Examining Factors Associated With Student Attrition in a Diagnostic Medical Sonography Program

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Attrition, or reduction of program size, is a common issue many education programs experience. A review of the literature indicates that the strongest predictors of student retention are sense of community, feeling of belonging, and membership in a group.[1] Other research suggests the most common causes of attrition are poor work-life balance, personal issues and responsibilities, and academic difficulties.[2-5] Personal issues and responsibilities can be linked to age. The older the student, the higher the rate of attrition due to home responsibilities such as dependents;[4] conversely, student maturity can be connected to lower attrition due to better focus.[6] Studies agree, however, that a firm educational foundation in math and science is related to decreased attrition rates.[4,6] Program faculty can be a resource to students with high responsibility loads by offering time management tips, providing advice about scheduling, and listening.[1,7]

Literature Review

Twelve articles published in peer-reviewed health-specific journals were identified using the search terms *attrition, retention, sonography, community,* and *clinical instructor characteristics*. The search was limited to peer-reviewed articles between the years 2013 to 2022 indexed in the *Journal of Diagnostic Medical Sonography, Radiologic Technology,* PubMed, Google Scholar, and MEDLINE. The guiding questions used for the literature review were:

- What factors affect attrition (ie, program dismissals and withdrawals)?
- What can faculty do to promote success in students' lives, as well as sonography programs?

Findings

High engagement, belonging, and a sense of community are the strongest predictors of student retention.[1] If students are engaged, have a strong bond with their professors, and feel a part of their community, then they likely will have a successful outcome.[1,8] When students develop a strong bond with faculty, they feel comfortable seeking support and asking for help. Faculty can offer tutoring sessions and post their office hours to encourage a comfortable atmosphere for students to gather outside of regular class time. Increasing the amount of faculty interaction with students allows bonding to occur, giving them a sense of belonging.[1,8] Program community service projects allow students to feel connected to their community and promote bonding time with faculty and peers.[1,8] If students are isolated or do not feel accepted at a college or university, they are more likely to withdraw compared with students who have academic difficulties.

Two studies revealed that having high stress levels can result in low self-esteem, which also leads to attrition.[7,9] Faculty can incorporate mindfulness interventions during class that have been shown to reduce stress and anxiety and increase student performance, focus, calmness, and concentration, which in turn

helps to reduce attrition rates.[10] Mindfulness interventions include mindful breathing exercises, yoga, and prayer. Mindfulness interventions can be performed as a group before the start of a lecture or exam to improve concentration and reduce anxiety. After these practices are introduced, many students continue to use mindfulness interventions throughout their education to ease their stressors. Another method to help reduce anxiety is using mock practice examinations in classroom and laboratory simulations. Mock examinations can increase confidence and competence when students enter clinical rotations and when they sit for their certification exams.[11]

Attrition usually happens in the first year of a program. If attrition rates are high, faculty should evaluate the admission screening process and program orientation.[12] Increasing the selectivity of admissions has been shown to increase retention in a program.[1] There is a strong correlation between admitting students who do not meet admission criteria and a potential increase in attrition rates. If a student does not meet admission criteria, they will be unprepared for the curriculum. Yearly assessment of the admission process regarding student attrition might be beneficial for all programs. Decreasing the enrollment in a program has been shown to increase retention rates.[1] Decreased student-to-instructor ratios promote bonding, and this can improve student interaction and lead to a sense of belonging.

In a radiography setting, attrition can be linked to unhappiness with clinical placement and dissatisfaction with clinical experience.[4,5,7] Clinical instructors have a vital role in student education, but instructors might be assigned the role as a job requirement, which means the responsibilities are not voluntary. This overload of duties could cause stress and resentment toward students.[7,11] Students can end up in a tense and disengaged environment because of their clinical instructor's attitude. One study revealed 18% of clinical instructors are demotivators for students.[7] This situation might cause students to become frustrated and disappointed, which could cause program attrition.

Clinical instructors should have frequent student interactions and modify instruction based on the individual student learner. A clinical instructor who is encouraging, professional, and supportive builds strong bonds with students and increases student autonomy.[1,7] Autonomy is making one's own choices and being in control of one's life. Examples of ways to build student autonomy are actively listening to students' questions, giving praise when needed, providing problem-solving activities with hints instead of answers, and offering constructive feedback.[7] Clinical instructors also need to create opportunities for students to use critical-thinking and reasoning skills to increase their autonomy and engagement. Surveys of students revealed 51% of engagement scores were directly related to treatment by clinical instructors.[7] Student engagement can be a predictor of success. When students take initiative and make their own choices, this amplifies academic performance, outcomes, retention rates, and self-esteem. In turn, high self-esteem is shown to reduce stress levels and lower attrition rates.[9]

Frequent communication between education programs and clinical instructors is vital. Faculty can provide behavior guidelines for clinical instructors to increase motivation for students in a clinical setting. Advisory committee meetings, university-based clinical instructor workshops, regular clinical visits, and communication logs are crucial to educate clinical instructors and making them feel needed and important for student success.

Program Analysis

The authors wanted to assess whether there were trends between academic performance, a diagnostic medical sonography (DMS) abdominal sonography course, and student attrition. Quantitative data from a DMS program at Morehead State University in Kentucky was analyzed by the authors to determine a correlation between scores on the American Registry of Radiologic Technologists (ARRT) radiography certification exam and performance in a DMS course. The radiography program at Morehead State University is an associate degree program, and the DMS program is a baccalaureate degree program. Students who are finishing their radiography degree and plan to pursue a baccalaureate degree in DMS take the ARRT radiography certification exam 1 to 2 months before they begin the DMS program. An institutional review board exemption was granted by the Office of Research and Sponsored Programs at Morehead State University.

A 5-year (2017-2021) selection of grades in the abdominal sonography course DMS 410 was collected

for 22 students. This course is the first fall semester course in the DMS program. Students must get a C or better to pass the course. The grading scale for DMS 410 was:

- A, 92-100%
- B, 84-91%
- C, 76-83%
- D, 68-75%
- F, ≤ 67%

This selection of course grades was compared with the ARRT radiography certification exam scores for these 22 students using a Pearson correlation analysis. The Pearson correlation coefficient yielded a strong, positive correlation between ARRT exam scores and DMS 410 final course grades ($r = .90$, $P < .001$). Low ARRT exam scores correlated with low final grades in DMS 410, and high ARRT radiography certification exam score results correlated with high final grades in DMS 410 (see **Figure**). Nine students who received the highest ARRT radiography certification exam scores also received high DMS 410 final course grades (≥ 92%) (see **Table**). Among students with the 4 lowest scores on the ARRT radiography certification, 3 received failing DMS 410 final course grades (≤ 69%); they also were dismissed during the 5-year period due to academic failure.

Discussion

Faculty must recognize predictors of attrition in the student demographic cohort to promote retention and reduce attrition in imaging programs. For example, predicting attrition in a baccalaureate degree sonography program by reviewing performance in an associate level radiography program can be beneficial. The program analysis showed that low academic performance in the associate degree radiography program demonstrated a direct relationship with poor success in the DMS 410 abdominal sonography course, and among the 4 students who had the lowest final grade in the DMS 410 course, 3 were dismissed from the program.

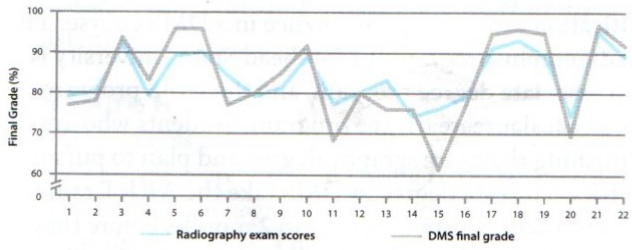

Figure. *Correlation between American Registry of Radiologic Technologists (ARRT) radiography certification exam scores (blue) and final grades in abdominal sonography course (ie, diagnostic medical sonography [DMS] 410) (black) for each of the 22 students. Figure courtesy of the authors.*

Table

ARRT Radiography Certification Exam Scores and Abdominal Sonography (ie, DMS 410) Final Course Grades Per Student

Student	ARRT score	DMS 410 course grade
1	79	77
2	80	78
3[a]	92	94
4	79	83
5[a]	89	96
6[a]	90	96
7	84	77
8	79	80
9	81	85
10[a]	89	92
11[b]	77	68
12	80	80
13	83	76
14	74	76
15[a]	76	61
16	79	77
17[a]	91	95
18	93	96
19[a]	89	95
20[b]	75	69
21[a]	95	97
22[a]	89	92

Abbreviations: ARRT, American Registry of Radiologic Technologists; DMS, diagnostic medical sonography.
[a] Nine students who received the highest ARRT radiography certification exam scores also received high DMS 410 final course grades (≥ 92%).
[b] Among students with the 4 lowest scores on the ARRT radiography certification exam, 3 received failing DMS 410 final course grades (≤ 69%).

Identifying the causes of poor academic performance at the onset of the program is important so faculty can mentor a student for success. Faculty can target predictors of student attrition and react to them as soon as they are identified. Tutoring sessions, mentoring, and documenting of grade progression can heighten awareness for faculty and students. Early intervention involving student awareness of academic standing can offset attrition. However, uncontrollable and unforeseen factors can contribute to program attrition, including financial difficulties, personal factors, level of maturity, and low academic performance in a radiography associate degree programs. DMS program faculty should continually recognize possible predictors of student attrition in their programs and implement methods to improve low student performance and deter program attrition.

Limitations

Limitations of the review and program analysis were small sample size, researching data from 1 DMS program course, and analyzing data from 1 of 3 baccalaureate degree programs in imaging sciences at Morehead State University. Data from clinical rotations was not included in analysis because rotations begin after the first 8-week courses are complete. One variable that was not addressed but could be of importance is financial stability. Future analyses might use larger sample sizes, include other imaging programs, review literature focused on sonography didactic vs laboratory and clinical performance, compare sonography attrition and retention rates, and analyze the correlation of attrition with associate degree radiography programs and baccalaureate degree imaging programs.

Conclusion

Programs in higher education experience attrition. Identifying reasons for student attrition and creating a planned mentoring process are important for program outcomes and can contribute to student success, engagement, belonging and sense of community. Mindfulness interventions, including students in community activities, bonding with students, and strong relationships with the clinical instructors are factors that can lower attrition rates. Further research to identify predictable factors of student attrition and solutions to common problems students encounter is important.

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