Nursing students' self-efficacy, self-regulated learning and academic performance in science

Sharon Andrew and Wilma Vialle

Graduate School of Education, University of Wollongong, Australia

The study examined the relationships among self-efficacy, learning strategies and academic performance. Specifically, it reports a study of students' academic and science self-efficacy, self-regulatory learning strategies and academic performance in first year science courses of undergraduate nursing programs. Students from several universities were surveyed by questionnaire and a sample of these students was interviewed by telephone.

In addition to socio-demographic items, the questionnaire incorporated several research instruments including: the Self-Efficacy For Science (Andrew, 1998), the Nursing Academic Self-Efficacy Scale (Harvey & McMurray, 1994) and selected scales from the Motivated Strategies for Learning Questionnaire (Pintrich et al 1991). The semi-structured telephone interviews included questions about students' interest and self-beliefs about science and learning strategies used for studying science. Preliminary results of these interviews and interrelationships among the research scales are discussed in this paper.

Introduction

Technological and informational systems are evolving with such rapidity that occupations challenged by these developments require the preparation, by educational institutions, of learners who are capable of adapting to these changes. Students who engage in self-regulated learning may be those best prepared to meet these challenges for the future.

Self-regulated students are those who are 'metacognitively, motivationally and behaviorally active participants in their own learning process' (Zimmerman 1986) and self-regulated students have been described as confident, autonomous, inquisitive learners who employ metacognitive strategies to facilitate their learning (Risemberg & Zimmerman 1992, Zimmerman & Martinez-Pons 1988).

In the framework of a social cognitive theory, in order to be classified as a self-regulated learner, a student must use 'specified strategies to achieve academic goals on the basis of

self-efficacy perceptions' (Zimmerman 1989). Self-efficacy relates to students' self-perceptions of their ability to perform a task (Bandura 1986).

Self-efficacy and learning strategies have been found to be associated with academic performance (Pintrich & DeGroot 1990, Pintrich & Schrauben 1992, Chye et al. 1997). Students who are high achievers use more self-regulated learning strategies than low achievers (Risemberg & Zimmerman 1992), although these strategies may vary among students (Zimmerman & Martinez-Pons 1990, Ablard & Lipschultz 1998). Self-efficacy has been found to be related to academic performance in nursing (Chacko & Huba 1991) and science (Andrew 1998) courses in nursing programs .

In the first year of a BN program, apart from studying specifically nursing courses (theory and clinical), nursing students may also study courses adapted from other disciplines such as chemistry, physics, biology, physiology, sociology and psychology. The merging of science (physics, chemistry and bio-sciences) has been problematic in nursing programs and nursing students have consistently had difficulties with this area of their programs irrespective of the type of course or institution conducting the program. These difficulties are not uniquely Australian, but have also been reported by researchers from the UK (see for example Akinsanaya & Hayward 1980, or Trnobranski 1993, 1997) and the USA (Lenehan 1994).

Students' perceptions of the relevance of science to nursing and students' science background have been among the variables examined in relation to these difficulties. Students' past science background has been found to be an unreliable predictor of academic performance in nursing programs (Kershaw 1989, Caon & Treagust 1992). Students judge the relevance of course content according to their beliefs about the applicability of the material (Thornton 1997) and students' perceived beliefs about nursing courses have been found to have a stronger influence on course outcomes than various learning strategies (Trigwell & Prosser 1991). Curriculum changes or courses aimed at reducing students' difficulties with the science content of the curriculum have met with modest success (Gillies & Soars 1992, Nicoll & Butler 1996).

An examination of nursing students' self-regulated learning may provide insight into students' motivation, and academic behaviour in science and expand our knowledge of how and why some students are more successful at science than others.

Methodology

Research Issue

The first research issue of this study related to an examination of the relationship between self-efficacy and other selected self-regulated learning behaviours to academic performance in a first year science course of Bachelor of Nursing (BN) programs.

The second research issue related to an investigation of the differences in self-efficacy and self-regulatory learning strategies between high and low achievers.

The last research issue related to the value (interest/relevance/importance) students placed on science in nursing and how these values related to academic performance.

Sample and Design

This study employed a triangulated methodology—pen and paper questionnaire and telephone interview—to examine the research issue. Undergraduate nursing students from three university campuses in NSW were surveyed, by questionnaire, early in the first semester of a BN program. The questionnaire incorporated several research instruments and items pertaining to the socio-demographic background of the students. The questionnaire was completed by 303 students. For these respondents, 246 (81%) were females, 57 (19%) were males and the mean age was 21 years.

The questionnaire also included a consent form to collect students' academic mark/grades for first year courses and consent to participate in a telephone interview. Approval to collect academic marks/grades was given by 190 students and 80 students consented to be interviewed by telephone. Subsequently, 40 telephone interviews were conducted, over several weeks, late in the first semester.

Instrumentation

The Questionnaire

SEFS and NASES

Both the Nursing Academic Self-Efficacy scale (NASES, Harvey & McMurray, 1994) and the Self-Efficacy for Science (SEFS, Andrew, 1998), the research instruments used in the study, were Australian and designed specifically to be used with nursing students.

Whilst the SEFS measures science self-efficacy, the NASES is more general and measures self-efficacy for various academic areas of the first year nursing curriculum including science. The internal reliability of the SEFS has been reported as alpha 0.90 (Andrew, 1998) and the NASES as alpha 0.94 (Harvey & McMurray, 1994). The Cronbach alphas for this study were 0.84 and 0.97 for the SEFS and NASES respectively (Table 1).

Motivated Strategies for Learning Questionnaire (MSLQ)

Adapted scales from the MSLQ were used to measure students' motivation and learning strategies (Pintrich, Smith, Garcia, & McKeachie, 1991). Two motivation scales: task value (TV) and self-efficacy for learning and performance (SELAP), were used in the study. The TV scale in the MSLQ is a measure of students' perceptions of the 'interest, importance and utility' (Pintrich, Smith, Garcia, & McKeachie, 1991) of a course, which can be conceptualised as similar to the aspect of relevance in nursing. From the learning strategies scales, critical thinking (CT) and metacognitive self-regulation (MCSR) were used. As the MSLQ was designed for an American sample, Cronbach alphas, a measure of the internal reliability of the research instrument, were calculated for this study (see Table 1).

The Telephone Interview

Semi-structured telephone interviews were conducted with 40 students. Students were questioned about their perception of the relevance of the science course to nursing practice; science background and past attitudes to science; confidence in their academic performance; and they were asked to describe how they studied for the science course.

Results

Means, standard deviations, (SD), and Cronbach alphas for the research instrument, with calculations based on the total sample (303) students, are given in Table 1.

Table 1

Summary Statistics and Cronchbach Alphas for SEFS, NASES and MSLQ Scales

	Mean	SD	Cronbach Alpha
SEFS	3.85	0.58	0.84
NASES	7.78	1.78	0.97
MSLQ			
TV	5.73	1.06	0.86
SELAP	4.58	1.29	0.94
MCSR	4.55	1.02	0.79
CT	4.00	1.32	0.79

n 303

To examine the interrelationship among the research instruments, Pearsons product-moment correlations were computed. All the self-efficacy measures (SEFS, NASES and SELAP) were statistically significantly related to each other (p=0.0001) with correlations ranging from 0.40-0.51 (see Table 2). As expected all the scales of the MSLQ were correlated statistically significantly with each other. The CT and MCSR scales of the MSLQ were also statistically significantly correlated with the SEFS and NASES although the correlations were stronger for the NASES.

Table 2

Correlations among SEFS, NASES and MSLQ Scales. TV: Task Value, SELAP: Self-Efficacy for Learning and Performance, MCSR: Metacognitive Self-Regulation, CT: Critical Thinking.

	SEFS	NASES	MSLQ Scales			
			TV	SELAP	MCSR	CT
SEFS	1.00					
NASES	0.49	1.00				
TV	0.32	0.50	1.00			
SELAP	0.40	0.51	0.67	1.00		
MCSR	0.28	0.43	0.51	0.40	1.00	
CT	0.22	0.36	0.42	0.49	0.65	1.00

All statistically significant at 0.0001 except CT: 0.0003

Self-Efficacy, Strategy Use and Academic Performance

Two measures were used to determine students' academic performance—students' academic score (mark) and grade— for their first semester science course (n163). Using students' science scores, Pearson product-moment correlations were computed to examine the association between self-efficacy, strategy use and academic performance in science (Table 3). The SEFS, NASES and all scales of the MSLQ were statistically significantly correlated to academic performance with the strongest correlation for TV (0.38, p=0.0001) and lowest for CT (0.19, p=0.01).

Table 3

Correlations Between SEFS, NASES, MSLQ Scales and Students' Academic Score for their First Semester Science Course

	Science Score
SEFS *n163*	0.32***
NASES *n163*	0.23***
MSLQ *n162*	
TV	0.38***
SELAP	0.28***
MCSR	0.24**
CT	O.19*

Statistical significance: *** p <0.0003,

**p 0.001, *p 0.01

The academic grades Fail, Pass, Credit, and Distinction/High Distinction (merged) were used to examine the relationship between the mean score for the research instruments and students' academic performance in science (Table 4). Students who were awarded a Fail or Pass grade for their science course had lower mean scores for all the research instruments than students who obtained a Credit or Distinction/High Distinction.

Table 4

Mean Score for SEFS, NASES and MSLQ Scales by Science Grades

	Science Grade						
	Fail	Pass	Credit	Distinction/High Distinction			
SEFS*n163*	3.46	3.83	3.86	4.16			
NASES*n162*	6.68	7.73	7.88	8.09			
MSLQ*n162*							

TV	4.92	5.74	5.97	6.42			
SELAP	3.80	4.60	4.74	4.93			
MCSR	3.81	4.50	4.80	4.75			
CT	3.57	3.69	4.36	4.28			

A Chi-square analysis was performed to determine if this association was statistically significant. To perform the analysis, academic performance was divided into two categories. The grades Fail and Pass were merged to form the low category, and the grades Credit, Distinction and High Distinction were merged to form the high category of academic performance.

The association was statistically significant for the SEFS (p=0.004), TV (p=0.03), MCSR (p=0.005) and CT (p=0.02) (Table 5). Although students in the high performance category were more likely to have scores above the mean for the NASES and the SELAP, students with low academic performance were evenly divided into the above and below mean categories for these scales and hence the association was statistically non-significant.

Table 5

Association between Mean Score for SEFS,

NASES, MSLQ Scales and Academic Performance

(low/high): p Values

	p
SEFS	0.004*
NASES	0.162
MSLQ	
TV	0.032*
SELAP	0.499
MCSR	0.005*
CT	0.024*

*Statistically significant

Telephone Interviews

Relevance

For the question relating to the relevance of science to nursing, students were categorised into yes, no or undecided. Students were more likely to consider it relevant (60%):

Yes [the science is relevant to nursing practice], I'm so glad I'm learning science although it is hard, but you need to know why you're doing things. We did pressure in science before we went on clinical. When I took a patient's BP [Blood Pressure] the family of the patient asked what BP is and I could explain it to the family.

than not (22%):

No [the science is not relevant to nursing practice]. I asked the Lecturer 'Why are we doing science?' [The Lecturer] says we need to know [science] to understand what we are doing on clinical. I don't think it's relevant. I don't see the relevance of why we are doing science.

whilst 10% were undecided (10% did not respond). An examination of those students in the no or undecided category revealed that 77% had obtained a Fail or Pass grade for their science course.

Self-beliefs

The majority of students who did biology frequently described liking (78%) this unit at school:

Yes, I did biology until year 11. I did like it [biology].

However, for those who had some experience with chemistry or physics the reaction was the reverse of that for biology, with the majority (78%) describing themselves as disliking these units. The terms 'difficult' and 'hard' were terms frequently used to describe these units:

I found chemistry and physics too hard [at high school] and avoided them.

I did physics until year 11 and then dropped it [physics] as I found it too difficult.

When questioned about their anticipated academic grades for their science course only 6% expected to obtain higher than a Pass grade.

Strategy Use

Students' responses to the question concerning their method of studying for their science course were coded, where appropriate, using the cognitive and metacognitive categories of the MSLQ Pintrich et al 1991, 1993). *Rehearsal* : included descriptions of recitation, memorisation or use of repetition strategies. *Organisation:* included descriptions such as reading textbooks/notes/dictionaries, making diagrams, re-writing notes underlining/highlighting material. *Elaboration:* included strategies such as making summaries, identifying main ideas and reading lab reports. *Time and study environment:* referred to comments about structuring the students' study environment:

I draw pictures on butchers paper [organisation] and stick it on the wall [time and study environment].

Help seeking: included descriptions of seeking assistance from tutors/lecturers/student learning services/work colleagues. *Peer learning*: included the strategies studying with friends/peers.

Metacognitive Self-Regulation: mainly included descriptions of monitoring or regulation of learning:

I write out the lecture notes [organisation] and try to get it into my head and then read a book alongside to confirm [what I know] [metacognitive self-regulation].

Finally an additional category termed *Other* was introduced to cover comments not applicable to the categories laready mentioned.

The number of strategies described by students were summed with the number of strategies increasing in accordance with academic grades. The range of strategies described and the mean score for each of the grade categories is given in Table 6.

Table 6

Descriptive Statistics for Cognitive and Metacognitive Learning

Strategies for Telephone Interview Sample

Grade	Range	Mean
Fail/Pass	1-3	1.79
Credit	2-4	2.30
Distinction/High Distinction	2-5	3.10

n39

Discussion

Self-efficacy, Learning Srategies and Academic Performance

The first research issue was examined by correlational analysis and in accordance with previous studies (Pintrich & DeGroot 1990, Pintrich & Schruben 1992, Chye et al. 1997), self-efficacy and learning strategies were related to nursing students' academic performance in BN science courses.

The three self-efficacy measures used in the study (SEFS, NASES and SELAP) were all statistically significantly related to overall academic performance in science, with the SEFS having the strongest correlation (0.32). Students who have high self-efficacy for science tasks, nursing academic areas and self-efficacy for learning and performance achieve higher academic performance in their first year science course.

Nursing students described a strong dislike of science (chemistry, physics and general science) at high school, mention avoiding these units where possible (generally after year 11), and, as indicated earlier, used terms such as 'hard' or 'difficult' to describe them:

I did chemistry and physics in years 7-10. Chemistry I found difficult, and physics was beyond me. That's why I didn't choose them [for the HSC].

As students' past academic background can be an important source of efficacy information (Bandura 1986) it can be surmised that students entering nursing programs have low self-efficacy perceptions about their science ability particularly for the chemistry and physics aspects of the curriculum. This would appear to be supported by the fact that nursing students had low expectations for academic success in their science course, although few expected to fail:

I'm going ok [in science course], but I failed science at school.

Students' use of learning strategies—metacognitive self-regulation and critical thinking—were statistically related to academic performance, albeit the correlation for critical thinking was low (0.19). Students described using rehearsal, organisation, elaboration, time and study environment, help-seeking, peer learning and metacognitive learning strategies when studying for their science course. Organisation and elaboration were the strategies most often described.

Hgh and Low Achievers

The use of learning strategies, in conjunction with strong self-efficacy results in higher academic grades as students' mean scores for the self-efficacy measures and learning strategies increased according to the academic grade obtained by students. When students' grades were divided into high and low academic categories, this association was statistically significant for the SEFS, MCSR and CT.

In congruence with previous studies (Zimmerman & Martinez-Pons 1990, Risemberg & Zimmerman 1992, Ablard & Lipschultz 1998), students who were high achievers in this study described using a variety of learning strategies:

I go through my lecture notes. I read them and find the relevant part in my text-book and highlight. I summarise and make summary notes for example explaining ...

Students who were low achievers described using fewer learning strategies, than high achievers, and appear to be uncertain of how to study for their science course:

I read books and underline. I have no idea how to study.

I take notes. Uncertain [how to study for science course].

It would appear that one way of helping low achievers to improve their academic performance in science would be to make them familiar with the various strategies that may be used in their study of the course area.

Value /Relevance

Students must be persuaded to see the value/relevance of their science course within a nursing program as it is strongly related to overall science academic performance. Students who value science are more likely to fall in the high achievers category whilst students who are low achievers more likely to question the relevance of science to nursing.

Conclusions

To be academically successful in a first year BN science course students, need strong self-efficacy beliefs, to employ a variety of learning strategies and to be convinced of the value/relevance of science to their nursing program. Educationalists involved in the teaching of science, therefore, need to: investigate ways of increasing students' self-beliefs about science, to teach students a variety of learning strategies that they can use when studying science and try hard to convince students of the value/relevance of the science they are studying.

Acknowledgments

Thank you to Ms V Kendrick for her computing expertise.

References

Ablard, K. & Lipschultz, R.E. (1998) Self-regulated learning in high-achieving students: relations to advanced reasoning, achievement goals, and gender. *Journal of Educational Psychology, 90*(1), 94-101.

Akinsanya, J.A. & Hayward, J.C. (1980). The biological sciences in nursing education: the contribution of bionursing. *Nursing Times, 76*(10), 427-432.

Andrew, S. (1998). Self-efficacy as a predictor of academic performance in science. *Journal of Advanced Nursing, 27*, 596-603.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Caon M. & Treagust D. (1992) Passing school biology: a predictor of success in nursing science courses? *The Australian Journal of Advanced Nursing*, *9*(4), 26-30.

Chacko, S.B. & Huba, M.E. (1991). Academic achievement among undergraduate nursing students: the development of a causal model. *Journal of Nursing Education, 32*(6), 255-259.

Chye, S., Walker, R.A. & Smith, I.D. (1997). Self-regulated learning in tertiary students; The role of culture and self-efficacy on strategy use and academic achievement. Paper presented at *AARE Conference*, http://www.swin.edu.au/aare/97.pap/CHYES97350.

Garcia, T & Pintrich, P.R. (1992). Critical thinking and its relationship to motivation, learning strategies, and classroom experience. Paper presented at *Centennial Annual Convention of the American Psychological Association*, Washington, DC, http://ccwf.cc.utexas.edu/~tgarcia/confpapers.html.

Gillies, R. & Soars, L. (1992). A pilot nursing preparatory program: basic mathematics and science skills for mature-age students. In R. Degabrielle (Ed.) (55-59) *COSINE 92 conference proceedings,* Australian Catholic University, Sydney, Australia.

Harvey, V. & McMurray, N, (1994). Self-efficacy: a means of identifying problems in nursing education and career progress. *International Journal of Nursing Studies*, *31*(5), 471-485.

Kershaw D.M. (1989) Student selection for tertiary nursing courses: efficacy of the Anderson score as a performance predictor. *The Australian Journal of Advanced Nursing 6* (3), 34-39.

Lenehan, M.C., Dunn, R., Ingham, J., Signer, B. & Murray, J.B. (1994). Effects of learning-style intervention on college students' achievement, anxiety, anger, and curiosity. *Journal of College Student Development*, *35*(6), 461-466.

Nicoll, L. & Butler, M. (1996). The study of biology as a cause of anxiety in student nurses undertaking the common foundation programme.*Journal of Advanced Nursing, 24,* 615-624.

Pintrich, P.R. & DeGroot, E.V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33-40.

Pintrich, P.R., & Schrauben, B. (1992). Students motivational beliefs and their cognitive engagement in classroom academic tasks. In D.H. Schunk & J.L. Meece (Eds.). *Student perceptions in the classroom* (pp. 149-183). Hillsdale, NJ: Lawrence Erlbaum Associates.

Pintrich, P.R., Smith, D.A., Garcia, T. & McKeachie, W.J. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ).* Ann Arbor:, Michigan: National Center for Research to improve Post Secondary Teaching and Learning (NCRIPTAL). The University of Michigan. Eric Document Reproduction Service, ED 338122.

Pintrich, P.R., Smith, D.A., Garcia, T. & McKeachie W.J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement*, 53(3), 801-813.

Risemberg, R. & Zimmerman B.J. (1992). Self-regulated learning in gifted students. *Roeper Review*, *15*(2), 98-101.

Thornton, T. (1977). Attitudes towards the relevance of biological, behavioural and social sciences in nursing and education. J*ournal of Advanced Nursing*, *26*, 180-186.

Trigwell, K. & Prosser, M. (1991). Improving the quality of student learning: the influence of learning context and student approaches to learning on learning outcomes. *Higher Education, 22*, 251-266.

Trnobranski, P.H. (1993). Biological sciences and the nursing curriculum: a challenge for the educationalists. *Journal of Advanced Nursing, 18,*493-499.

Trnobranski, P.H. (1997). Power and vested interests—tacit influences in the construction of nursing curricula? *Journal of Advanced Nursing, 25*, 1084-1088.

Zimmerman, B.J. (1986). Becoming a self-regulated learner; which are the key subprocesses? *Contemporary Educational Psychology, 11*, 307-313.

Zimmerman, B.J. (1989). A social cognitive view of self-regulated academic learning, *Journal of Educational Psychology*, *81*(3), 329-339.

Zimmerman, B.J. & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. J*ournal of Educational Psychology*, *80*(3), 284-290.

Zimmerman, B.J. & Martinez-Pons, M. (1990). Student differences in self-regulated learning: relating, grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology, 82*(1), 51-59.