SIMPLE STATISTICS: MAKING IMPROVEMENT IN TEACHING AND TESTING

GOALS:

1. Encourage nursing faculty to determine their statistical educational variables for consistent review and comparative analyses.
2. State the definition and purpose of the National Council Licensure Exam (NCLEX).
3. Establish an active faculty effort to identify current facts related to student NCLEX testing success, what appears to have worked in nursing education to prepare for the NCLEX test, and what seems to have failed in nursing education as a part of NCLEX preparation.
4. Define, recognize, and use the concept of leadership and management in the pursuit of educational perfection.
5. Recognize the use of learning management systems (LMS) to meet the need for basic faculty understanding of simple statistical data.
6. Increase a faculty's understanding of collective and unique testing trends leading to testing success or failure.
7. Recognize the existence of prepared pre-entrance nursing exams.
8. Use simple statistical calculations to better understand the correlation between faculty teaching methods and NCLEX testing outcomes.
9. Correlate faculty teaching, teaching methods, NCLEX outcomes, and pre-requisite nursing program testing scores.
10. Differentiate between different charts and graphs that could effectively represent collected data.
11. Increase awareness related to encouraging student success.

KEYWORDS FOR APPLICATION

1. National Council Licensure Exam (NCLEX)
2. Test of Essential Academic Skills (TEAS)
3. HESI A2 (Online Practice Tests)
4. HOBET (Health Occupations Basic Entrance Test)
5. Entropy
6. Entrance Exam(s)
7. Statistics
8. Learning Management Systems (LMS)
9. Predictive Analytic Systems
10. Canvas (LMS)
11. Leadership
12. Management
13. Statistical Analysis
14. Multiple Choice Questions
15. Critical Thinking
16. Comparative Statistics

17. Correlation
18. Correlation Analysis
19. Data
20. Item Analysis
21. Mean
22. Median
23. Mode
24. Product
25. Quantitative Data
26. Qualitative Data
27. Range
28. Ratio
29. Reliability
30. Validity
31. Value
32. Variable
33. NCLEX-RN
34. NCLEX-PN
35. Pie Charts
36. Line Graphs
37. Bar Graphs
38. Feynman Technique of Learning
39. Mentors
40. Transformational Leadership
41. Nurse Administrator
42. Nurse Leader
43. Nursing Program Director

According to its members' working collaborative ability and willingness, faculty are strengthened by sharing with other faculty members statistical student testing information for meeting and improving teaching and program outcomes. With the right attitude by all faculty members and the expectation and guidance of a supportive nursing program director, shared simple categorically determined (according to mutually selected types of testing or situations) will provide the basis of improved program teaching and testing outcomes.

This document is not intended to tell a nursing faculty specifically "how to do it." However, this document is designed to increase knowledge and information about testing and basic simple statistics to the point of encouraging nursing faculty to mutually (together) determine their own "best way" through the use of simple statistics. It strengthens all nursing program testing outcomes. Figuratively speaking, the fuel and a statistical road map to increase success are shared in this document. The best road to travel and means to reach a goal to improve student testing success is ultimately related to the sharing of agreed-upon and faculty-acquired simple statistics related to student success (or lack thereof).

FACULTY APPROACH TO NCLEX TESTING SUCCESS

The National Council Licensure Exam (NCLEX) is a national exam for nurses' licensing in the United States and Canada. There are two types of exams—NCLEX-RN (Registered Nurse) and NCLEX-PN (Practical Nurse). After graduation from a school of nursing, he/she becomes eligible to take the NCLEX exam. This test is considered to be the crowning determinate of nursing educational success.

As nursing educators, we feel a significant amount of responsibility for our student's NCLEX testing outcomes. There is probably nothing more satisfying to nursing instructors than to have a high percentage of graduate nursing students pass their first try at taking the NCLEX exam. Conversely, there is nothing more disheartening to have too high a percentage of graduate nursing students who *do not* pass their NCLEX examination on their first try. Since we are nursing educators, we have to ask ourselves why some of our students did not pass on their first try—after all, he/she seemed to do just fine?! The lingering question is: What could we have done better to help encourage all student NCLEX testing success? The increase in ongoing faculty awareness and accountability will most likely result in the occasional entrance and teaching adjustments that will result in more positive NCLEX testing outcomes.

By considering national research and prepared testing trends by various testing companies, there is some hope of beginning to understand, at least, their findings that help to encourage NCLEX testing success. However, we cannot ignore that faculty-prepared nursing classroom tests and entrance exams can be a profound over-all indicator of NCLEX success.

There are many reasons for the success and lack of NCLEX examination success by graduating nursing students. This document addresses some related research to enhance/improve NCLEX success. Any nursing faculty can use the faculty-shared student statistical testing outcomes when systematically, collectively, and graphically documented over-time. The purpose is to increase a faculty's understanding of specific, ongoing, and personally unique statistical trends that result in continuing student and program testing success.

PREPARED TESTING TO ENCOURAGE SUCCESS

There are efforts by some nursing programs to have pre-admission company-prepared testing and pre-NCLEX practice situations to produce positive testing outcomes. TEAS (Test of Essential Academic Skills), HESI A2 (Online Practice Tests), HOBET (Health Occupations Basic Entrance Test) were determined to be commonly used pre-admission tests by nursing programs.

> ***On a pre-admission test, the SCIENCE section was the best nursing education indicator that resulted in NCLEX success. (Science Categories: Math and Logics, Biological, Social Science, and Physical Science). Perhaps, selective student science astuteness could be a significant part of a program's pre-admission test.***

THE ROAD TO SUCCESS

As a basis of understanding how to be NCLEX-success savvy, a nursing program director should consider and know when/how to practice the concept of faculty leadership and faculty management. There is a

difference between “leadership” and “management.” Leadership means that the nursing program director involves faculty in determining activities that will evaluate the faculty’s chosen statistical assessments, evaluations, and outcomes. Conversely, management implies that the nursing director tells the faculty what to do, maybe how to do it. Determining effective *strategies of management or leadership could significantly improve an NCLEX no-pass problem.*

Collectively, as a group of nursing educators, blaming and predetermining the *supposed* problem of NCLEX failures by one or a few of the faculty member(s) can happen. Also, finding generalized fault with nursing experiences or clinical practices can occur. However, finding the real problem is not that easy. Through the use of the faculty establishing and using simple collective statistics, the assessment and evaluation of the NCLEX failures become more objective. It becomes a far more acceptable and accurate collection of information that negates just “what feels right/good.” The faculty collective problem-solving efforts support the concept of effective leadership.

Nursing faculty do not need to perform “high math!”--- just basic easy to understand differences that are the most pre-determinates of NCLEX testing success. The entire faculty works together to keep ongoing documentation of simple statistics related to student scores of like-tests (e.g., multiple-choice, fill in the blank, critical thinking responses, essay, etc.) Faculty members can effectively predetermine with a high rate of success student NCLEX outcomes.

There are many testing and observational opportunities for faculty to apply a numerical value to student performance. For example, it includes examining outcomes by taking and developing multiple-choice questions, regular attendance, and classroom problem-solving/creative thinking. All responses are noted by faculty and documented per student. These retrospective student observations and documentation by faculty are easily compared to eventual individual student NCLEX success or lack of success.

Teaching methods that often prepare students for NCLEX success are related to a student learning the process of writing course-appropriate multiple-choice questions and related answers to those multiple-choice questions. Also, (and just as important) students must practice the skills for selecting the correct multiple-choice answer related to the stem of the problem ---and know *why*.

Over time, comparing individual students’ statistical testing trends in each course and categories, existing program entrance testing outcomes, and their NCLEX exam outcome does not require miraculous energy, academic prowess, or costly computer programs to predict student educational trends.

Consequently, there is no excuse for a faculty to dismiss this simple (and documented) data collection as a significant factor in understanding better determinates that will result in more successful NCLEX outcomes. When correctly and consistently kept, simple displays of retained and graphed comparisons will identify, disaffirm, or confirm predisposing factors/trends that identify precursors to academic and NCLEX testing success.

Once a nursing faculty identify the persistent scores and recurrent educational student behaviors as a precursor to NCLEX success, the outcome becomes reliable and valid.

If a nursing educator is interested in promoting a student's academic success, at what point in nursing education is a failing student (according to established criteria) encouraged to pursue another profession? Is it considered intellectual honesty to have a student understand upon admission to the nursing program the testing and behavior requirements to *remain* in the nursing program? For a nursing administrator/director and faculty to make that determination takes courage. It places a responsible onus on nursing faculty to consistently judge performance and make necessary changes to ensure graduation and NCLEX success. Is it better to redirect students to educational programs that would be more likely to support a student's academic success than to continue to encourage a student that obviously or is not likely to succeed in a nursing program? A nursing faculty can only come to the most accurate decisions regarding these questions by studying student success indicators and failure indicators.

TIME CHANGES EVERYTHING—IT IS CALL ENTROPY!

The universal concept of entropy says that every student (and faculty) will have personality and characteristic changes requiring ongoing awareness and constant monitoring over time. It means that faculty should note the current statistical *trends* that lead to academic success or failure due to faculty and students' ever-changing uniqueness! After all, faculty are professionals who are expected to explore possible inconsistencies and alter teaching trends and behaviors that respond to changes in student outcomes, leading to increased student academic success.

Very important---An accurate and consistently successful *faculty-determined Program Entrance Criteria and testing* must be determined and changed over some time! Making assumptions and appropriate adjustments due to faculty members' increased awareness is a dynamic procedure resulting from faculty ongoing statistical research and universal entropy. Making necessary educational changes to either course work, clinical experience, or testing are determined by ongoing comparative statistical studies. Approaches to nursing education will change over time. Even clinical situations and preceptors will change. Therefore, the statistical pursuit of the most current, reliable, and accurate nursing program entrance requirements, clinical experiences, and exams must go on!

It is easy to recognize, usually, the increased awareness by all nursing faculty as to course testing outcomes and mutual consideration of testing variables and their results. Such up-to-date intellectual collective concern by all faculty members will result in a positive and goal-oriented working behavior that highly encourages (and maybe forces) current faculty teaching excellence.

LONG-TERM ENTRANCE EXAM CONSIDERATIONS FOR DETERMINING FUTURE SUCCESSFUL NCLEX RESULTS

Let us consider a few possible examples of nursing program entrance considerations that could predispose future program/state board test success or failure. For example, consider data/variables that are, probably, some general differences within a student group —and indeed, the five (5) stated, hereafter, are just a few.

Whether you are using a purchased corporate pre-nursing entrance test or a nursing program entrance exam for admission, be careful in selecting post-exam questions. Use carefully chosen items for collective review to not appear discriminatory in your queries or entrance criteria.

Some possible and simple statistical evaluation questions to be considered by the nursing faculty might be:

1. What was the average passing score of all students taking the entrance exam?
2. What are the percentages of students who passed and non-passing?
3. What is the age range of potential students taking the exam?
4. What are the differences in past years of health care experience?
5. What is the correlation between passing scores with good science knowledge? Consider setting a predetermined entrance policy related to an exam score.

At the end of the nursing courses and post taking the NCLEX exam, what is the relationship/correlation between students' entrance exam questions and scores, *and the NCLEX score*? (There are numerous possibilities for statistical comparisons).

Consider a policy related to entrance exam outcomes. Policies (in all situations) are pre-set expectations that determine acceptable results. To establish predetermined policies or procedures help to control bias and discrimination in final decisions.

From this information and many other possible questions, the collection of simple statistics can improve awareness for increased NCLEX success.

A faculty should identify possible successful trends that could become a part of an entrance exam and course expectations by comparing admission information and NCLEX outcomes.

Duo-testing is a possibility. There is no problem giving both a nursing program and a company-generated researched entrance exam and a faculty researched and generated entrance exam. You might find the duo-testing outcomes exciting and productive in making more accurate future predictions. Compare both tests to determine if the pre-admission tests show/predict somewhat the same information about each student.

INTRODUCTION TO LEARNING MANAGEMENT SYSTEMS (LMS)

An excellent place to start this unique road toward collecting successful educational statistical outcomes is learning about the learning management computer systems on the market that are used for analyses, predicting outcomes, and determining results.

Understanding the need and use of sophisticated Predictive Analytic Systems (LMS) as a choice of analyses *would be helpful (and expensive)*, no doubt! However, in most cases, the general LMS information and intelligent use of simple comparative studies by faculty, over time, will produce distinct collective details as to "what is going on." The result is a common-sense testing outcome.

LMS became well-known and in widespread use in 1990. LMS could provide a technological advantage for tracking and ultimately understanding the statistics related to the variables a faculty identifies to determine a student's success. It answers many administrative needs through purchase, such as documentation, tracking, reporting, and delivering educational/training programs. Historically, LMS has been used to help instructors provide material/information and test students, perform administrative tasks and other assignments, track student progress, and manage record-keeping. However, historically most LMS programs have been for online courses and blended learning educational offerings.

The program entitled "Canvas" is just one example of a purchased LMS used by some colleges/universities. Suppose any such sophisticated computer program is used. In that case, it requires an administrator of the computer program (so research tells us) that is in constant contact with faculty and controlling the accurate input and evaluation of faculty data input and statistical outcomes. The computer efforts for use can certainly be helpful. It requires time to set-up appropriately and correctly use the information for a specific need. Another option might be "Moodle," which is "possibly helpful."

The LMS variables/factors might help to support information related to NCLEX success or show areas of academic educational weakness—that is, testing outcomes, attendance, grades, etc. The faculty becomes the resource for data input, therefore, determining what is wanted/needed as trackable variables.

An LMS administrator is already in place in many colleges/universities. The LMS administrator involvement increases the chance of reliability and validity in the generated results.

GETTING STARTED---ASSESSING THE EDUCATIONAL PROCESS

Leadership is needed to direct an assessment of "what is going on." It is *not* the director of the nursing program that has the answers—it is the faculty. Together, it is time for all faculty members to develop a down-to-earth and soul-searching statement regarding the nursing program information. The process involves:

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1. *Current Facts*
2. *What has worked (the good)*
3. *What did not/does not work (the failings)*

Initially, this three-prong process by the entire nursing faculty (stating and recording current facts, what is known to work--the good), and what did not work --the failings) forces objectivity and rewards what is *right and good.* It gives credit where credit is due but does not ignore what might be *wrong or should be improved*. Sometimes it is difficult to ascertain what works and where to start to improve! That is normal. Force what is known by asking and documenting the three questions. Start from there! What

is the old "saying"?--Never throw out the baby with the bathwater!? So--Keep what is right and build on what needs to be improved to eradicate the possible failings.

Once you finally identify what did not work (item #3), *prioritize* the identified failings that need addressing. When prioritizing the identified failings, be sure that the faculty votes on and agrees on the *significant failing.* Then, assign faculty to work on each identified failing—especially the significant failing!

Maybe it is one person that works on a failing, or perhaps several, or a committee. When we say "works" on a failing, we mean defining the problem, resolutions, alternatives, and produces researched ideas that help resolve the failing. Regardless, it should be recorded and known by the entire faculty as to who is responsible and held accountable for the pursuit of resolutions and accompanying research to back up suggestions. The director expects frequent meetings for reporting by each person or group to update and ultimately accept responsibility for suggested changes or recommendations of the nursing program. (Be sure these expectations are a part of the faculty member's job description!)

<u>There is an exciting happening that occurs if the MAJOR WRONG/PRIORITY PROBLEM is identified and resolved! Once a major problem is solved (all or almost all), the other minor failings/problems/wrongs seem to be reduced or go away. If this phenomenon does not happen, it is usually because the MAJOR FAILING/PROBLEM/WRONG has not been accurately identified.</u>

TEACHING FOR NCLEX SUCCESS

A well-known college faculty found the following increased their percentage of first-time NCLEX passing when the faculty mutually required students to:

1. Write multiple-choice questions according to multiple-choice question theory.
2. Differentiate and theoretically understand the different components (types of choices) related to multiple-choice questions.
3. Have students, individually or in a group, answer each other's instructor-approved multiple-choice questions as a part of a paper and pencil, group, or computerized exam.
4. Substantiate the reason for their answer choice of a multiple-choice question either in writing or verbally in class.
5. Discuss and provide a rationale for the correct answers to faculty generated multiple-choice questions related to course content.
6. Have all courses include multiple-choice questions as a determinant of the course grade.
7. Use the computer to answer multiple-choice questions.

Through this process (stated above) of critical thinking by all nursing students in all nursing courses, they found the personal use of paper and pencil testing, verbal discussions, and computer testing of multiple-choice questions to be an essential and useful conditioning component of future NCLEX success. It required consideration of selecting an answer from several options by using taught theoretical reasoning. They claimed their tenacious, collective, and consistent uniform multiple-choice testing efforts by all faculty resulted in a notable increase in their state-board passing percentage. Such cooperation and collaboration between faculty resulted in a more significant effort to support faculty members' educational endeavors.

Faculty members are often sure that one company or one testing method is better than another. However, it most often depends on the student and their propensity for a learning style and approach. Consistent, frequent, repetitive, applicable, and alternative learning opportunities produce the most positive outcomes. It encourages (almost forces) students to increase their **critical thinking skills,** which ultimately provides a better testing outcome.

REVIEWING THE LANGUAGE AND DEFINITION OF SIMPLE STATISTICS

Simple statistical language is necessary for the overall and over-time comparative mathematical language related to testing outcomes. The standard deviation from the mean (quantifying the amount of testing variation) might be or might not be as useful; however, this specific statistical information (standard deviation) is not covered in this document. There is no big mysterious mathematical equation or statistical language! The language is a shared language by all who are universally educated. It often involves just a comparison of a group of numbers. For a faculty to mutually, consistently, and accurately relate to simple statistics, the shared language, definitions, and samples (when appropriate) are as follows:

Comparative Statistics/Studies: Compares and contrasts two things to determine differences or similarities that appear to be different on the surface.

Correlation: Mutual relationship between two or more things.

Correlation Analysis: Analysis used to understand the nature of relationships between two different variables.

(A positive correlation is said to occur when the movement of one variable is similar to or accompanied by the movement of another variable on a graph or chart.)

Data: Facts and statistics collected together for reference or analysis.

Item Analysis: Examines responses to individual test questions to assess each test question's quality and the test as a whole.

Mean: Average score.

(It requires an adding up of all the testing scores of all students who took the test and, then, dividing that number by the total number of scores; such as, if the scores were 10, 12, 15—the added total of the scores is 32 divided by three scores—equals 10.66.)

Median: Middle score in a listing of scores from least to greatest.

(If there is an even number of scores, then the median is the average of the two (2) middle scores.)

Mode: Test score that shows up most frequently.

(30, 56, 32 56, 56 = mode of 56) There can be more than one mode, or there can be no mode.)

Product: Answer to a multiplication problem.

(The product of 2 X 6 = 12.)

Quantitative Data: Defines data with measurable information that is numerically expressed and is objective.

Qualitative Data: Describes data that are not able to be measured and is subjective.

Range: Difference between the maximum score and the minimum test score.

(In other words, it is the spread of test data; such as the difference between 92 and 70 is 22.)

Ratio: Indicates a relationship between two numbers.

(If the total number of students taking a test is nine and only seven pass the test, the ratio is 7/9, 7:9, or 7 out of 9.)

Reliability: Quality assessment of performing consistently well.

Statistics: Practice or science of collecting, analyzing, interpreting, and presentation of quantitative data.

Validity: Quality assessment of being factually sound.

Value: Quantity or the amount of something.

(e.g. The value of 100 plus 100 = 200.)

Variable: Element within a program that tends to change.

USE OF PIE CHARTS, LINE GRAPHS, AND BAR GRAPHS

There are three common types of graphs and charts used for constant comparisons. Each graph or chart requires creative thought to determine variables on each graph or chart. Some simple examples are the Pie Chart, Line Graph, and Bar Graph. Using any of these charts and graphs, we surpass speculation and enter a realm of visual comparative statistics. One chart or graph might be more appropriate than another for a specific purpose. Graphs and charts allow for comparisons using numbers or percentages over time. It encourages a nurse administrator and nurse faculty to know student trends to modify or predict future outcomes.

Pie Charts--

A Pie Chart (by definition) is a recognizable division of a circle into different colored parts that represent collectively to be 100%. It provides a visual depiction representing different percentages of specific data/variables. Pictorially, it is like when you cut an edible pie into wedge sections. One of its most useful factors is that it is easy to read and understand. As with any other type of chart, a pie chart can be repeated again and again. New percentages for each pie chart are compared with past pie chart percentages. Over time, it can become an impressive colored transparent overlay to show improvement or decline in any percentage change. (Examples of Pie Charts: HTTP: Pie Chart Templates.)

Line Graphs---

A Line Graph (by definition) can be a horizontal or vertical line that can show the progression or regression of data/variables over time. The graph (horizontal or vertical) could represent a time frame.

In contrast, the *other direction* of the graph (horizontal or vertical) could represent a degree or an amount. (Examples of Line Graphs: HTTP: Line Graph Example.)

Bar Graphs---

A Bar Graph (by definition) is a creative visual depiction of horizontal or vertical bar heights that provide enhanced visual comparisons of data/variables. Bar Graphs are for easy visual understanding through the comparison of data/variables. (Examples of Bar Graphs: HTTP: Bar Graph Example.)

IMPROVING SIMPLE STATISTICAL OUTCOMES THROUGH STUDENT LEARNING ACTIVITIES AND SUPPORTIVE PROCESSES

Many possible supportive faculty endeavors have been recommended in literature and used by different nursing programs to improve simple and ongoing statistical understanding. Some out-of-the-ordinary successful behavior ideas that appear to enhance learning or personal student success have been stated in literature as:

1. Use peer tutoring.
2. Determine learning areas that need more study by performing a test item analysis.
3. Use case-based learning.
4. Require waiting one year before allowing a re-take of a course if course failure occurs.
5. Use computer-based testing.
6. Require one-on-one counseling.
7. Change or require an alternative study path.
8. Incorporate part-time study or courses.
9. Refer the student to disability services.
10. Require repeating the course.
11. Have a faculty open-door policy.
12. Have a caring attitude as a faculty member.
13. Identify areas that need more study.
14. Show commitment to the student's success.
15. Arrange a private meeting with the chair of the department.

The Feynman Technique of Learning Involves---

1. Choosing a Concept.
2. Teaching a Toddler (In this instance, a student teaches another student under supervision).
3. Identifying Gaps (Grading the student's ability to teach another person correctly using the necessary steps).
4. Reviewing and Simplifying (optional).

What the Best Mentors Do---

1. Put relationships before mentorship.
2. Focus on character rather than competency (obviously mentorship involves mastering competency; however, go beyond skill to integrity, values, self-awareness, empathy, and capacity for respect).

3. Shout-out your optimism, and keep quiet with your cynicism.
4. Be loyal and available to your mentee.

CRITICAL THINKING QUESTIONS

1. How can you increase nursing educational accountability through simple statistical faculty input?
2. To what extent do faculty members need help to understand simple mathematical processes and incorporate this information into meaningful outcomes?
3. Is the organization currently using LMS programs? Who, by name and title, will/can be of assistance to nursing educators in the collection, computerization, and evaluation of statistical information?
4. How does the faculty plan to use statistical information to improve NCLEX outcomes?
5. What graphs are best utilized to increase the understanding of educational outcomes?
6. What collected statistical information best identifies what processes need to occur for positive educational outcomes?
7. What variables are/have been identified by the faculty that need to be the basis of statistical information?
8. What are alternative educational processes used/taught by faculty that will ultimately increase the opportunity for the first-time passing of NCLEX?
9. What methods will be used to keep what is "good" in the program and encourage positive NCLEX outcomes?
10. What processes are or will be used to change the "deficits" in the program? (These deficits will possibly result in less than acceptable NCLEX outcomes).
11. What in-class or course expectations occur by each instructor that encourages learning theoretical concepts and understanding multiple-choice test-taking?
12. What statistics and processes are necessary for the development of a nursing program's unique pre-entrance exam?
13. What faculty behaviors are known to improve student learning and academic success?

LAST THOUGHTS

***WE CANNOT ACCURATELY PREDICT OR ACCURATELY CHANGE THE FUTURE WITHOUT BEING KNOWLEDGEABLE ABOUT THE PAST!**

RECOMMENDED READING

Transformational leadership by this author (Reference for Problem Conquering)

Understanding Test Preparation and Application by this author

Critical thinking by this author

The Feynman Technique: The Best Way to Learn Anything, http://getpocket.com/feynman-technique

Secrets of Success for High NCLEX-RN Pass Rates for BSN Nursing Programs, Nonie Wiggins, Volume 2, Issue 3 CONFERENCE PROCEEDINGS: October 4th-5th, 2012

What the Best Mentors Do, Anthony K. Tjan, Harvard Business Review, February 2017

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