Nurse Education Today 35 (2015) 1283–1288

Contents lists available at ScienceDirect

Nurse Education Today

journal homepage: www.elsevier.com/nedt

Nursing students' attitudes toward statistics: Effect of a biostatistics course and association with examination performance

Panagiotis Kiekkas *, Aliki Panagiotarou, Alvaro Malja, Daniela Tahirai, Rountina Zykai, Nick Bakalis, Nikolaos Stefanopoulos

Nursing Department, Technological Educational Institute of Western Greece, Patras, Greece

ARTICLE INFO

Article history:
Accepted 13 July 2015

Keywords:
Nursing students
Biostatistics
Course
Attitudes toward statistics
Examination performance

SUMMARY

Background: Although statistical knowledge and skills are necessary for promoting evidence-based practice, health sciences students have expressed anxiety about statistics courses, which may hinder their learning of statistical concepts.
Objectives: To evaluate the effects of a biostatistics course on nursing students' attitudes toward statistics and to explore the association between these attitudes and their performance in the course examination.
Design: One-group quasi-experimental pre-test/post-test design.
Setting and participants: Undergraduate nursing students of the fifth or higher semester of studies, who attended a biostatistics course.
Methods: Participants were asked to complete the pre-test and post-test forms of The Survey of Attitudes Toward Statistics (SATS)-36 scale at the beginning and end of the course respectively. Pre-test and post-test scale scores were compared, while correlations between post-test scores and participants' examination performance were estimated.
Results: Among 156 participants, post-test scores of the overall SATS-36 scale and of the Affect, Cognitive Competence, Interest and Effort components were significantly higher than pre-test ones, indicating that the course was followed by more positive attitudes toward statistics. Among 104 students who participated in the examination, higher post-test scores of the overall SATS-36 scale and of the Affect, Difficulty, Interest and Effort components were significantly but weakly correlated with higher examination performance.
Conclusions: Students' attitudes toward statistics can be improved through appropriate biostatistics courses, while positive attitudes contribute to higher course achievements and possibly to improved statistical skills in later professional life.

Introduction

Biostatistics refers to the application of statistical theories and methods in health sciences. The central role of biostatistics in analyzing and interpreting research data has advocated for teaching biostatistics in health sciences students as part of their undergraduate education. Gaining knowledge in understanding and using biostatistics is expected to help healthcare professionals in complex clinical decision-making and in applying evidence-based interventions (Hannigan et al., 2014; Zhang et al., 2012).

Despite the advantages of mastering biostatistics, health sciences students generally perceive statistics as difficult and non-popular subject and experience high levels of anxiety, or even fear, during statistics courses (Freeman et al., 2008; Garfield, 2003). Anxiety about statistics has been attributed to poor mathematical background, previous negative experiences in mathematics or statistics courses, difficulty in understanding the usefulness of statistics and limited evidence on the pedagogy of teaching biostatistics (Baloglu, 2003; Bechrakis et al., 2011). Negative consequences of anxiety about statistics include hindering students' learning of statistical concepts and methods, as well as limiting their ability for developing statistical thinking skills and for applying these skills in clinical practice (Beurze et al., 2013; Onwuegbuzie, 2003).

Existing literature on the attitudes of undergraduate nursing students toward statistics is particularly limited. Students in a Canadian university reported moderate levels of fear and anxiety toward statistics courses, moderate self-confidence in using mathematics and fair self-confidence in using computers for statistics (Hagen et al., 2013). A second study conducted in a US university revealed that nursing students had significantly more negative attitudes toward statistics compared with non-nursing ones (Mathew and Aktan, 2014). Besides students, graduate nurses from Canadian universities identified the inherent value of statistics, but they stated that they would not feel comfortable to use statistics in their practice (Gaudet et al., 2014).

* Corresponding author. Tel.: +30 2610 274789.
E-mail address: kiekkpan@otenet.gr (P. Kiekkas).

http://dx.doi.org/10.1016/j.nedt.2015.07.005
0260-6917/

Considering the possible inhibiting effects of negative attitudes toward statistics on their learning, important questions would be whether statistics courses can contribute to the development of students' positive attitudes toward statistics, and how students should be taught statistics to develop positive attitudes. Students' positive attitudes toward statistics include their need to believe that they can understand and use statistics, think that statistics is useful in their professional lives, recognize that statistics can be interesting, be willing to invest the effort needed to learn statistical thinking and skills, and realize that statistics is not too difficult to learn (Ramirez et al., 2012). A literature review identified particularly limited evidence concerning the pedagogy of statistics in undergraduate nursing students (Epstein et al., 2011); the only beneficial effects were suggested for taking research simultaneously, and not in sequence, to the statistics course and for web-based statistics programs. However, a more recent study reported that nursing students' fear and anxiety about statistics dropped by 40% after a statistics course, which intended to be applied, engaging and enjoyable (Hagen et al., 2013). In this study, preferred learning styles according to students' responses included real life examples, "hands on" learning, visual learning aids, use of PowerPoint slides and weekly quizzes. Likewise, preferred teaching styles included clear explanations from instructors, approachability, patience, in-depth knowledge of statistics, careful pacing, timely feedback to students and clearly stated learning expectations.

Students' positive attitudes toward statistics are expected to improve their learning process in statistics courses and be associated with higher performance in course examinations. Unfortunately, evidence on respective associations among nursing students is missing from literature. In most studies, attitudes toward statistics have been positively and strongly correlated with examination performance in statistics courses among graduate and undergraduate students (Cashin and Elmore, 2005; Chiesi and Primi, 2009; Finney and Schraw, 2003), while small but significant correlations have also been reported (Evans, 2007). With regard to the components of attitudes toward statistics, a meta-analysis of studies conducted on post-secondary students reported positive, moderate correlations of statistics courses achievement with affect and cognitive competence among US students, while correlations with value and difficulty were small among both US and non-US students (Emmioglu and Capa-Aydin, 2012). When coming to health sciences, significant correlations were reported between higher achievement in a statistics course and positive attitudes toward statistics of medical post-graduate students (Zhang et al., 2012).

The aims of this study were to investigate the attitudes toward statistics of undergraduate nursing students in Greece, to evaluate the effects of a biostatistics course on their attitudes toward statistics and to explore the associations between their post-course attitudes toward statistics and their performance in the biostatistics course examination.

Methods

Design and Participants

This study was conducted in the Nursing Department of the Technological Educational Institute of Southwestern Greece. Biostatistics constitutes a mandatory course of the undergraduate curriculum, which lasts 13 weeks during the fifth semester of studies and is followed by written examination of voluntary participation for students. Students being at the fifth or higher semester of their studies, who registered for attending the biostatistics course during the winter semester of 2014–15 academic year, were invited to participate; no other inclusion or exclusion criteria were used. One-group quasi-experimental pre-test/post-test design was used. Participants' attitudes were evaluated prior to the beginning of the biostatistics course (pre-test) and immediately after this course was completed (post-test).

Instrument and Data Collection

The Survey of Attitudes Toward Statistics (SATS)-36 scale was adopted for evaluating students' attitudes toward statistics (Schau, 2005). This scale is an extension of the earlier version of SATS-28 scale (Schau et al., 1995), in which two more subscales (components) and 8 more items were added. SATS-36 scale consists of 36 items divided into six subscales: Affect (feelings concerning statistics — 6 items), Cognitive Competence (attitudes about intellectual knowledge and skills when applied to statistics — 6 items), Value (attitudes about usefulness, relevance, and worth of statistics in personal and professional life — 9 items), Difficulty (attitudes about difficulty of statistics as a subject — 7 items), Interest (individual interest in statistics — 4 items), and Effort (amount of work expended to learn statistics — 4 items). Considering that all items are 7-point Likert-type and assessed with 1 = "strongly disagree" to 7 = "strongly agree" (4 = "neutral"), higher scores of the overall SATS-36 scale and its subscales correspond to more positive attitudes toward statistics, provided that the responses to some negatively worded items are reversed (e.g. 1 replaced by 7). Item responses are summed within the overall scale and each subscale and then divided by the number of respective items to calculate the overall scale and subscale scores.

SATS-36 scale is a cross-cultural tool that has been previously validated in different languages; it has a pre-test form used before or in the beginning of the statistics course, and a post-test form used after the course has ended. The two forms are identical except for some wording differences among items, which relate to assessment timing and enable comparisons of participants' attitudes at different time points during the learning process. SATS-36 survey also includes questions about participants' prior math/statistics course experience and achievement, math/statistics cognitive competence and future use/mastery of statistics (information from these questions is not presented in this study).

Among available scales used for evaluating students' attitudes toward statistics, SATS-36 scale appears to have the strongest evidence of content, substantive and construct validity, as well as of internal consistency, across samples and countries with regard to both the overall scale and its subscales (Epstein et al., 2011; Nolan et al., 2012). SATS-36 scale has been translated into Greek (forward and backward translation by independent professional translators) by Andreadis and Chadjipantelis (2005); however, validity and internal consistency of the Greek version have not been evaluated. An evaluation of the earlier SATS-28 scale version among Greek undergraduate students revealed satisfactory construct validity and internal consistency for both the overall scale and its subscales (Bechrakis et al., 2011).

Just before the beginning of the first lesson of the biostatistics course, the authors briefly presented and explained study aims and methods to eligible students. After study presentation, the pre-test form of the SATS-36 scale, along with a demographic sheet, was administered to students willing to participate; participants were asked to complete them in the classroom and return them to the authors. In the demographic sheet, participants provided information about their name, age, gender and semester of studies. Similarly, immediately after the end of the last lesson of the biostatistics course, students who had already completed the pre-test form of the scale were asked to complete its post-test form (along with their name, so that the post-test form could be matched with the pre-test one) and return it to the authors.

Biostatistics Course

The biostatistics course was designed by the authors, primarily by A.P., who was the sole teacher during lessons. The objective of the course was to introduce students to the major principles of biostatistics. With regard to the content, course curriculum mainly included the following: statistical theory, basic principles of statistical methodology, descriptive statistics, probability, random variables and probability