopus vulgaris*: Applications and Future Directions in Invertebrate Neuroscience and Tissue Regeneration" (3). This article discussed methods by which  $^{18}\text{F}$ -FDG was used to image regenerative tissue in various octopi. The instructor thought this an excellent article to highlight on the first day of class because it not only demonstrated the unique properties of radiopharmaceuticals but also exhibited the unlimited potential of research being conducted within the field. Instructors who present articles such as this during their first class have noticed that they not only pique the interest of students about the field they have chosen to enter but also serve to break up a long lecture.

To give students an incentive to post articles on Blackboard, such postings have been adopted as a small part of a first-year student's grade. Five percent of the grade is awarded as participation points if a student selects 2 articles of interest and posts them on Blackboard with a brief explanation of why they chose that particular article.

After we completed a 1-y pilot program of using the article-share presentation in our first-year classes, we felt the program to be successful. Not only did it demonstrate the value of the SNMMI and *JNMT*, but it also helped to increase participation within class. Instructors noted that when they were doing article-share presentations, their students were less anxious about asking questions and more open to having discussions with classmates. This greater ease not only helped the cohort become more collegial but also decreased future anxiety about asking questions or participating in lectures. In view of the success of the article-share program in the first-year class, we decided to incorporate a version into the second-year class as well.

### Second Year

By their second year, the students have become well versed in accessing and sourcing information from *JNMT*. Rather than simply selecting articles for the instructor to present, second-year students do an article-share presentation of their own, starting in the NMT 71 (Nuclear Physics Laboratory) course. Since students are able—during their first year—to observe a variety of article-share presentations by the instructor, they are able—in conjunction with the grading rubric (Table 1)—to gain an understanding of how to format a presentation on a topic of their choice. The students e-mail to the instructor a choice of 2 recent *JNMT* articles that they would like to present, and the instructor chooses the one to be presented. This tactic eliminates the possibility that 2 students will present the same article or that too many articles will be on the same topic.

The article-share project begins with scheduling the presentations, with 2–3 students randomly assigned to make their presentation at the beginning of class on roughly 7 days throughout the semester, depending on the total number of students in the class. Typically, the assigned day is one on which the presenter is not also scheduled to take an examination. At first, we had reserved an entire class day for article-share presentations; however, we found that when the presentations were spread throughout the semester, as opposed to all being held on the same day, the students showed increased engagement (it had often been challenging to engage students during their evening classes, as many were tired or impatient to return home after completing a full day of clinical requirements). In addition, completing the discussion of the article-share presentations before a lecture helped to improve students' overall focus on the subsequent lesson.

The students are provided with a detailed rubric that lays out the criteria by which they will be graded. This rubric is used not only to guide the student presentations but also to evaluate the project

**TABLE 1**  
Article-Share Grading Rubric

Criterion	Needs improvement (1)	Fair (2)	Accomplished (3)	Exemplary (4)	Grade
Delivery	Holds no eye contact with audience; reads entire report from notes; speaks in low volume; causes audience disengagement	Displays minimal eye contact with audience; reads mostly from notes; speaks in uneven volume with little to no inflection	Consistently uses direct eye contact with audience but still frequently returns to notes; speaks with satisfactory volume	Holds attention of entire audience with direct eye contact; seldom looks at notes; speaks with volume and inflection to maintain audience interest	
Content and organization	Does not have grasp of information and cannot answer questions about topic	Provides relatively disorganized presentation; is challenging to follow; can answer only basic questions about selected topic	Provides well-organized and well-thought-out presentation; is at ease with providing expected answers to most questions	Demonstrates full knowledge by answering questions with explanations; provides clear, organized presentation put together in logical order	
PowerPoint presentation	Is unorganized, with no pictures, graphics, or title slide	Is somewhat organized but includes only 1 picture; includes title slide, but it is missing some components, including article link	Is organized and has a few pictures and an appropriate title slide that includes article link	Is well-written and well-organized; includes pictures or graphics; provides title slide with all necessary components	
Relevance of article to field	Has no relationship to NMT or related physics field	Has some relationship to nuclear medicine, molecular imaging, or physics; lacks purpose or understanding; is a nuclear medicine article but not from peer-reviewed journal	Relates to NMT or suggested health field and is selected from peer-reviewed journal	Provides well-written, detailed explanation of relation to our field; is selected from peer-reviewed journal and covers topic with proficiency	

for our course assessment. The grades are based on how well the student adheres to 4 criteria: delivery, content and organization, PowerPoint presentation, and relevance of the article to the field of NMT. Because of the cumulative nature of the article-share assignment, the students understand its significance and how it will ultimately affect their class participation grade. Using this rubric, we evaluate students on a 16-point scale, with a grade of 12 points meeting our benchmark of 75% for course assessment. All students have met or exceeded the required project benchmark.

### **Benefits to NMT Program**

The NMT program as a whole has recognized a variety of additional benefits from this article-share project, such as an increase in the number of current events discussed, an improvement in oral communication skills, and increased confidence in presenting at chapter conferences.

Through these presentations, a multitude of articles have been shared on a variety of topics. Allowing the students to select the articles has expanded the diversity of topics presented to the class. Recent topics have pertained to advanced instrumentation, novel radiopharmaceuticals, job outlook, the effect of COVID-19 on NMT studies, continuing education, and more. The 2019/2020 cohort was the first class to have the continuity of article-share presentations in their first and second years. Students within this cohort were exposed to upward of 40 current articles from either the *JNM* or *JNMT* (as instructors had access to both the *JNM* and *JNMT* and would share from both journals). Students continue to express how much they enjoy the article-share project and how it has helped boost their passion for the field of nuclear medicine.

In addition, oral communication skills have been improved since adoption of the project. Although the requirements for the associate of applied science degree in nuclear medicine require fundamental English and communication courses, transfer students in particular may not have done an oral presentation in some time. Having opportunities to speak in front of their small group of classmates has helped students improve their oral communication skills without the associated anxiety of presenting in front of a large group. We feel that practicing speaking in front of the class may improve a graduate's overall interview performance. Additionally, some students have mentioned that their increased level of comfort in making oral presentations to the class has led them to present at chapter conferences. At the conference of the Greater New York Chapter of the SNMMI Technologist Section, 2 students from the class of 2019 presented abstracts—an increase from previous years. The class of 2020 was to have 3 speakers, but the conference was postponed because of COVID-19 restrictions.

In retrospect, one faculty member who implemented the article-share assignment in her course made several observations on it. First, she noted that overall student participation increased over the level seen in the same course in previous semesters. After talking with the students informally, she found that they generally felt less intimidated about asking questions or giving presentations when the instruction setting was online. “Public” speaking, at least in an online classroom, is no longer performed in public. This change allowed students who were normally apprehensive about speaking in front of a large audience to gain a feeling of increased confidence.

As challenging as this last year has been because of the pandemic, we have been fortunate to still be able to run the article-share project via a distance-learning modality. Students have been attending class synchronously via the Zoom platform and do their presentations live via Zoom, sharing their screen and moving through the PowerPoint presentation at their own pace. Those who

do not have access to a webcam or have increased anxiety about public speaking can simply turn off their video, speaking over the slideshow. Especially in these unprecedented times, we are pleased to have observed that with the implementation of this project, engagement among the cohort has increased. However, like the change in instruction modality, there has been a change in the fluidity of the cohort as well. Although the cohort is still a cohesive unit, online instruction has reduced the personal interaction that develops naturally in a face-to-face setting. Even with this unforeseen consequence, we feel fortunate that the NMT program can still conduct these presentations in a meaningful way.

### **EFFECTIVENESS ASSESSMENT**

Deciding how to evaluate the effectiveness of the article-share assignment must begin with an understanding of how and why it was assigned in the first place. This assignment not only tests student knowledge of industry standards and common practices but also evaluates the communication skills of students by ultimately requiring them to make a presentation of their own.

The instructors agree that the success of the assignment depends heavily on the structure of the rubric. To ensure that the rubric serves a formative purpose, each criterion describes what is being asked of the student and details how to complete the assignment, thus allowing the teacher and student to work together toward meeting the common requirements. In contrast, if the rubric were designed solely for evaluative purposes, it could not guide students or serve any formative role.

As part of the self-study for the JRCNMT, it is a requirement that student-level outcomes be assessed. One of the outcomes within our program states that “The nuclear medicine graduate...be able to demonstrate written and oral skills focusing on effective communication” (4). The article-share assignment was designed with this particular outcome in mind.

The number of students in the pool that was assessed was 12. All 12 students submitted articles before or on the due date. A simple satisfactory/unsatisfactory rubric was used to evaluate the quality and thoughtfulness of the articles chosen. After quickly analyzing the data, we found that the professor gave every student who participated in this assignment a satisfactory rating, which positively affected the student's class participation grades. Remote learning largely prohibited using the journal in its printed format due to the pandemic, as the students did not have access to the college library. Over the entire class, final class participation grades averaged 90%, which exceeds the benchmark of 75% established by college standards and practices.

The benchmark for the total class-participation assessment, which includes Formal Assignment 1 (the article-share assignment) and Formal Assignment 2 (a separate assignment unrelated to the article-share presentation but still addressing the student learning outcome for the course), is at least 75%. The students use the article-share rubric as a guide through the entire process leading up to their presentation. Throughout the course, guidance and revisions are encouraged, leading up to the final assessment of the article-share presentation. The class average for the article-share presentation was 87.4% (for this original pilot cohort), which exceeded the benchmark by 12.4% and ultimately satisfied the student learning outcome.

### **THE FUTURE**

Because of the success of the pilot phase of the article-share assignment, and how closely it aligns with required student learning

outcomes, Bronx Community College has decided to continue using this type of assignment. Exposing the students to *JNMT* early in their NMT careers has encouraged them to rely on the valuable, reputable, and relevant information that a primary-literature resource provides.

Educators recognize the many challenges of teaching during the COVID-19 pandemic. Didactic courses have transitioned to an online setting, whereas clinical courses have been saddled with restrictions. To ensure that our students remain our priority during these challenging times, the NMT program at Bronx Community College will be participating in an online-modality assessment project. Conducted by the college, this project will analyze how well student learning outcomes are being satisfied in an online setting. It is expected that in this collegewide assessment the nuclear medicine technology program will have a significant presence because of its success in embracing the online classroom and its recent reaccreditation by the JRCNMT.

## DISCLOSURE

No potential conflict of interest relevant to this article was reported.

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