The Significance of Self-directed Learning Readiness, Academic Self-efficacy, and Problem-solving Ability Among Filipino Nursing Students

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Abstract. A professional skill that permits nursing students to carry out nursing interventions in the workplace is the ability to solve health care problems. This is essential if they want to become professional nurses. Educators have been attempting to establish effective instructional techniques to improve nursing students' problem-solving abilities. This study examined the relationship between problem-solving ability, academic self-efficacy, and self-directed learning readiness (SDLR) among nursing students. This study utilized a descriptive correlational study and recruited 170 nursing students in a private higher education institution in the Philippines. Standardized questionnaires were distributed, and data were analyzed using descriptive and inferential statistics. Results show that there is a significant indirect association between problem-solving ability and SDLR (r = -0.525, p < 0.001). Secondly, there is a significant direct association between SDLR and academic self-efficacy (r = 0.549, p < 0.001). Lastly, there is a significant indirect association between academic self-efficacy and problem-solving ability (r = -0.505, p < 0.001). The findings substantiate the assumptions of the study that academic self-efficacy, SDLR, and problem-solving ability of students have relationships with each other. Thus, students who are self-directed learners and are confident with their abilities of success in school tasks are able to solve complex problems or issues. Future research may be explored using longitudinal designs to be able to ascertain the causal link and directionality of the variables related to the present study.

Keywords: academic self-efficacy; health professions education; nursing education; problem-solving ability; self-directed learning

1. Introduction
With the relatively recent implementation of the Outcomes-Based Education Framework in the Philippines, it is very important for schools and teachers to be

able to produce graduates with the right competencies who can address the needs of society. For health professionals to be able to provide quality care, they must be able to solve relevant health care problems. This is clearly outlined in the Philippine Qualifications Framework (PQF) and one of the program outcomes for health professionals, according to the Commission on Higher Education (CHED, 2017) of the Philippines. This skill should be developed in health sciences schools so that students will be able to become competent professionals in the future (Higgs et al., 2008).

Among health professionals, nurses are a critical part of health care and make up the largest section of the health care profession. As part of their training to become professional nurses, nursing students are faced with various cases across their lifespan in different health care settings. By improving problem-solving abilities, nursing students can discover and solve patient problems using cognitive, affective, and behavioral processes (D'Zurilla et al., 2011; Karatas et al., 2017). Nursing graduates are expected to "perform safe, appropriate, and holistic care to individuals, families, population groups, and community utilizing [the] nursing process" (Philippines. CHED, 2017). The nursing process is a problem-solving process specific to the nursing profession.

This is a very important competency to be developed. Because of the increasingly complicated health care system and technology developments in the health care environment, nurses encounter more crises and are confronted with a greater variety of difficulties. There have been observations that some nursing students have low to moderate problem-solving abilities (Altun, 2003; Durmaz et al., 2018). A study has found that nursing students perceive themselves to have low problem-solving abilities (Altun, 2003). With a high workload and conflicting service and training demands, the clinical workplace is a fast-paced and dynamic learning environment (Irby & Bowen, 2004; Ramani & Leinster, 2008; White, 2007). As a result, problem-solving abilities in nursing students must be improved in order to assist them to overcome the challenges they would face in clinical settings. Furthermore, this reality necessitates the development of new learning capabilities, such as self-directed learning (SDL) approaches, in order for students to enhance their problem-solving abilities (Walton & Elliott, 2006).

In order to improve problem-solving abilities and critical thinking, one must be able to modify the learning context. This is very important because outcomes-based education gives emphasis to student-centered learning as opposed to the traditional teaching methodologies. Traditional techniques are teacher-centered, giving learners little opportunity to investigate, discover, or solve complicated issues. Another traditional strategy is content-based learning, which makes students memorize the knowledge rather than analyze the true nature of the knowledge. This cannot improve higher order thinking skills such as problem-solving. Since educators want to develop higher order thinking skills such as problem-solving, SDL is an educational idea that has received a lot of attention in recent years, especially in the context of higher education. Adult learners value SDL methods, skills, and systems over assessments and subject coverage when it comes to learning (Brookfield, 1984). With or without the assistance of others,

learners in SDL demonstrate significant initiative in assessing their own learning requirements, formulating objectives, evaluating learning resources, employing suitable learning techniques, and evaluating educational outcomes. Being able to develop self-directed lifelong learners is also one of the program outcomes common to all health professions. It is also emphasized in the Bachelor of Science in Nursing program, where the goal is for nursing students to "engage in lifelong learning with a passion to keep current with national and global developments in general, and nursing and health developments in particular" (Philippines. CHED, 2017). Aside from evaluating if students have become self-directed learners as an outcome, it is also important for teachers to be able to assess the readiness of the students for SDL methodologies at the outset. According to an earlier study, nursing students' SDL readiness (SDLR) was strongly linked with their problem-solving ability, and enhancing students' SDL preparation might assist problem-solving capacity (Choi et al., 2014; Zhang et al., 2018). As a result, SDLR and problem-solving abilities are interconnected.

Another consideration for learning is a student's perception of his or her own capabilities of success in terms of academics or academic self-efficacy. The breadth or strength of one's conviction in one's own capacity to perform activities and achieve goals is known as self-efficacy (Ormrod, 2006). Self-efficacy is described by Bandura (2004) as one's belief in one's capacity to succeed in certain conditions or complete a task. The way one handles objectives, tasks, and problems is influenced by one's feeling of self-efficacy (Luszczynska & Schwarzer, 2005). Learners who have a high level of self-efficacy are more motivated and perseverant. They put out more effort than people who have poor self-efficacy (Puzziferro, 2008). Self-efficacy has been shown to have a beneficial impact on a person's problem-solving abilities (Zhang et al., 2018). Students will work harder and be more successful in solving problems when they have high beliefs of success in doing problem-solving activities or exercises. Self-efficacy predicts that students work harder on a learning task and understand the problem better when they have high self-efficacy.

In the Philippines, there are nursing schools that have been in existence for more than 50 years, with teachers who are used to the traditional way of teaching and learners who are not yet ready for SDL techniques (Baron, 2017). The purpose of this study is thus to examine the learning context, specifically the relationship between SDLR, problem-solving ability, and academic self-efficacy, in this specific setting. This could be instrumental in designing educational strategies and reforms to enhance students' problem-solving abilities as well as SDLR.

2. Methodology
2.1. Study Design
A descriptive correlational cross-sectional design was used to determine if there are associations among the study variables – problem-solving abilities, SDLR, and academic self-efficacy. Data were thus gathered at one point in time using this design.

2.2. Study Setting and Population

The study was conducted in a private higher education institution in Cebu City, Philippines which offers the Bachelor of Science in Nursing program. The chosen institution has been offering the nursing degree program for over 60 years. It is one of the oldest nursing schools in Cebu City. It also offers other health-allied degree programs such as medical biology, medical technology, and physical and occupational therapy. Respondents were all officially enrolled nursing students. The total number of respondents included in the study was 170. A power analysis using G-power software yielded a sample size of 112 individuals (power = 0.90; α = 0.05; medium effect size = 0.3), which is based on the statistical test used. All respondents were of legal age (at least 18 years old) and were included regardless of their academic status (regular or irregular). Since complete enumeration was used, all students enrolled for the program were recruited for the study.

2.3. Data Collection Procedure

After approval by the technical and research ethics committee, data gathering started. Online administration of the questionnaires was done using Google Forms. Respondents were invited to participate voluntarily by a cover letter prefaced to the questionnaire. The purpose of the study was explained, and emphasis on voluntary participation and the right to refuse was indicated in the letter. It was also indicated that returning the questionnaire would indicate implied consent to participate in the study. The researcher made sure that any concerns and questions were addressed properly before, during, and after the administration of the questionnaires.

Three standardized tools were used as the main research instruments for this study, namely Self-directed Learning Readiness Scale (SDLRS) for nursing education, the Problem-solving Inventory (PSI), and the Academic Self-efficacy Scale. These tools were used for this research with permission from their respective authors. The main criteria for the choice of these tools were appropriateness to the study objectives, instrument validity, acceptable reliability, as well as practical reasons, such as cost and author response and permission. No modifications were made to the tools used.

The first part of the questionnaire obtained the demographic profile of the respondents in terms of age, sex, year level, and section. The second part was the SDLRS for nursing education to assess SDLR levels. This instrument was developed by Fisher et al. (2001). It consisted of 40 items in three subscales: "self-management (13 items), the desire to learn (12 items), and self-control (15 items)." The instrument used a five-point Likert scale, with a higher score indicating a higher level of SDLR, ranging from 5 (strongly agree) to 1 (strongly disagree). The SDLRS has a cumulative Cronbach α value of 0.932, indicating high reliability. The sum of the items is the total score of the respondents' SDLR, with a higher score indicating a higher SDLR.

The third part of the questionnaire was the PSI by Heppner and Petersen (1982), which assesses perceptions of one's problem-solving ability as well as behaviors and attitudes associated with problem-solving style. This included three factors: problem-solving confidence (PSC), approach–avoidance style (AAS), and

personal control (PC). PSC is defined as "an individual's self-assurance, a belief, and trust in one's ability to effectively cope with a wide range of problems" (Heppner et al., 2004, p. 351). Lower scores reflect higher levels of PSC. AAS refers to "a general tendency to approach or avoid different problem-solving activities" (Heppner et al., 2004, p. 351). Lower scores are associated with an approaching style rather than avoiding problems. PC refers to "the belief of control of one's emotions and behaviors while solving problems" (Heppner et al., 2004, p. 351). Lower scores reflect a more positive perception of control in handling problems. Reliability estimates of the 32 items revealed that the constructs were internally consistent ($\alpha = 0.79 – 0.91$) and stable over time. The PSI has been used in academe wherein it used to measure problem-based learning and risk for academic failure (Heppner & Baker, 1997). Scores for all three factors and the total PSI are continuous rather than categorical scores. A lower score indicates better perceived problem-solving abilities.

The final component of this study is academic self-efficacy. The Academic Self-Efficacy Scale by Sagone and De Caroli (2014) explores the perceived self-efficacy in the academic context and includes 30 items each measured on a 7-point Likert scale, ranging from 1 (not at all efficient) to 7 (completely efficient). This scale is made up of four variables that were determined using the principle components technique and factorial analysis (Varimax rotation and eigenvalues greater than 1): 1) self-engagement ($\alpha = 0.79$), "the ability to overcome difficulties with personal involvement" (p. 225); 2) self-oriented decision-making ($\alpha = 0.79$), "the ability to solve problems using themselves as helping source" (p. 225); 3) others-oriented problem-solving ($\alpha = 0.80$), "the ability to solve critical issues using other people as helping source" (p. 225); and 4) interpersonal climate ($\alpha = 0.67$), "the ability to create a prosocial and collaborative climate in interpersonal relationships" (p. 225). The internal consistency reliability resulted to be satisfactory for the total scale ($\alpha = 0.88$). The sum of the four dimensions is the total score of the respondents' academic self-efficacy, with a higher score indicating a higher level of academic self-efficacy.

2.4. Data Analysis
SPSS statistical software was used to examine the data gathered. For continuous variables (e.g., age, SDLR, the PSI, academic self-efficacy), descriptive statistics, such as means and standard deviations (SDs), were computed. For categorical variables (e.g., sex), percentages and frequencies were used. Pearson product-moment correlation using SPSS was applied to correlate problem-solving ability, SDLR, and academic self-efficacy.

3. Results
There was a total of 170 respondents who participated in the study. Of these, 132 (78%) were female and 38 (22%) were male. Furthermore, the mean age of the participants was 19.6 years (SD = 0.6), the youngest being 18 years old and the oldest 21.

3.1. Self-directed Learning Readiness

Generally, the students who participated in the study had high SDLR (M = 3.95, SD = 0.44), as seen in Table 1. Although all subscales are interpreted as high, the data show that the highest score among the subscales was the desire for learning (M = 4.20, SD = 0.41).

Table 1: Level of Self-directed Learning Readiness

Rank	Subscale	M	SD	Interpretation
1	Desire for learning	4.20	0.41	High
2	Self-control	4.00	0.29	High
3	Self-management	3.62	0.40	High
	Total	**3.95**	**0.44**	**High**

Note. 1.0 – 1.80 = very low; 1.81 – 2.60 = low; 2.61 – 3.40 = moderate; 3.41 – 4.20 = high; 4.21 – 5.00 = very high

3.2. Problem-solving Ability

Generally, the students who participated in the study had a slightly positive perception of their problem-solving abilities (M = 2.95, SD = 0.88), as seen in Table 2. Specifically, the data show that the highest score among the subscales was for PSC (M = 2.67, SD = 0.62). On the other hand, the respondents had a slightly negative perception in terms of PC (M = 4.23, SD = 0.35).

Table 2: Level of Problem-solving Ability

Rank	Subscale	M	SD	Interpretation
1	Problem-solving confidence	2.67	0.62	Slightly positive
2	Approach-avoidance style	2.75	0.82	Slightly positive
3	Personal control	4.23	0.35	Slightly negative
	Total	**2.95**	**0.88**	**Slightly positive**

Note. 1.0 – 1.83 = very positive; 1.84 – 2.66 = positive; 2.67 – 3.49 = slightly positive; 3.50 – 4.32 = slightly negative; 4.33 – 5.15 = negative; 5.16 – 6.00 = very negative

3.3. Academic Self-efficacy

Generally, the students who participated in the study had a moderately high academic self-efficacy (M = 4.77, SD = 1.05), as seen in Table 3. Specifically, the data show that the highest score among the subscales was for interpersonal climate (M = 5.33, SD = 0.77). Alternatively, others-oriented problem-solving received the lowest score (M = 3.52, SD = 1.12).

Table 3: Level of Academic Self-efficacy

Rank	Subscale	M	SD	Interpretation
1	Interpersonal climate	5.33	0.77	High
2	Self-oriented decision-making	5.27	0.44	Slightly high
3	Self-engagement	4.75	0.67	Slightly high
4	Others-oriented problem-solving	3.52	1.12	Slightly low
	Total	**4.77**	**1.05**	**Slightly high**

Note. 1.00 – 1.86 = very low; 1.87 – 2.72 = low; 2.73 – 3.58 = slightly low; 3.59 – 4.44 = moderate; 4.44 – 5.30 = slightly high; 5.31 – 6.16 = high; 6.17 – 7.00 = very high

Results show that there is a significant indirect association between SDLR and problem-solving ability (*r* = -0.525, *p* < 0.001), as seen in Table 4. Moreover, there

is a significant direct association between SDLR and academic self-efficacy (r = 0.549, p < 0.001). Lastly, there is a significant indirect association between academic self-efficacy and problem-solving ability (r = -0.505, p < 0.001).

Table 4: Correlation Matrix

Variable	1	2	3	*M*	*SD*
1. SDLR	—			3.95	0.44
2. Problem-solving ability	-0.525***	—		2.95	0.88
3. Academic self-efficacy	0.549***	-0.505***	—	4.77	1.05

***p < 0.001, two-tailed

4. Discussion

The majority of the respondents were female and aged 19 years old. In terms of SDLR, the findings indicate that the respondents have a strong willingness to study on their own. Based on the specific items assessed, the respondents are open to new ideas and want to learn new information. They also enjoy learning new things and to gather facts before they make any decisions. The respondents also have high self-control for their own learning. Based on the specific items assessed, the respondents set their own learning goals and are aware of their own limitations. They also believed that they are responsible for their own actions. Furthermore, the respondents show high self-management for their own learning. Based on the specific items assessed, the respondents manage, organize, and plan their own activities to be able to learn. Thus, these respondents demonstrated a clearer grasp of their obligation in examining themselves, as they pursue meaningful learning experiences (Brockett, 2002; Yang & Tu, 2020). The results suggest that generally the students who participated in the study are able to take the initiative to identify their learning needs, develop their learning goals, choose and implement appropriate learning strategies, and evaluate learning outcomes (Knowles, 1975; Premkumar et al., 2018; Rascón-Hernán et al., 2019).

In terms of problem-solving ability, the results show that the respondents are confident in finding solutions to problems they encounter. Based on the specific items assessed, the respondents identify the problem and think of creative and alternative solutions to solve it. They also believed that they are able to solve problems if they have adequate and appropriate resources. Hence, the respondents trust their capabilities to successfully cope with varied problems (Heppner et al., 2004). Moreover, the respondents also tend to approach problems using various strategies. Based on the specific items assessed, the respondents usually think of various courses of action to solve the problems and then evaluate the outcomes. However, they believed that there are challenges in controlling their emotions and behaviors while solving problems. Generally, however, the results suggest that the respondents believed that they are able to find solutions to difficult or complex issues (Heppner & Lee, 2002; Karatas et al., 2017).

In terms of academic self-efficacy, the results show that the respondents believed that a conducive interpersonal climate is vital for academic success. Based on the specific items assessed, the respondents believed that they are able to cooperate

with their classmates in group activities. They also believed that they are able to build a positive climate among their schoolmates. Therefore, the respondents trust their capability to build a prosocial and collaborative atmosphere in interpersonal relationships among their peers (Sagone & De Caroli, 2014). Moreover, the respondents choose the best solutions to be able to accomplish school tasks that match with their own personal goals. The respondents believed that they can solve school problems using themselves as a helping source (Sagone & De Caroli, 2014). The respondents also believed that they are able to achieve their academic goals by employing personal learning strategies Thus, the respondents believed that they can overcome difficulties with personal involvement (Sagone & De Caroli, 2014; Luo et al., 2019). However, the respondents find it difficult to tackle crucial problems with the assistance of others (Sagone & De Caroli, 2014). Based on the specific items assessed, this may be due to their hesitancy in engaging with their teachers openly with their struggles or even disagreements. Research suggests that communication between teachers and students is a factor for academic achievement (Davis, 2001). Enhancing the student's relationship with the teacher may compensate for these communication difficulties. But generally, the results imply that the students who participated in the study are confident in their own capabilities to be able to successfully accomplish school tasks or activities (Luo et al., 2019; Schunk, 1991; Shim, 2018).

Finally, the correlation results indicate that students who have better SDLR are more likely to have better appraisals of their problem-solving ability. Furthermore, students who have better SDLR are more likely to have more confidence in succeeding in academic tasks. Lastly, students who are more confident in their abilities to accomplish academic tasks are more likely to have better appraisals of their own problem-solving ability.

The results of the study are supported by previous studies, which show that SDLR of nursing students was strongly associated with their problem-solving ability. Furthermore, problem-solving ability can be improved by enhancing the SDLR of students (Choi et al., 2014; Zhang et al., 2018). Research has also shown that cultivating the problem-solving ability of students could boost their preparation for SDL (Struyf, 2005; Williams, 2004). This is important because nursing students are expected to use problem-solving abilities to provide safe, appropriate, and holistic care to people, families, population groups, and the community through the nursing process (Philippines. CHED, 2017; Rascón-Hernán et al., 2019).

Additionally, studies have shown that self-efficacy influences how students learn to solve problems in an academic setting, and the link between academic performance and confidence in self-efficacy has been established (Gore, 2006; Hayat et al., 2020; Zajacova et al., 2005; Zimmerman, 2000). Students who have high self-efficacy perform better in a learning challenge and better grasp the problem. The results further suggest that students who boost their self-efficacy can increase their performance in solving problems through studying (Hayat et al., 2020; Zhou et al., 2020). In addition, prior studies found a strong positive association with the academic self-efficacy of students and their SDLR (Meng et al., 2019; Zhang et al., 2018). In general, previous research has shown that the

SDLR of students was strongly associated with their problem-solving performance, and the performance to solve problems could be facilitated by enhancing the SDLR of students (Choi et al., 2014; Struyf, 2005; Williams, 2004; Zhang et al., 2018). In addition, research has shown that academic self-efficacy has a positive influence on the problem-solving ability of an individual and their preparation for SDL (Meng et al., 2019; Zhang et al., 2018).

5. Limitations
Potential study limitations may include having one study site and possible bias in answering self-reported measures in the study. There is a possibility that findings may not be generalizable to other settings and populations that were not included in the study. Lastly, teacher perceptions related to the study variables were not included in this study. This provides guidance in interpretations and directions of future research.

6. Conclusion and Recommendations
The findings are able to support the assumptions of the study that academic self-efficacy, SDLR, and problem-solving ability of students have relationships with each other. Thus, students who are self-directed learners and are confident with their abilities of success in school tasks are able to solve complex problems or issues.

Based on the findings, it is recommended that nursing students practice developing skills related to SDL and academic self-efficacy. This will help them in accomplishing academic requirements and solving problems in class. This skill is also vital when they become professional nurses.

For teachers, they may incorporate strategies in their instructional designs to be able to enhance or develop SDLR and academic self-efficacy. They should regularly monitor the students' SDLR and problem-solving abilities as they progress throughout the degree program. Furthermore, teachers should also try to assess their own readiness and competencies in implementing activities that support and enhance SDL.

The admissions and testing office may also use SDLR as a possible method for screening or as a diagnostic test for new student applicants. They may use the data to be able to plan for the development of the students' SDL, which is influential in the development of problem-solving ability, a crucial academic and professional competency.

School administrators should also make sure that the infrastructure and systems are in place to support and develop the SDL of the students. Moreover, teachers should also be supported so that they are able to implement teaching-learning strategies that enhance SDL, academic self-efficacy, and problem-solving.

Future researchers may explore other factors that would influence or predict problem-solving ability of students and their SDLR. Experimental research may be done to be able to employ strategies to enhance SDL and how it would affect

specific outcomes such as the problem-solving abilities or academic performance of students. Research could be expanded to other degree programs and settings. Future research may also be explored using longitudinal designs to be able to ascertain the causal link and directionality of the variables related to the present study. Lastly, a more holistic perspective of the phenomenon of SDL may use qualitative designs to enrich our understanding of specific contexts and situations of students.

6. Conflict of Interests
The author declares no potential conflict of interest concerning this research.

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