Original research

Self–regulated learning ability, metacognitive ability, and general self-efficacy in a sample of nursing students: A cross-sectional and correlational study

Jian Hua Chen[a], Annica Björkman[b,c,*], Ji Hua Zou[a], Maria Engström[b,c]

[a] Department of Nursing, Medicine and Health College, Lishui University, 323000, Lishui, Zhejiang Province, China
[b] Faculty of Health and Occupational Studies, University of Gävle, Kungsbäcksvägen 47, 801 76, Gävle, Sweden
[c] Department of Public Health and Caring Sciences, Uppsala University, Box 564, 751 22, Uppsala, Sweden

ABSTRACT

The healthcare sector is fast-growing and knowledge-intensive, and to meet the demands associated with it, nursing students must have high levels of self-regulated learning (SRL), metacognition, and general self-efficacy (GSE). In this cross-sectional, correlational study, data were collected from 216 nursing students through a questionnaire. The aims were: 1) to describe the levels of SRL ability, metacognitive ability and GSE among second- and third-year nursing students; 2) to explore the relationships between the SRL ability, metacognitive ability and GSE of second- and third-year nursing students; 3) and to compare SRL ability, metacognitive ability and GSE between second- and third-year nursing students. Nursing students had moderate levels of SRL ability and metacognitive ability, but lower levels of GSE. Positive relationships between SRL ability, metacognitive ability, and GSE were observed. Third-year nursing students had a higher level of SRL ability but lower levels of GSE, compared to second-year students. In terms of metacognitive ability, no significant differences were observed between the student batches. Interventions are required for the improvement of nursing students' SRL ability, metacognitive ability, and GSE.

1. Introduction

Globally, the shortage of nurses has become a growing concern. In the United States (U.S.), there is a requirement for about 1.1 million new registered nurses by 2022 (American Nurses Association, 2014), and in China, there is a need for 1.2 million new registered nurses by 2020 (National Health and Family Planning Commission of the People's Republic of China, 2016). The factors contributing to this shortage in nursing staff are diverse. With the ageing of the global population, the need for nursing resources is also on the rise and, additionally, in some countries, nursing students do not complete their education. For example, a study from the US reported that > 50% nursing students withdrew from their courses (Harris et al., 2014). The findings of an Italy-based study showed that 45.3% of nursing students considered giving up their courses (Dante et al., 2011). Another Italy-based study showed that 37.2% of students did not complete the degree programme in time and that the majority of students had dropped out by the end of the 2 nd year, when the learning process was more complex (Dante et al., 2013). Results from Australia and Italy indicated that > 30% of nursing students failed to graduate (Dante et al., 2011; Salamonson et al., 2011). The skills acquired during education and the transition from education to practice have been considered important in providing respite in the context of the shortage of nurses (American Nurses Association, 2014). One way to prepare students for a complex and knowledge-intensive work-life is to promote SRl (Kuiper and Pesut, 2004), which promotes lifelong learning (Zimmerman, 2002).

2. Concepts

As argued by Loyens et al. (2008), very few studies have clearly distinguished between SRL and Self-Directed Learning (SDL). SRL refers to students' ability to diagnose learning needs, set goals, select resources and self-evaluate. SRL focuses on motivational processes and beliefs (e.g., self-efficacy needs and self-reflection) (Zimmerman, 1989, 1995). SDL is described by Knowles (1975) as a process through which individuals take the initiative regarding their learning needs, with or

without the assistance of others when diagnosing learning needs, formulate learning goals, identify resources needed, choose appropriate learning strategies and evaluate the outcome. According to Loyens et al. (2008), the concepts of SRL and SDL should not be used synonymously, as SRL is usually considered a learning characteristic while SDR is both a learning characteristic and a design feature of the learning environment. SRL focuses mainly on learning within school environments. Zimmerman and Lebeau (2000) argue that the definition of SDL in problem-based learning is very similar to the definition of SRL found in other literature. SRL and SDR differ in tradition and terminology, but both terms have been used synonymously in previous research owing to their similarities (Evensen et al., 2001). However, because SDL has its roots outside school learning and SRL has been studied in relation to school learning (Loyens et al., 2008), the present study uses the concept of SRL. SRL is, according to Zimmerman (2002), a dynamic, cyclical and complex process, and is composed of three cyclical phases: the forethought phase, performance phase, and self-reflection phase. The forethought phase includes the beliefs and processes that precede students' learning, as well as task analyses and self-motivation beliefs. Task analysis consists of goal-setting and strategic planning. Setting specific goals has been shown to increase academic performance. Self-motivation has been proven to have a close relationship with a student's self-efficacy beliefs and intrinsic interest/value. The performance phase consists of self-control and self-observation. Self-observation is students' self-recording of performance or experiences during the learning process e.g. writing down process protocol and recording the time spent on studying. The self-reflection phase consists of self-judgment and self-reaction. Self-judgment pertains to students' evaluation of their own performance, in relation to prior performance and the performance of others. Self-reaction includes feelings of self-satisfaction; positive feelings, in this phase, increase students' motivation and efforts to learn. The three phases do not occur only once; they occur cyclically and promote lifelong learning (Zimmerman, 2002). Additionally, a theory, related to SRL in nursing, suggests that, "… *using self-regulated learning contribute*(s) *to the development of metacognitive insights and strengthens the application of metacognition in clinical reasoning contexts …*" (Kuiper and Pesut, 2004, p. 389). Research has found that nursing students have moderate levels of SRL (Chen et al., 2016; Zang et al., 2009; Zhang and Li, 2007), and that SRL is related to GSE (Ying et al., 2016; Zhao et al., 2010), learning adaptability (Zang et al., 2009), and a sense of coherence (Salamonson et al., 2016), among nursing students. Furthermore, SRL has been shown to predict students' academic performance (Keyser and Viljoen, 2015; Long and Aleven, 2017; Salamonson et al., 2016). According to Zimmerman (2002), self-regulatory processes can be taught and learned through other methods. With regards to SRL ability, during different school years, current research points to different findings. For example, Zhang and Li (2007) and Zang et al. (2009) reported no statistically significant differences between students, across school years and Chen et al. (2016) reported higher scores among second-year students than third-year students. The results might indicate that nursing educators do not take corresponding measures to improve nursing students' SRL ability.

According to Flavell (1979, p.908), "*metacognitive knowledge can have a number of concrete and important effects on the cognitive enterprise; it can lead you to select, evaluate, revise, and abandon cognitive tasks, goals and strategies in light of their relationships with one another and with your own abilities and interests with respect to that enterprise. Similarly it can lead to any of a wide variety of metacognitive experiences concerning self, tasks, goals and strategies, and can help individuals to interpret the meaning and behavioral implications of metacognitive experiences*". Interest–based activities have been found to help students stay on task and to improve metacognitive ability (Katz et al., 2006; Pintrich, 1999). Thus, it could be assumed that an individual's interest in his/her major would promote metacognitive ability. Research has found that nursing students have poor or moderate levels of metacognitive abilities (Wang et al., 2016; Xing et al., 2017; Zhang and Fan, 2012). Metacognitive ability

has been shown to be related to GSE (Zhang et al., 2014b), critical-thinking ability (Zhang et al., 2014a), skill performance (Oh, 2016), and clinical-practice ability (Wang et al., 2016) among nursing students. Furthermore, metacognitive ability has been found to predict students' academic performance (Callan et al., 2016; Kassab et al., 2015; Schleifer and Dull, 2009). The existing literature points to higher levels of metacognitive ability among students in the later parts of the course (Zhang et al., 2014b).

GSE is described as the general belief of one's competence in coping with a broad range of stressful or challenging demands in life (Schwarzer, 2014; Schwarzer and Jerusalem, 1995). Research from Egypt, China, and the UK has shown that nursing students' GSE levels varied from 25 to 30 (the scale's possible range is from 10 to 40, and a higher score indicates higher self-efficacy) (Du et al., 2012; Kassem, 2015; Priesack and Alcock, 2015; Ying et al., 2016). Some studies conducted in China pointed to lower GSE levels, varying from 19 (Zhang and Fan, 2012) to 24 (Zhao et al., 2010). Relationships have been found between students' GSE levels and optimism, perception of a challenge (Scholz et al., 2002) and social cognitive variables, e.g., goal intention, outcome expectancies and self-regulation (Luszczynska et al., 2005). Among nursing students, GSE levels have been found to be positively related to metacognitive ability (Zhang et al., 2014b), well-being (Priesack and Alcock, 2015), optimistic coping and problem-solving behaviours (Zhao et al., 2015), time-management disposition (Du et al., 2012), clinical competence and leadership skills (Park et al., 2012), and performance in clinical practice education (Rice, 2015). Furthermore, GSE has showed to be negatively related to anxiety and depression (Du et al., 2012; Scholz et al., 2002). Disparities have been observed in the results of GSE levels among nursing students, in terms of school years. Liu et al. (2009) and Park et al. (2012) suggested that the GSE scores were higher in the later part of education. However, Ying et al. (2016) suggested that there were no differences in nursing students' GSE scores across school years.

Several studies have emphasized the importance of fostering SRL, metacognition and GSE among nursing students. Previously conducted studies have found that the levels of SRL ability (Chen et al., 2016; Zang et al., 2009; Zhang and Li, 2007), metacognitive ability (Wang et al., 2016; Xing et al., 2017; Zhang and Fan, 2012), and GSE (Zhang and Fan, 2012; Zhao et al., 2010) were predominantly low to moderate. It is of interest to further study these concepts and the relationships between the concepts as the research on development during school years shows disparities and little focus has been on nursing students. Therefore, the aims of this study were: 1) to describe the levels of SRL ability, metacognitive ability and GSE among second- and third-year nursing students; 2) to explore the relationships between the SRL ability, metacognitive ability and GSE of second- and third-year nursing students; 3) and to compare SRL ability, metacognitive ability and GSE between second- and third-year nursing students.

3. Methods

3.1. Design

A cross-sectional, correlational design was used, and the data were collected in September 2015.

3.2. Sample

A convenience sample of nursing students was chosen for participation; they were in their second and third years at a university in China. Of a total of 216 students, 199 responded and completed all the items in the questionnaires (response rate 92.1%). Inclusion criteria were nursing students in their second and third year of a nursing programme.

3.3. Data collection

Questionnaires were handed out in September 2015, in connection to a lecture. The questionnaire included socio-demographic data such as age, gender and year of schooling, and three instruments for the measurement of SRL ability, metacognitive ability and GSE. Furthermore, four questions addressed students' interest in nursing (see results section).

The 30-item SRL ability scale includes four subscales: learning motivation (8 items), self-management ability (11 items), cooperative learning ability (5 items), and information quality (6 items). The scale was developed by Zhang and Li (2007), in China, for use among undergraduate nursing students. The response alternative is a five-point scale with scores ranging from 1 to 5 (1 = very unlike me, 2 = unlike me, 3 = neutral, 4 = more like me, 5 = very like me). Some of the statements are reversed before calculating the total scores. The sum of all the items reflects the SRL ability (range 30–150). The higher score, the better the SRL ability. The Cronbach's alpha for total score has been reported to be 0.82: 0.77 for learning motivation; 0.79 for self-management ability; 0.86 for cooperative learning ability and 0.74 for information quality. The scale was developed based on the theory of SRL (Zimmerman, 1989, 2002). The content validity was determined during two rounds with experts (Zhang and Li, 2007).

The 24-item metacognitive ability scale has four factors: metacognitive planning (7 items), metacognitive monitoring (6 items), metacognitive regulating (6 items); and metacognitive evaluating (5 items). The scale was developed by Kang and Zhang (2005), using a sample of 800 college students in China; Zhang and Fan (2012) used the scale for nursing students. The response alternatives are on a five-point Likert scale (1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = always). The total score ranges from 24 to 120, with higher scores indicating better metacognitive ability. The Cronbach's alpha for total score has been reported to be 0.93: 0.87 for metacognitive planning, 0.83 for metacognitive monitoring, 0.85 for metacognitive regulating and 0.79 for metacognitive evaluating. The content validity (experts) and construct validity (exploratory and confirmatory factor analyses) of the scale has been reported to be acceptable. The four factors explained 66.9% of the variance (Kang and Zhang, 2005; Zhang and Fan, 2012).

The 10-item GSE scale is a single-dimension scale. The response alternatives are on a four-point scale (not at all = 1, hardly true = 2, moderately true = 3, and exactly true = 4). A higher score indicates higher self-efficacy (Schwarzer, 2014; Schwarzer and Jerusalem, 1995). In the Chinese version, the Cronbach's alpha was reported to be 0.87, and the 10-day test-retest reliability 0.83 (Wang et al., 2001). Scholz et al.'s (2002) results support the assumption that the GSE scale is a unidimensional and universal construct, based on data from 25 countries (including the Chinese version).

3.4. Data analysis

The data were analysed using IBM SPSS Statistics 22.0. Descriptive statistics, as mean (M), standard deviation (SD), median (Md), quartile (Q), range and frequency, were used to describe data. Bivariate correlations were explored using the Spearman's rank correlation coefficient (r_s), and comparisons between groups, using the Mann-Whitney U test. The significance level for all the analyses was set at $P < 0.05$. The reliability estimates were calculated using Cronbach's alpha. When describing the results for the items in the SRL ability scale, dichotomy was noted in the responses: disagreement (response alternative 1–3) and agreement (response alternative 4–5).

3.5. Ethical considerations

The study obtained ethical approval from the research ethics committee of Lishui Univiersity. Prior to recruitment, the nursing students received information on the study, in terms of its purpose, the procedure involved, and the fact that anonymity was guaranteed. The students were further informed that participation would be voluntary and that the results would be presented at a group level. If a student completed and returned the questionnaire, it was considered informed consent to participate in the study.

4. Results

Most students were female (94.0%; n = 187) and 6.0% were male (n = 12). The students' average age was 20.7 years (SD 0.94), ranging from 18 to 22 years; 57.8% (n = 115) were second-year students and 42.2% (n = 84) third-year students. Female students rated their self-management ability (Md 38) significantly higher than male students (Md 35.5) (Mann-Whitney U-test, P 0.048). For the other variables, there were no significant differences between female and male students. More than half of the students (58.3%, n = 116) answered that nursing was their first choice of programme of study after having completed the college entrance examination, while 41.7% (n = 83) reported that it was not their first choice. About one-third (32.2%, n = 64) of students reported being fairly interested in nursing, 59.8% (n = 119) were neutral and 8.0% (n = 16) were not interested in nursing. More than half (54.8%, n = 109) of students reported that they liked their major/ nursing, while 45.2% (n = 90) reported that they did not like it. After graduation, 88.9% (n = 177) planned to work as nurses, while 11.1% (n = 22) did not plan to. Because interest in a given task has been shown to be related to metacognitive ability (Katz et al., 2006; Pintrich, 1999), we compared the results of the second- and third-year students, with regard to the four questions presented above, and no statistically significant differences were found.

In terms of SRL ability, the nursing students' score was higher than the average of the scale's possible range (Md 103; Q1 94, Q3 110; M 102.6, SD 11.4, range 62–150), while for total metacognitive ability, the score was slightly higher than the average of the scale's possible range (Md 80; Q1 72, Q3 88; M 79.9, SD 12.2, range 47–118). In terms of GSE, the score was slightly lower than the average of the scale's possible range (Md 24; Q1 22, Q3 27; M 24.3, SD 4.3, range 12–40).

4.1. Nursing students' SRL ability

More than 70% students agreed with the statements that they paid more attention to mastering professional knowledge and skills, than to just pass examinations. They believed that the knowledge and skills they acquired would be of great importance in future jobs, and that excellent academic performance could be achieved through hard work (Table 1). Furthermore, > 70% did not agree with the statements that they were reluctant to exchange information on their learning and problems faced with their classmates, and that they were reluctant to express their viewpoints in group discussions. About 60% agreed with the statements that they believed in their ability to solve problems, that they arranged their time according to different tasks, that they chose different learning methods depending on the situation, and that they learned something they were interested in during their spare time. However, < 50% students agreed with the statements that getting a scholarship was a strong driver, learning was interesting, they had a strong desire to learn, they always made a study plan in advance, they usually reviewed the learning contents of a day's topics, they tried to relearn if they did not understand, they carried on with their study despite how hard it was, they knew whether they had reached the desired learning objectives, they were sensitive to new information sources, they always wrote down points after reading and if necessary organized the information collected into a report, and they regularly read nursing journals. Approximately 37% often felt anxious with regards to learning, and were confused about what to do.

Table 1
Descriptive data of nursing students' self-regulated learning ability.

	Disagree/neutral %(n)	Agree % (n)	M (SD)	Md (Q1; Q3)
1. I pay more attention to mastering professional knowledge and skills, and not just to pass examinations.	26.6 (53)	73.4 (146)	4.0 (0.7)	4.0 (3.0; 4.0)
2. Getting a scholarship is a strong driver, inspiring me to study.	55.3 (110)	44.7 (89)	3.3 (0.9)	3.0 (3.0; 4.0)
3. I would get stressed, and try to get ahead of others, if their academic performance was better than mine.	47.2 (94)	52.8 (105)	3.5 (0.9)	4.0 (3.0; 4.0)
4. I believe that the knowledge and skills I acquire will be of great importance in my future job.	28.6 (57)	71.4 (142)	3.9 (0.8)	4.0 (3.0; 4.0)
5. I believe that excellent academic performance can be achieved through hard work.	28.1 (56)	71.9 (143)	3.9 (0.8)	4.0 (3.0; 4.0)
6. I believe I have the ability to solve problems in my learning.	40.2 (80)	59.8 (119)	3.7 (0.8)	4.0 (3.0; 4.0)
7. I think learning is interesting.	51.3 (102)	48.7 (97)	3.5 (0.8)	3.0 (3.0; 4.0)
8. I have a strong desire to learn, always ask questions and try to find answers.	57.3 (114)	42.7 (85)	3.4 (0.7)	3.0 (3.0; 4.0)
9. I always make a study plan in advance.	65.3 (130)	34.7 (69)	3.3 (0.9)	3.0 (3.0; 4.0)
10. I usually arrange my time according to the tasks, in different subjects.	38.2 (76)	61.8 (123)	3.6 (0.8)	4.0 (3.0; 4.0)
11. I usually review the learning contents of the day's topics.	63.3 (126)	36.7 (73)	3.2 (0.9)	3.0 (3.0; 4.0)
12. If I cannot understand any knowledge points, I try to relearn them until I understand.	57.3 (114)	42.7 (85)	3.4 (0.8)	3.0 (3.0; 4.0)
13. I carry on my study, no matter how difficult the learning tasks.	53.8 (107)	46.2 (92)	3.4 (0.8)	3.0 (3.0; 4.0)
14. I often feel anxiety in learning and confused about what to do.	63.3 (126)	36.7 (73)	2.8 (0.9)[a]	3.0 (2.0; 3.0)[a]
15. I am able to find a suitable place for study and take appropriate measures, to eliminate distraction.	42.7 (85)	57.3 (114)	3.6 (0.8)	4.0 (3.0; 4.0)
16. I pay great attention to my teachers' words and deeds, in the process of learning.	47.2 (94)	52.8 (105)	3.6 (0.8)	4.0 (3.0; 4.0)
17. When I face problems, I don't give up easily; I find solutions independently.	43.7 (87)	56.3 (112)	3.6 (0.7)	4.0 (3.0; 4.0)
18. I choose learning methods suitable for me according to different learning contents.	41.7 (83)	58.3 (116)	3.6 (0.8)	4.0 (3.0; 4.0)
19. I am clearly aware of how to achieve the desired learning objectives after I finish learning.	53.3 (106)	46.7 (93)	3.4 (0.8)	3.0 (3.0; 4.0)
20. I am reluctant to exchange with my classmates what I have learned and problems I have faced in study.	73.9 (147)	26.1 (52)	3.2 (1.1)[a]	3.0 (2.0; 4.0) [a]
21. I am reluctant to express my viewpoints in group discussions.	76.9 (153)	23.1 (46)	3.3 (1.0) [a]	3.0 (3.0; 4.0) [a]
22. I am willing to share my learning experiences with students in other fields, to enrich my knowledge.	46.2 (92)	53.8 (107)	3.6 (0.8)	4.0 (3.0; 4.0)
23. When I have problems related to study, I take the initiative to consult teachers or others.	45.7 (91)	54.3 (108)	3.6 (0.8)	4.0 (3.0; 4.0)
24. When I ask people for help with study problems, I adopt all their opinions.	72.4 (144)	27.6 (55)	2.9 (0.9)	3.0 (2.0; 4.0)
25. In my spare time, I learn something that I am interested in.	41.7 (83)	58.3 (116)	3.7 (0.9)	4.0 (3.0; 4.0)
26. I am sensitive to new information sources.	53.3 (106)	46.7 (93)	3.4 (0.8)	3.0 (3.0; 4.0)
27. I regularly read the nursing journals I am familiar with.	72.4 (144)	27.6 (55)	2.9 (0.9)	3.0 (2.0; 4.0)
28. In my study, I seldom search for literature online.	68.3 (136)	31.7 (63)	3.0 (1.0) [a]	3.0 (2.0; 4.0) [a]
29. I always write down points after I read a book or an article.	57.8 (115)	42.2 (84)	3.4 (0.8)	3.0 (3.0; 4.0)
30. If necessary, I organize the information collected into a report, review, or other learning materials.	62.8 (125)	37.2 (74)	3.2 (0.9)	3.0 (3.0; 4.0)

[a] Reversed scores have been used to calculate the mean (M) and median (Md). SD = standard deviation, Q = quartile. The response alternatives for each item are 1 = very unlike me, 2 = unlike me, 3 = neutral, 4 = more like me, 5 = very like me; 1–3 presented as disagree/neutral, and 4–5 as agree, in the table.

4.2. Relationships between nursing students' SRL ability, metacognitive ability, and GSE

The results showed positive and significant relationships between nursing students' SRL ability and GSE ($r_s = 0.32$, $P < 0.001$), metacognitive ability and GSE ($r_s = 0.40$, $P < 0.001$), and SRL ability and metacognitive ability ($r_s = 0.48$, $P < 0.001$). Furthermore, positive and significant relationships were found between the subscales of SRL ability and GSE (r_s ranging from 0.16 to 0.32), and subscales of metacognitive ability and GSE (r_s ranging from 0.30 to 0.39) (Table 2).

4.3. Second- and third-year nursing students' SRL ability, metacognitive ability, and GSE

Third-year nursing students had significantly higher SRL ability

total scores, and higher self-management ability and cooperative learning ability compared to second-year students (*P*-values 0.010, 0.010 and 0.001, respectively). However, in terms of GSE, third-year nursing students had lower scores than second-year students ($P < 0.038$). In terms of metacognitive ability and the other subscales of SRL ability, there were no significant differences between the second- and third-year nursing students (Table 3).

5. Discussion

The results revealed that, among second- and third year Chinese nursing students, the levels of SRL ability and metacognitive ability were moderate and the level of general GSE quite low. The findings of the study, which point to moderate levels of SRL ability and metacognitive ability, are similar to those of other studies (Chen et al., 2016;

Table 2
Correlation coefficients (Spearman's rho) between self-regulated learning (SRL) ability, metacognitive ability (MA) total score (TS) and factor scores, general self-efficacy (GSE) and age.

Variables	SRL-TS	SRL1	SRL2	SRL3	SRL4	MA-TS	M1	M2	M3	M4	GSE
Self-regulated learning total score	0.87										
- Learning motivation (SRL1)		0.79									
- Self-management ability (SRL2)		0.69***	0.77								
- Cooperative learning ability (SRL3)		0.37***	0.43***	0.21							
- Information quality (SRL4)		0.49***	0.48***	0.40***	0.46						
Metacognitive ability total score	0.48***	0.41***	0.47***	0.24***	0.32***	0.92					
- Metacognitive planning(M1)	0.47***	0.38***	0.50***	0.19**	0.32***		0.79				
- Metacognitive monitoring(M2)	0.40***	0.33***	0.34***	0.32***	0.31***		0.62***	0.75			
- Metacognitive regulating(M3)	0.40***	0.33***	0.40***	0.14*	0.25***		0.73***	0.52***	0.83		
- Metacognitive evaluating(M4)	0.35***	0.32***	0.33***	0.20**	0.23**		0.63***	0.66***	0.59***	0.72	
- General self-efficacy	0.32***	0.24**	0.32***	0.16*	0.27***	0.40***	0.39***	0.34***	0.32***	0.30***	0.85
- Age	0.02	−0.04	0.07	0.15*	−0.07	−0.03	−0.04	−0.06	−0.01	−0.00	−0.08

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
Cronbach's alpha values are shown in the diagonal.

Table 3

Second-year and third-year nursing students' self-regulated learning ability, metacognitive ability, and general self-efficacy.

Variables	All participants		Second-year		Third-year		P value
	Md (Q1; Q3)	M (SD)	Md (Q1; Q3)	M (SD)	Md (Q1; Q3)	M (SD)	
Self-regulated learning total score	103 (94; 110)	102.6 (11.4)	101 (92; 108)	101.2 (11.9)	105 (98; 112)	104.5 (10.5)	**0.010**
- Learning motivation	29 (26; 32)	29.1 (4.0)	29 (25; 31)	28.8 (4.3)	30 (27; 32)	29.4 (3.6)	0.242
- Self-management ability	38 (34; 40)	37.5 (4.9)	37 (33; 40)	36.8 (5.0)	39 (36; 41)	38.4 (4.6)	**0.010**
- Cooperative learning ability	16 (15; 18)	16.5 (2.3)	16 (15; 17)	16.1 (2.2)	17 (15.25; 19)	17.0 (2.4)	**0.001**
- Information quality	19 (18; 21)	19.6 (2.7)	19 (18; 21)	19.5 (2.8)	20 (18; 22)	19.7 (2.6)	0.233
Metacognitive ability total score	80 (72; 88)	79.9 (12.2)	80 (71; 88)	79.1 (12.3)	81 (72; 89)	81.1 (12.1)	0.424
- Metacognitive planning	23 (20; 25)	22.5 (4.0)	23 (19; 25)	22.2 (4.1)	23 (20; 26)	22.8 (4.0)	0.395
- Metacognitive monitoring	21 (18; 23)	20.6 (3.4)	21 (18; 23)	20.4 (3.6)	21 (19; 23)	20.8 (3.2)	0.822
- Metacognitive regulating	19 (17; 22)	19.5 (3.8)	19 (17; 22)	19.1 (3.8)	19 (18; 22)	19.9 (3.9)	0.225
- Metacognitive evaluating	18 (15; 19)	17.4 (2.9)	18 (15; 19)	17.3 (3.0)	17.5 (15; 19)	17.5 (2.7)	0.869
General self-efficacy	24 (22; 27)	24.3 (4.3)	25 (23; 27)	24.8 (4.3)	23 (21; 27)	23.5 (4.2)	**0.038**

The Mann-Whitney *U* test was used to compare the groups; Bold text indicates statistically significant *P*-values; Md = Median; Q = quartile; M = Mean; SD = standard deviation.

Zang et al., 2009; Zhang and Li, 2007; Xing et al., 2017; Zhang et al., 2014a). Regarding GSE, the score was quite low and was similar to that reported by Zhao et al. (2010), while higher levels of GSE 30.4 were found among nursing students in a study from the UK (Priesack and Alcock, 2015). In a China-based study, the scores were even lower than the scores obtained in our study, at 19.2 (Zhang and Fan, 2012). The score in our study was also lower than that reported by Wu (2009) in a study which included 25 countries, and in which the mean GSE score was 29.6 (Wu, 2009). The lower scores could be attributed to differences between cultures as well as to gender (Scholz et al., 2002; Wang et al., 2001). For example, Scholz et al. (2002) reported that Asian students (i.e., students from collectivistic cultures such as Japan [mean GSE scores 20] and Hong Kong [mean 23]) have lower GSE scores than their non-Asian peers, such as students from Costa Rica, Denmark, and France (mean 32–33). Looking at undergraduate students in China, Wang et al. (2001) reported that GSE levels among females were slightly lower than those among males.

Regarding SRL, > 70% participants in this study reported that they paid great attention to mastering professional knowledge and skills, and not just to pass examinations and they did not agree with the statement about reluctant to express their viewpoints in group discussions and exchange with their classmates what they have learned and the problems they had faced. The results indicate that having an open communication climate among nursing students is central to safe care. Effective communication, (including communicative openness) is of great importance in the healthcare industry to reduce errors (Randmaa et al., 2014), and ensure cooperative relationships (Randmaa et al., 2017; Salamonson et al., 2009; San Martín-Rodríguez et al., 2005; Suter et al., 2009). Large improvement spaces were reported for the statements about learning methods and interest in learning (Table 1). These findings are consistent with others (Salamonson et al., 2009; Zahner and Henriques, 2013).

We found positive relationships between all the three concepts– SRL ability, metacognitive ability and GSE. These results support the theory of SRL (Kuiper and Pesut, 2004; Zimmerman, 2002), and it can be said that SRL ability, metacognitive ability and GSE, interact with each other positively. We also found that third-year nursing students had significantly higher levels of SRL than second-year students. For the factor cooperative learning ability the levels were also higher for third-year students. Cooperative awareness and communication skills are of great importance ot safe care and teamwork (Randmaa et al., 2017; Leonard et al., 2004). This finding showing higher levels for third-year students is in line with the theory, but differs from results of other studies. Zang et al. (2009) found no differences between the school years, in terms of the SRL, and Chen et al. (2016) showed that third-year nursing students had lower levels of SRL ability than second-year students. In our study, there was no statistically significant difference

with regards to metacognitive ability between second- and third-year students; this contradicts the findings of other studies (Schleifer and Dull, 2009; Zhang et al., 2014b). Surprisingly, our results showed that third-year nursing students had lower GSE than second-year students. Liu et al. (2009) found that GSE increased as education progressed, and Ying et al. (2016) found no significant differences between the school years, in this context. Based on Zimmerman's (2002) description of SRL, one possible explanation of our results could be that third-year students were likelier to dislike or have lesser interest in their major. Previous findings (Chen et al., 2016; Zhang and Wang, 2011) revealed that nursing students who liked their major had higher levels of SRL ability than those who were neutral or disliked their major; those who liked their major were also likelier to use metacognitive strategies (Zhang et al., 2014b). In this study, nearly half of the nursing students (45.2%) disliked their major and more than two-thirds (67.8%) had little interest in their major; this might have affected the scores of SRL ability, metacognitive ability and GSE. However, in our data, no significant differences were observed between the school years, with regards to having interest in the major. Another possible explanation of the results is that third-year nursing students had greater stress and anxiety, which have been found to decrease the scores of GSE (Scholz et al., 2002). In China, third-year students should be prepare to participate in clinical practice, for the first time, during their last [fourth] year. Lack of professional knowledge and skills causes nursing students great stress (Chan et al., 2009). Having less intensive clinical nurse-to-student supervision, receiving a higher level and structured tutorial strategy and initially reporting higher levels of SDL scores before clinical learning have been shown to be associated with increased levels of SDL (Cadorin et al., 2015). As suggested in the literature, SDL can encompass SRL but not the opposite. SRL might facilitate SDL, and SRL abilities are required to become a successful self-directed learner (Cosnefroy and Carre, 2014). Hence, if we can enhance students' SRL, their ability to become self-directed learners may increase and they may develop the life-long learning skills needed for their complex work tasks (Zimmerman, 2002; Kuiper and Pesut, 2004; Loyens et al., 2008).

5.1. Limitations

The limitations of the study include its cross-sectional design and the convenience sample used, as well as the fact that only one university in China was included. Thus, the directions of causality cannot be drawn, and the generalizability of the findings may be affected. However, the sample characteristics are similar to the characteristics of nursing students in China (see, e.g., Zhao et al., 2010; Wang et al., 2014), and the descriptive results, pertaining to the levels of SRL, metacognition ability and GSE, are similar to those of other Chinese studies. The internal consistency was low for two factors of the SRL ability

scale, and the results of these two subscales need to be interpreted with caution.

6. Conclusion

The moderate levels of SRL and metacognitive ability, and low levels of GSE observed in this study point to the importance of creating nursing programmes that promote students' SRL ability, not only to influence present learning outcomes but also to foster lifelong learning. Intervention studies as well as longitudinal studies are needed in the future to extend the current knowledge. It is necessary for nursing educators to pay attention to students' professional interest, cooperative awareness, communication skills and to promote SRL.

Funding source

Conflicts of interest

None.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nepr.2019.04.014.

References

American Nurses Association, 2014. Increased Investment Needed to Produce 1.1 Million RNs, Head off Nursing Shortage. (9/2/14) [News Release] [WWW Document]. http://www.nursingworld.org/FunctionalMenuCategories/MediaResources/PressReleases/2014-PR/Increased-Investment-Needed-to-Produce-11-Million-RNs-Head-off-Nursing-Shortage-2.html, Accessed date: 16 August 2017.

Cadorin, L., Rei, A., Dante, A., Bulfone, T., Viera, G., Palese, A., 2015. Enhancing self-directed learning among Italian nursing students: a pre-and post-intervention study. Nurse Educ. 35, 746–753.

Callan, G.L., Marchant, G.J., Finch, W.H., German, R.L., 2016. Metacognition, strategies, achievement, and demographics: relationships across countries. Kuram ve Uygulamada Egitim Bilimleri 16, 1485–1502.

Chan, C.K.L., So, W.K.W., Fong, D.Y.T., 2009. Hong Kong baccalaureate nursing students' stress and their coping strategies in clinical practice. J. Prof. Nurs. 25, 307–313.

Chen, J.H., Ying, B.H., Chen, Y.L., Guo, Z.P., Lian, Z.M., Wang, Y., Zhao, L., 2016. Analysis of status quo and influencing factors of independent learning ability of undergraduate nursing students in school. Chin. Nurs. Res. 30, 1702–1705.

Cosnefroy, L., Carré, P., 2014. Self-regulated and self-directed learning: why don't some neighbors communicate? International Journal of Self-Directed Learning 11, 1–12.

Dante, A., Fabris, S., Palese, A., 2013. Time-to-event analysis of individual variables associated with nursing students' academic failure: a longitudinal study. Adv. Health Sci. Educ. 18, 1047–1065.

Dante, A., Valoppi, G., Saiani, L., Palese, A., 2011. Factors associated with nursing students' academic success or failure: a retrospective Italian multicenter study. Nurse Educ. Today 31, 59–64.

Du, L., Zhang, Q., Xiao, J.J., 2012. The relationship among undergraduate nursing students' time management disposition, self-efficacy and anxiety. Chin. J. Nurs. 47, 430–433.

Evensen, D.H., Salisbury-Glennon, J.D., Glenn, J., 2001. A qualitative study of six medical students in a problem-based curriculum: toward a situated model of self-regulation. J. Educ. Psychol. 93, 659–676.

Flavell, J.H., 1979. Metacognition and cognitive monitoring: a new area of cognitive—developmental inquiry. Am. Psychol. 34, 906.

Harris, R.C., Rosenberg, L., Rourke, M.E.G.O., 2014. Addressing the challenges of nursing student attrition. J. Nurs. Educ. 53, 31–37.

Kang, Z.H., Zhang, J.S., 2005. The Preliminary Construction of the Scale for College Student's Metacognitive Ability. Shan Xi University, Shan Xi, China.

Kassab, S.E., Al-shafei, A.I., Salem, A.H., Otoom, S., 2015. Relationships between the quality of blended learning experience, self-regulated learning, and academic achievement of medical students : a path analysis. Adv. Med. Educ. Pract. 6, 27–34.

Kassem, A.H., 2015. Bullying behaviors and self efficacy among nursing students at clinical Settings : comparative study. J. Educ. Pract. 6, 25–36.

Katz, I., Assor, A.V.I., Kanat-maymon, Y., 2006. Interest as a motivational resource : feedback and gender matter, but interest makes the difference. Soc. Psychol. Educ. 9, 27–42.

Keyser, J.N., Viljoen, M.C., 2015. Self-regulated learning as predictor of academic performance. Journal for New Generation Sciences 13, 87–100.

Knowles, M., 1975. Self-directed Learning: A Guide for Teachers and Learners. Follett, Chicago, IL.

Kuiper, R.A., Pesut, D.J., 2004. Promoting cognitive and metacognitive reflective reasoning skills in nursing practice: self-regulated learning theory. J. Adv. Nurs. 45, 381–391.

Leonard, M., Graham, S., Bonacum, D., 2004. The human factor: the critical importance of effective teamwork and communication in providing safe care. BMJ Qual. Saf. 13 (Suppl. 1), i85–i90.

Liu, F.P., Lin, P., Li, D., 2009. A study on self-efficacy feeling of college nursing students and its influencing factors. Chin. Nurs. Res. 23, 113–114.

Long, Y., Aleven, V., 2017. Enhancing learning outcomes through self-regulated learning support with an Open Learner Model. User Model. User-Adapted Interact. 27, 55–88.

Loyens, S.M., Magda, J., Rikers, R.M., 2008. Self-directed learning in problem-based learning and its relationships with self-regulated learning. Educ. Psychol. Rev. 20, 411–427.

Luszczynska, A., Scholz, U., Schwarzer, R., 2005. The general self-efficacy Scale : multi-cultural validation studies. J. Psychol. 139, 439–458.

National Health and Family Planning Commission of the People's Republic of China, 2016. Development Planning of the National Nursing Career (2016-2020) from National Health and Family Planning Commission of the People's Republic of China. [WWW Document]. http://www.nhfpc.gov.cn/yzygj/s3593/201611/92b2e8f8cc644a899e9d0fd572aefef3.shtml, Accessed date: 17 August 2016.

Oh, H., 2016. Impact of metacognitive ability on learning achievement and skill performance in nursing simulation learning. Advanced Science and Technology Letters 128, 83–88.

Park, J.W., Kim, C., Kim, Y.S., Yoo, M.S., Yoo, H., Chae, S., Ahn, J., 2012. Impact of critical thinking disposition, general self- efficacy, and leadership on clinical competence in nursing students. Korean Journal of Medical Education 24, 223–231.

Pintrich, P.R., 1999. The role of motivation in promoting and sustaining self regulated learning. Int. J. Educ. Res. 31, 459–470.

Priesack, A., Alcock, J., 2015. Well-being and self-efficacy in a sample of undergraduate nurse students : a small survey study. Nurse Educ. Today 35, e16–e20.

Randmaa, M., Engström, M., Swenne, C.L., Mårtensson, G., 2017. The postoperative handover : a focus group interview study with nurse anaesthetists, anaesthesiologists and PACU nurses. BMJ Open 7, 1–8.

Randmaa, M., Mårtensson, G., Swenne, C.L., Engström, M., 2014. SBAR improves communication and safety climate and decreases incident reports due to communication errors in an anaesthetic clinic : a prospective intervention study. BMJ Open 4, 1–9.

Rice, E., 2015. Predictors of successful clinical performance in associate degree nursing students. Nurse Educat. 40, 207–211.

Salamonson, Y., Andrew, S., Clauson, J., Cleary, M., Jacobs, S., 2011. Linguistic diversity as sociodemographic predictor of nursing program progression and completion. Contemp. Nurse 38, 84–93.

Salamonson, Y., Everett, B., Koch, J., Wilson, I., Davidson, P.M., 2009. Learning strategies of first year nursing and medical students: a comparative study. Int. J. Nurs. Stud. 46, 1541–1547.

Salamonson, Y., Ramjan, L.M., Nieuwenhuizen, S. Van Den, Metcalfe, L., Chang, S., Everett, B., 2016. Sense of coherence, self-regulated learning and academic performance in fi rst year nursing students : a cluster analysis approach. Nurse Educ. Pract. 17, 208–213.

San Martín-Rodríguez, L., Beaulieu, M.-D., D'Amour, D., Ferrada-Videla, M., 2005. The determinants of successful collaboration: a review of theoretical and empirical studies. J. Interprofessional Care 19, 132–147.

Schleifer, L.L.F., Dull, R.B., 2009. Metacognition and performance in the accounting classroom. Issues Account. Educ. 24, 339–367.

Scholz, U., Gutiérrez-Doña, B., Sud, S., Schwarzer, R., 2002. Is general self-efficacy a universal Construct ? Eur. J. Psychol. Assess. 18, 242–251.

Schwarzer, R., 2014. Everything You Wanted to Know about the General Self-Efficacy Scale but Were Afraid to Ask. [WWW Document]. http://userpage.fu-berlin.de/~health/selfscal.htm, Accessed date: 17 August 2016.

Schwarzer, R., Jerusalem, M., Weinman, J., Wright, S., Johnston, M., 1995. Generalised self-efficacy scale. In: Measures in Health Psychology: A User's Portfolio. Causal and Control Beliefs, first ed. NFER-NELSON, Windsor, England, pp. 35–37.

Suter, E., Arndt, J., Arthur, N., Parboosingh, J., Taylor, E., Deutschlander, S., 2009. Role understanding and effective communication as core competencies for collaborative practice. J. Interprofessional Care 23, 41–51.

Wang, C.K., Hu, Z.F., Liu, Y., 2001. Evidences for reliability and validity of the Chinese version of general self-efficacy scale. Chinese Journal of Applied Psychology 7, 37–40.

Wang, C.L., Xing, S.Y., Zhao, L.L., Li, L.L., Sun, Z., 2016. Relevant factors of metacognitive ability and clinical practice ability for undergraduate nursing students. China Higher Medical Education 91–92.

Wang, G.M., Zhang, X., Yin, B., 2014. Relationship among general self-efficacy, critical

thinking and self-directed learning in undergraduate nursing students. Chinese Journal of Nursing Education 11, 10–12.

Wu, C., 2009. Factor analysis of the general self-efficacy scale and its relationship with individualism/collectivism among twenty-five countries : application of multilevel confirmatory factor analysis. Pers. Indiv. Differ. 46, 699–703.

Xing, S.Y., Wei, L.L., Dai, T.H., Liu, F., Zhou, D., Li, S.L., Gu, R.T., Zhang, X.Y., 2017. A survey of metacognitive ability of postgraduates in nursing. Chinese Journal of nursing education 14, 126–129.

Ying, B.H., Chen, J.H., Zhao, L., Chen, Y.L., Lian, Z.M., Wang, Y., 2016. Correlation between general self- efficacy and autonomous learning ability in undergraduate students specializing in nursing. Nursing of Integrated Tradition Chinese and Western Medicine 2, 120–123.

Zahner, S.J., Henriques, J.B., 2013. Interest in public Health careers among undergraduate student nurses. J. Public Health Manag. Pract. 19, 62–69.

Zang, S., Li, X.H., Zhang, X.Y., 2009. A related study on self-learning ability and learning adaptability of college nursing students. Chin. Nurs. Res. 23, 1800–1801.

Zhang, K.L., Wang, J.P., 2011. Analysis on the status quo of self-learning ability of nursing graduates. Chin. Nurs. Res. 25, 3321–3322.

Zhang, X.Y., Fan, X.Z., 2012. The Relationship Among Meta-Cognition, Self-Efficacy and Perceived Critical Thinking in Nursing Students. Shan Dong University, Shan Dong, China.

Zhang, X.Y., Fan, X.Z., Li, J., Liu, Y.X., 2014a. Relationship between critical thinking ability and meta-cognitive ability of nursing undergraduates. Bing Zhou Medical

university of Journal 37, 51–53.

Zhang, X.Y., Li, J., Fan, Y.Y., Zhao, X.M., Yin, S.Y., 2014b. A correlation research on self-efficacy and meta-cognitive ability in nursing students. China Higher Medical Education 47–58.

Zhang, X.Y., Li, X.H., 2007. Study on the Ability of Self-Regulated Learning in Nursing Undergraduates: Measuring Instrument and Investigation of the Current Status. China medical university, Shen Yang, China China medical university.

Zhao, F.F., Lei, X.L., He, W., Gu, Y.H., Li, D.W., 2015. The study of perceived stress, coping strategy and self-efficacy of Chinese undergraduate nursing students in clinical practice. Int. J. Nurs. Pract. 21, 401–409.

Zhao, F.F., Gu, Y.H., He, W., Liu, W.W., Zhang, F., 2010. Relationship between general self-efficacy and self-regulated learning ability in undergraduate nursing students. Chinese Journal of nursing training 25, 519–522.

Zimmerman, B.J., 1989. A social cognitive view of self-regulated academic learning. J. Educ. Psychol. 81, 329–339.

Zimmerman, B.J., 1995. Self-regulation involves more than metacognition: a social cognitive perspective. Educ. Psychol. 30, 217–221.

Zimmerman, B., Lewbeau, R.B., 2000. A commentary on self-directed learning. In: Evensen, D.H., Hmelo, C.E. (Eds.), Problem-based Learning: A Research Perspective on Learning Interactions. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 299–313.

Zimmerman, B.J., 2002. Becoming a self-regulated learner: an overview. Theory Into Pract. 41, 64–70.