Role of academic self-efficacy in the relationship between self-directed learning readiness and problem-solving ability among nursing students

1. Introduction

Problem-solving is a core ability for students to develop professional nursing skills and perform quality care. By improving problem-solving abilities, nursing students can discover and solve patient problems using cognitive, effective, and behavioral processes. Today, problem-solving is believed to be an evaluation index of a student’s high-level thinking ability, and since it can help nurses design and implement effective interventions, problem-solving is a core competency of nursing students. Furthermore, as the economy develops, individuals are paying more attention to health care and seeking holistic care, requiring nurses to be good at solving problems. To improve nursing students’ problem-solving abilities, educators must develop pertinent teaching methods and curricula. However, researchers have previously found that nursing students in different countries had low problem-solving abilities. Therefore, to help nursing students confront the challenges they...
Academic self-efficacy, SDLR, and problem-solving ability

According to the Organization for Economic Cooperation and Development, problem-solving is a process that leads an individual to recognize, formulate, and solve problems. This skill helps individuals solve problems effectively and guide the implementation of solutions. Psychologists believe that the ultimate goal of education is to train students to solve problems, including those related to life, society, and the environment. China’s Ministry of Health and Education (2001) stressed the need for higher medical educators to cultivate medical students’ learning ability, which can help them assess the entirety of their patients’ needs and determine timely countermeasures to solve clinical problems. In the nursing profession, problem-solving abilities affect job performance, quality of nursing care, and prognosis intervention for patients. Although the need for nurses who make appropriate decisions and possess strong problem-solving skills is always increasing, China’s traditional model for nurse education, which affects the cultivation of the students’ practical and problem-solving abilities, is not of high quality. Therefore, to achieve a better learning effect, educators must cultivate their students’ problem-solving abilities.

In self-directed learning (SDL), with or without the help of others, learners display great initiative to judge their own learning needs, formulate goals, evaluate learning resources, engage appropriate learning methods, and evaluate education results. Anyone can become a self-directed learner; however, the outcome of SDL depends on several factors, including motivation and learning attitude, self-confidence, experience, and individual characteristics, which comprise self-directed learning readiness (SDLR). To help students convert from dependent to active learners and then become self-directed lifelong learners, the Accreditation Council for Pharmacy Education encouraged colleges to combine teaching and learning methods. According to previous research, nursing students’ SDLR was significantly correlated with their problem-solving ability, and problem-solving ability could be facilitated by improving the students’ SDLR. Research by Struyf et al. and Williams showed that cultivating students’ problem-solving abilities could improve their self-learning abilities. Therefore, SDL and problem-solving ability are mutually influential and stimulated. In summary, nursing educators should cultivate nursing students’ SDLR and problem-solving ability, which will help nurses effectively cope with complex working environments.

Academic self-efficacy, which relates to an individual’s perception of his or her own capabilities, is an internal factor that influences a student’s SDLR ability. Additionally, it is a key factor that affects students’ learning behaviors, such as problem-solving ability and thinking. According to an individual study, self-efficacy has a positive psychological effect on an individual’s problem-solving process, which was conducive to solving problems.

In conclusion, the ability to solve problems is a professional skill that enables nursing students to enact nursing interventions when they step into clinical work. Further, SDLR is a key factor for improving problem-solving abilities. To enhance nursing students’ problem-solving abilities, educators are making many efforts to develop appropriate teaching methods, such as problem-based learning (PBL). For nurses who face a new environment and the stressful occupation of clinical work, self-confidence and self-evaluation can play an important role in their problem-solving efficacy. Nursing students should be confident when confronting various clinical problems and unpredictable situations. Therefore, academic self-efficacy can have a positive effect on nursing students’ abilities to solve problems. Today, most research investigates the relationship between problem-solving ability and SDLR or the relationship between problem-solving ability and academic self-efficacy, but researchers ignore the relationship among the three skills. This study identified the role academic self-efficacy plays in the relationship between SDLR and problem-solving ability in nursing students. From the perspective of positive psychology, this study suggests that SDLR can improve students’ abilities to solve problems by improving their academic self-efficacy. If this hypothesis is valid, nursing educators can improve their students’ SDLR and problem-solving abilities by improving their academic self-efficacy and learning enthusiasm.

2. Methods

2.1 Design and study sample

A cross-sectional design was used to identify the mediating effect of academic self-efficacy in the relationship between nursing students’ SDLR and problem-solving ability. Convenience sampling was used to select participants from a nursing school in Tianjin, China. With a total of 500 respondents, undergraduate nursing students in all grades participated in this survey.

2.2 Instruments

A demographic questionnaire was designed to collect a range of information, including age, gender, grade, and national origin, as well as whether the participant was...
an only child. Students were asked five questions: did they have experience working in a part-time job; did they choose nursing as their first profession; did they enjoy nursing; did they feel satisfied with their learning; and did they have difficulty learning.

The Self-Directed Learning Readiness Scale (SDLRS) for nursing students was used to measure the level of SDLR. This instrument was developed by Fisher et al.\textsuperscript{22} and translated into Chinese by Wang.\textsuperscript{9} It consisted of 25 items in five subscales: rational problem-solving (RPS), positive problem orientation (PPO), negative problem orientation (NPO), avoidance style (AS), and impulsivity/carelessness style (ICS). A five-point Likert scale was used to measure responses. Prior research concluded that the C-SPSI could measure the level of problem-solving ability in nursing students. For example, Huang and Li\textsuperscript{23} and Li and Xu\textsuperscript{24} found that Cronbach’s $\alpha$ coefficients for the C-SPSI were 0.840 and 0.871, respectively. In this study, the total Cronbach’s $\alpha$ coefficient for the C-SPSI was 0.774.

The final component of this study was academic self-efficacy. Using a questionnaire designed by Liang,\textsuperscript{24} the nursing students’ level of academic self-efficacy was tested. The questionnaire included 22 items in two subscales. The sum of the two dimensions was the total score of the respondent’s academic self-efficacy, with a higher score indicating a higher level of academic self-efficacy. This method has high reliability and validity and has been widely used in the evaluation of college students’ academic self-efficacy. For example, using an academic self-efficacy questionnaire, Guo et al.\textsuperscript{26} analyzed college students’ academic self-efficacy and its influencing factors. Additionally, researchers used an academic self-efficacy questionnaire\textsuperscript{26} to test the level of academic self-efficacy among nursing students. In this study, Cronbach’s $\alpha$ coefficient was 0.815.

### 2.3 Data collection

From November to December 2016, we collected data among nursing students in Tianjin. With an 85.8% response rate, 429 questionnaires were returned, all of which were adapted for analysis.

### 2.4 Ethical considerations

This study was approved by Tianjin University of Traditional Chinese Medicine’s Research Ethics Committee. Students who voluntarily participated were informed about the purpose of the study. Researchers also ensured that respondents’ school records were unaffected, and they experienced no negative consequences for their participation in the study.

### 2.5 Data analysis

SPSS version 21.0 (IBM Corporation, Armonk, NY, USA) was used to analyze the data. Demographic characteristics of the study participants were summarized using descriptive statistics. Correlations among SDLR, academic self-efficacy, and problem-solving ability were analyzed by Pearson’s correlation coefficient. The linear regression method was used to analyze the mediating effect of academic self-efficacy on the relationship between SDLR and problem-solving ability. To establish a valid mediation model, three requirements must be satisfied in three steps: the mediator (academic self-efficacy) must predict the independent variable (SDLR) in Step 1; the independent variable (SDLR) must be a predictor of the dependent variable (problem-solving ability) in Step 2; and the dependent variable (problem-solving ability) must predict the mediator (academic self-efficacy) in Step 3. Partial mediation will be considered if there is a significant relationship between the independent and dependent variables in Step 3.\textsuperscript{27}

### 3. Results

#### 3.1 Participant demographic characteristics

Participants’ ages were between 17 and 25 years (mean: 21.3 years). Nursing student participants included 379 females (88.3%) and 50 males (11.7%). Five hundred students from different grades participated: 105 freshmen (24.5%), 105 sophomores (24.5%), 132 juniors (30.8%), and 87 seniors (20.3%). Most students (65.7%) were satisfied with their school’s teaching methods. More than half of the students (67.1%) had no difficulty with learning and reported that they were satisfied with their major (53.14%). Most participants came from the village (48.5%), and the remainder were from the town (27.5%) and city (24%). The results are shown in Table 1.
3.2 Scores of and correlations among variables

The total scores for SDLR and academic self-efficacy were 149.98 (standard deviation [SD] = 15.73) and 76.26 (SD = 8.16), respectively, which were at the medium-to-high level. Further, problem-solving ability was at a low level, with a score of 85.14 (SD = 10.08).

SDLR was remarkable when correlated with academic self-efficacy and problem-solving ability. Academic self-efficacy was significantly correlated with problem-solving ability. The four dimensions of problem-solving ability were related to the other variables, except ICS (Table 2).

3.3 Mediating effect of academic self-efficacy on the relationship between SDLR and problem-solving ability

The results of the mediating effect of academic self-efficacy on the relationship between SDLR and problem-solving ability are shown in Table 3 and Figure 1. In Step 1, SDLR had a significant effect on academic self-efficacy ($F = 323.634$, $P = 0.000$). In Step 2, academic self-efficacy had a significant effect on problem-solving ability ($F = 118.84$, $P = 0.000$). In Step 3, when adding academic self-efficacy to the regression model in Step 2, the standardized coefficient decreased from 0.493 to 0.251, and the variance of SDLR explained by problem-solving increased from 24.3% to 27.9%. Academic self-efficacy predicted problem-solving ability. Moreover, the
4. Discussion

The results of our research were consistent with the results from other studies and showed that SDLR was significantly positively correlated with problem-solving ability, indicating that higher levels of SDLR in nursing students leads to better problem-solving ability. Further, academic self-efficacy had a remarkable positive correlation with SDLR and problem-solving ability. In their research, Wang et al. and Zhang and Liu showed that when the level of a student’s academic self-efficacy increased, the level of the student’s SDLR and the ability to solve problems also increased. This study suggested that academic self-efficacy was a partial mediator in the relationship between SDLR and problem-solving ability among nursing students.

SDLR is a major priority for the development of professional health education. Medical schools should not hesitate to cultivate nursing professionals’ SDL ability, such that students’ knowledge and skills can exceed beyond graduation, and they can form the habit of observation, thinking, and solving problems in study and life. To encourage students to engage in the process of SDL, Alotaibi recommended that nursing educators pay attention to students’ independence, especially during times of knowledge exploration and the evolution of technology. In turn, this ability will enhance their problem-solving abilities and academic performance.

However, in China, the majority of teaching strategies are teacher-centered, which provides students with little opportunity to discover, explore, or solve problems in continuing education programs. This study demonstrated that Chinese nursing students’ SDLR was at a medium-to-high level, but their problem-solving ability was at a low level, which was consistent with previous findings. The ability to solve problems is particularly important for nursing students, especially in their clinical work, when they must plan and implement appropriate nursing interventions for their patients. Therefore, it is imperative for nursing educators to pay more attention to improving nursing students’ problem-solving abilities.

In addition, previous research showed that the impact of academic self-efficacy on individual development varied, and it was related to the individual’s perception of their capabilities, such as thinking, goal-setting, and the ability to cope with difficulties, all of which can improve students’ SDLR and problem-solving ability. With increased academic self-efficacy, students will have confidence in themselves. They learn how to set goals, solve problems, and bring a positive attitude to their studies.

Sobel test indicated a partial mediating effect of academic self-efficacy on the relationship between SDLR and problem-solving ability.

### Table 3. Mediating effect of academic self-efficacy on the relationship between self-directed learning readiness and problem-solving ability (N = 429)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>t</th>
<th>β</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic self-efficacy</td>
<td>Self-directed learning readiness</td>
<td>17.99***</td>
<td>0.657</td>
<td>0.431</td>
<td>0.430</td>
</tr>
<tr>
<td>Problem-solving ability</td>
<td>Academic self-efficacy</td>
<td>10.90***</td>
<td>0.467</td>
<td>0.218</td>
<td>0.216</td>
</tr>
<tr>
<td>Problem-solving ability</td>
<td>Self-directed learning readiness</td>
<td>11.72***</td>
<td>0.493</td>
<td>0.243</td>
<td>0.242</td>
</tr>
<tr>
<td>Problem-solving ability</td>
<td>Self-directed learning readiness</td>
<td>6.027***</td>
<td>0.329</td>
<td>0.279</td>
<td>0.276</td>
</tr>
<tr>
<td>Problem-solving ability</td>
<td>Academic self-efficacy</td>
<td>4.598***</td>
<td>0.251</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ***P<0.001.

### Figure 1. Mediating effect of academic self-efficacy on the relationship between self-directed learning readiness and problem-solving ability.

Note: ***P<0.01.
Therefore, nursing educators face a common challenge of determining how to improve academic self-efficacy by increasing student confidence and how to foster the students’ capabilities to be successful in school.

Academic self-efficacy partly mediates SDLR and problem-solving ability. This finding shows that nursing students with SDLR are likely to have a higher ability to solve problems. Furthermore, positive psychological effects, such as self-confidence, were conducive to solving problems.

Convenience sampling was used to extract the samples. We recruited students only from Tianjin, China, which may not be representative of all nursing students. Further research will be needed to expand the study sample and recruit students from different regions. Another limitation was that we used a Likert scale to conduct a quantitative analysis of nursing students’ responses. Without a qualitative analysis, the effect of the evaluation was limited.

5. Conclusions

Problem-solving is considered an evaluation index of high-level thinking ability, and it is a core competency of nursing students. Problem-solving can also influence nurses when making decisions related to their patients’ outcomes in the clinic. Therefore, to achieve a better learning effect, educators must cultivate nursing students’ problem-solving ability.

The findings of this study suggest that academic self-efficacy partly mediates SDLR and problem-solving ability. From the perspective of psychological cognition, nursing educators can enhance students’ SDLR and problem-solving ability by improving their learning confidence and attitude. This study provides a basic understanding of the role of academic self-efficacy in the relationship between SDLR and problem-solving ability among nursing students.

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Conflicts of interest

All contributing authors declare no conflicts of interest.

References