A Basic Science Pre-Test to Assess Academic Risk of First Year Nursing Students

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At a medium sized private university in the mid-Atlantic region, nursing and science faculty collaborated to improve nursing student retention through development of a Science Pre-test for use with incoming students. This assessment test was designed to identify students with deficiency in fundamental science knowledge so that intervention strategies could be initiated early for those students.

According to sources cited by Harris, Rosenberg and O'Rourke (2014), the rate of attrition from associate and baccalaureate nursing programs may be as high as 50% or even 85% for minority students. The Commission on Collegiate Nursing Education (CCNE) states an expected goal of at least 70% retention, or no more than 30% attrition (CCNE, 2013). Horkey (2015) cites National League for Nursing (NLN) data that indicate an average first year attrition rate of 18% for pre-licensure nursing programs, with most attrition occurring within the first year. In the initial year of a nursing curriculum, students may not even be counted within a nursing class cohort, however that first year serves as a gateway or barrier to nursing studies. With increasing attention given to retention in nursing education, scholars and administrators seek explanations for the root causes of retention and attrition, as well as evidence-based interventions to improve nursing program completion. Jeffreys' (2015) Nursing Universal Retention and Success model identifies multiple student profile characteristics that affect nursing student retention, including age, gender, language, ethnicity, family educational background, work experience and prior educational experience. When considering prior educational experience, prerequisite science course performance or basic science knowledge are frequently cited as correlates of nursing program completion (Abele, Penprase & Ternes, 2011; Simon, McGinnis & Krauss, 2013). In a broader discussion of contemporary college student attrition and retention in science, technology, engineering and math (STEM) programs, scholars suggest high school preparation in math and science is lacking, and "low proficiency in basic skills calls for the need to bridge high school and college science curricula" (Sithole, Chiyaka, Mupinga, Bucklein & Kibirige, 2016, p. 52.) In our nursing program, first year student attrition ranged from 30 to 35 per cent over the last three years, mainly for academic reasons. Achievement of passing grades in science courses, particularly anatomy and physiology, represents the greatest challenge for these students. Therefore, in conjunction with professional staff in our academic support service department, science and nursing faculty concluded that a focus on improving success in the first anatomy and physiology course would be an appropriate initial step towards improving retention in the nursing program.

We chose to assess the science knowledge of incoming students to gather additional information about student academic risk before the start of the first semester of study. In our program’s experience, while students in incoming nursing classes all meet the same admission requirements, there is much variability in level of high school preparation in science, as well as a wide range of study skill proficiency. While assistance in the form of tutoring and supplemental instruction is available to all nursing students in the first-year science courses, many do not seek help until late in the semester, when achieving a passing grade is not realistic. We sought to develop an objective measure to identify students most in need of academic assistance in time to make a meaningful difference.

The 25-item Science Pre-test was developed by a panel of three science faculty who regularly teach the required anatomy and physiology courses. This test was intended to measure background knowledge foundational to concepts addressed in the initial lessons of the first semester anatomy and physiology course. Concepts addressed include characteristics of cells, basic genetic concepts and chemistry principles such as pH and concentration. These topics are generally contained in high school science courses and are included in the beginning chapters of the required anatomy and physiology textbook. For
three consecutive years, the Science Pre-test was administered to students during the freshman orientation period prior to the start of classes. Two hundred forty-six nursing students were among a larger group of health professions and science majors who took the test. Early in the semester, learning support staff contacted students with a score of less than 50%, to encourage them to take advantage of tutoring and supplemental instruction. Student participation in academic assistance services was on a voluntary basis.

The Science Pre-test was administered to 485 students over three years, including majors in nursing, occupational therapy, athletic training and biology. The internal consistency as measured by Kuder-Richardson scores, ranged from 0.57 to 0.62, which is considered acceptable for a teacher-made test (McGahee & Ball, 2009). For the nursing students (n= 246), the relationship between scores on the Science Pre-test, and spring, fall and cumulative first year science course grade point average was investigated using Pearson product-moment correlation coefficient. There was a moderate positive correlation between the Pre-test scores and science grades for fall semester (r = .406), spring semester (r = .379) and total year (r = .416), p < .001.

Analysis of correlation between results of a Science Pre-test given to first year nursing students and college science grades shows a positive relationship, supporting content validity of the Science Pre-test. This test has potential to be a valid, reliable, economical and efficient way to screen students in an objective way, enabling early identification of those students more likely to need supplemental instruction, tutoring services or other study skill development.

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References:


Abstract Summary:
This presentation describes development and use of a 25-item objective test on basic science topics intended to assess academic risk of incoming first year nursing students. Administered to three classes of baccalaureate nursing students, the test was found to be predictive of first year science grades.

Content Outline:
A Basic Science Pre-test to Assess Academic Risk of First Year Nursing Students

1. Introduction
   1. Challenge of retaining students in pre-licensure nursing programs
   2. Sciences courses at the beginning of nursing education programs a major cause of attrition
   3. Identified need to assess students’ baseline knowledge in science to target at-risk students in need of support
2. Science Pre-Test Development
   1. Collaboration of nursing faculty, science faculty and academic support staff in support of student retention
   2. Science faculty generated 25 items based on teaching experience with first level students
   3. Analysis of test scores over three years for internal consistency reliability
3. Use of the Science Pre-Test
   1. Procedures for administration of the test
   2. Using results to prompt early intervention for at-risk students
4. Correlation of Science Pre-Test Scores and Science Grades
   1. First semester, second semester positive correlation of Pre-Test Scores and science course grades, statistically significant
   2. Predictive validity of the Science Pre-test supported
   3. Relationship of science grades and progression in the nursing major
5. Conclusion
   1. The Science Pre-test is supported as a valid, economical and efficient screening tool
   2. Implications for future research testing early intervention strategies using the Science Pre-test

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**Author Summary:** Dr. Mary Ellen Symanski has practiced as a nurse educator for 31 years, initially at the University of Maine and for the past 12 years at Alvernia University. She has a PhD in Nursing from Wayne State University. Dr. Symanski has a special interest in promoting student success and retention, particularly first generation college students, and students of minority or international heritage.

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**Author Summary:** Dr. Kielbasa, one of the authors of the Science Pre-test, is passionate about improving science education, and believes that student learning in science should occur as much as possible through inquiry and activity-based approaches. Her research involves the use of cultured mammalian cells to examine fundamental biological processes. Dr. Kielbasa has several recent publications in the areas of cell biology and science education. She teaches cell biology and anatomy and physiology courses at Alvernia University.