EXPLORING THE MEDIATING ROLE OF STUDENT SATISFACTION FOR THE RELATIONSHIP BETWEEN SELF-DIRECTED LEARNING ABILITIES AND ELEARNING OUTCOMES

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ABSTRACT

Elearning in a blended learning approach provides enormous opportunities for working nurses to further their studies and enhance their professional development and life-long learning. To date, the impact of self-directed learning (SDL) abilities among working nurses in elearning education in Malaysia remains uncertain. This study aims to investigate the relationship between SDL abilities and elearning outcomes, as well as the mediating effect of student satisfaction between the variables. This is a cross-sectional quantitative correlational study using a predictive design and multivariate analysis method. A stratified random sampling technique was applied to recruit 241 nursing students through an online survey. The Self-Directed Learning Instrument (SDLI) and an elearning course evaluation survey were used to measure the independent and dependent variables of the study. The variance-based Partial Least Squares Structural Modeling (PLS-SEM) method was employed to analyse the possible effects on the relationships among the variables studied. The findings revealed statistically significant relationships among SDL abilities, student satisfaction, and elearning outcome. A total effect of 62.4% is predicted for SDL abilities on elearning outcomes through student satisfaction. This study highlights the vital role of SDL abilities for online learners' success. A collaborative effort between universities and faculty and support personnel is essential to ensure successful, continuous elearning education for student nurses. We recommend that future studies explore other possible factors in the model that could help to enhance successful elearning in nursing education.

Keywords: *self-directed learning abilities, elearning outcomes, mediating effect, nurses*

INTRODUCTION

The use of elearning or a blended learning model to deliver the bachelor's degree programme in nursing has increased dramatically over the years. Advancements in educational technology have sparked interest among busy working nurses to sign up for the programmes as part of their continuous professional development and to fulfil personal, life-long learning goals. In light of this, it is important to examine how the students' competence in self-directed learning (SDL) could influence the outcomes of elearning for working nurses enrolled in elearning undergraduate programmes. The core principles in SDL are being self-driven, setting goals, implementing the learning process, and evaluating learning with or

without the support from others (Knowles, 1975). The ability to self-direct is vital for student nurses, as well as for practicing nurses, in order to adapt to the rapid changes in the clinical environment, which involves the acquisition of knowledge, skills, and an attitude for effective care delivery. In this study, we measured the perceptions of students on their SDL abilities, learning satisfaction, and elearning outcomes.

To meet the demand for more degree-holding nurses and the needs of diploma nurses to upgrade themselves to bachelor's degree, many universities that offer bachelor's degrees in nursing are now tailoring their programmes towards elearning or blended learning models. However, didactic classroom teaching in nursing education remains dominant, with teacher-centered methods still being practiced in many nursing institutions (Hwang et al., 2022), including Malaysia (Romli et al. 2022). Online courses are heavily dependent on self-directed learning and students' motivation to learn. These can be key contributing factors to the high attrition rate of students who are not able to manage their studies in the online learning environment. Similar trends are observed in Malaysian institutions where the rate of student attrition, termination, module/semester deferment, and appeals for extension of study is high in elearning nursing undergraduate programmes. Students enrolled in higher education, especially in the elearning programmes, are not well prepared for SDL (Adams et al., 2018). This raises the question of whether working adults, who were taught in a didactic teaching paradigm, are ready to be independent and self-directed students when learning online.

LITERATURE REVIEW

Many studies delve into the topic of SDL in the online environment. According to Al-Adwan et al. (2022), the lack of SDL skills is a major barrier to successful elearning adoption. Using structuring equation modeling analysis, SDL showed a significant relationship between students' satisfaction and their intention to utilise the elearning system. The researchers demonstrated the need to develop SDL skills in university students. This is supported by Namgung and Kim's (2022) study, which reported that self-directed learning and self-determination are important factors for increasing learning satisfaction of elearning among Korean students. Similarly, a study in Malaysia revealed a significant correlation between readiness of SDL in online studies and student satisfaction among Malaysian undergraduates in a public university (Hasim & Yusof, 2023). The study supported the self-determination theory in which the greater the self-determination and online readiness in students, the higher their satisfaction with an elearning environment.

Another study by Lasfeto and Ulfa (2020) found a significant relationship between SDL and social interaction ($r = 0.432$, $p < 0.01$) in the online learning environment. Students who had higher social interactions were shown to have a higher ability for self-direction. Accordingly, students who showed positive behaviour in self-directed learning were able to manage their online studies better. The findings of the study showed that students who had a high level of self-directed learning, self-efficacy, and social interaction in the online learning environment also had greater academic achievement. A recent study by Narenjithani et al. (2022) revealed that there was a significant association between SDL and perceived learning outcomes among elearning undergraduate students. The findings of their study showed that the SDL variable explained 30% of the elearning effectiveness.

A randomized controlled study by Tohidi et al. (2019) found a significant difference in clinical competency (Mann–Whitney U-test: $z = -2.58$, $p = 0.010$) among student nurses in the SDL intervention group. Students demonstrated an increased competency in nursing skills after they participated in the self-learning method. Similarly, Kerr et al. (2020) reported that SDL had a positive effect on the level of confidence of students during nursing practice. In the study, students were found to be motivated to learn and they were more confident in personal development as compared to those in the teacher-centred learning method. However, these findings contradicted the study by Ramli et al. (2018) that revealed no significant direct effect of SDL on academic achievement ($t = 0.061$, $p > 0.05$).

Murniaty et al. (2022) found that self-efficacy ($\beta = 0.381$, $p < .000$) and technology readiness were significant predictors of students' abilities in SDL. The researchers supported the need to use technology tools as a mediator for the relationship between technology and self-efficacy, online communication, and SDL. The study implied that

the use of technologies has a direct influence on students' SDL readiness and an indirect influence on SDL self-efficacy with web-based tools. Based on the findings, learners, instructional designers, and faculty could utilise resources more effectively while enhancing their ability to self-direct in the technology-mediated environment.

There is a paramount need to investigate the direct and indirect impacts of SDL on student satisfaction in elearning nursing. The extensive use of technologies in nursing education warrants studies to investigate SDL and its relationship with elearning. Many researchers believe SDL provides the best avenue for students to be independent in searching for and gathering relevant information in class, as well as to be involved in active interactions with experts, faculty, and peers. Based on the findings of the past studies mentioned above, leaners' perspectives on SDL, student satisfaction, and elearning outcomes are intricately connected. But there are still limited studies that examine the relationships among the three constructs simultaneously.

Despite the importance of student satisfaction in predicting academic achievement shown in previous studies, its important role in intervening in the level of elearning outcome has not been well established. Hence, we hypothesise that student satisfaction is a mediator that is vital in highlighting the relationship between the constructs. This study, therefore, aims to address gaps in the research by investigating the mediating effect of student satisfaction for the relationship between SDL abilities and elearning outcomes perceived among nursing undergraduates in Malaysia. The outcomes of this study will allow researchers to understand the perception of nursing students of their ability

for self-direction in an elearning environment and how that may lead them to accomplish their learning goals. It is crucial to focus not only on the quality of elearning systems but also on SDL pedagogy in online education, which will contribute scientific values for a successful implementation of the SDL model in the elearning systems in nursing education.

RESEARCH MODEL AND HYPOTHESES
Research Model
This study uses the Information System Success model (DeLone & McLean, 2003) as a framework to examine the system design (SDL abilities), system delivery (student satisfaction), and system outcome (elearning outcome) of elearning nursing programmes. The conceptual framework of the study is depicted in Figure 1. The dependent (endogenous) variable of the study, Elearning Outcomes, is displayed on the right side of the model. It refers to the extent to which learners perceived that using the elearning information system benefited their learning outcomes in terms of learning enhancement, empowerment, time saving, and academic achievement in undergraduate post registration programmes in nursing. To the left of the model, SDL Abilities is defined as the perception of student nurses who are capable of taking their own initiative for self-directed learning to pursue elearning nursing studies. SDL Abilities is an independent (exogenous) variable representing its direct effect on the dependent/endogenous variable. On the other hand, Student Satisfaction refers to the level of satisfaction perceived by nursing students in using the elearning system in the nursing programmes. An endogenous variable is influenced directly or indirectly by the exogenous variable, while the

Figure 1.
Conceptual Framework of the Study
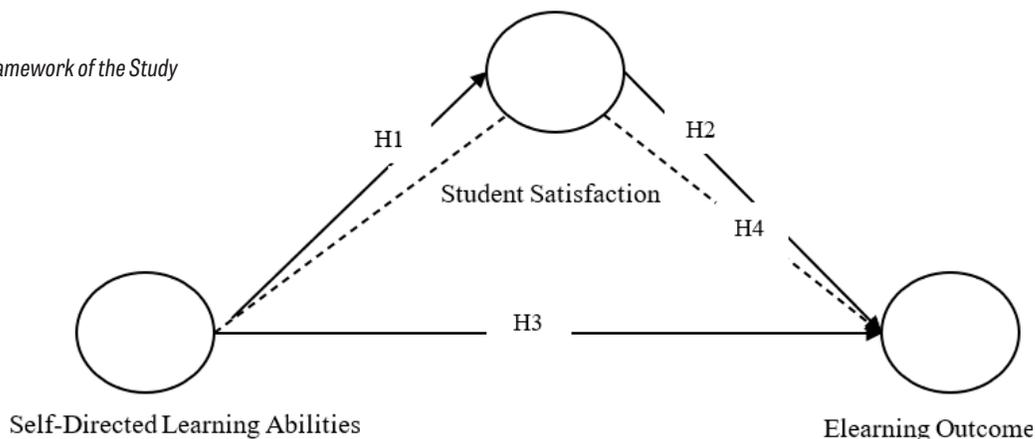
mediator is a variable that intervenes between the independent variable and the dependent variable, and an exogenous variable is the causal factor to another construct in a structural model (Hair et al., 2021). Hence, student satisfaction is identified as a mediating variable as well as endogenous variable in the study.

Purpose of the Study

In this study, the relationships among SDL abilities, student satisfaction, and elearning outcomes were measured to determine the direct effect (straight arrow for H1 to H3) in the elearning environment success. The model also determines whether student satisfaction mediates (dotted arrow for H4) the relationship between an independent variable (SDL Abilities) and a dependent variable (Elearning Outcomes) in the study. The possible effects on the relationships among the variables studied were analysed using the variance-based Partial Least Squares Structural Modeling (PLS-SEM) method.

Research Hypotheses

The following are the hypotheses posited for the study:

H1: There is a statistically significant effect of self-directed learning abilities on student satisfaction.

H2: There is a statistically significant effect of student satisfaction on elearning outcomes.

H3: There is a statistically significant effect of self-directed learning abilities on elearning outcomes.

H4: There is a statistically significant mediating effect of student satisfaction for the relationship between self-directed learning abilities and elearning outcomes.

METHOD AND INSTRUMENT

We employed a cross-sectional quantitative survey using correlational and predictive design with a multivariate analysis method to investigate the (a) the relationships between variables of SDL abilities, student satisfaction, and elearning outcomes, and (b) the mediating effect of student satisfaction for the relationship between SDL abilities and elearning outcomes. An online, self-administered questionnaire was used to examine the study variables. The population of the study (N=1100) comprised adult working nurses enrolled in the elearning undergraduate nursing programme

at two private universities in Malaysia. A stratified random sample of 241 nursing students was recruited. The 46.9% response rate from 513 targeted sample size for an online survey was considered adequate as it fell within the acceptable range of 25%–50% (Grove & Gray, 2022).

An elearning course evaluation survey scale (Holsapple & Lee-Post, 2006) was adapted to measure the perceptions of students of learning outcomes and satisfaction in using the elearning system in undergraduate, post registration nursing programmes. The four aspects of elearning outcomes include Enhanced Learning, Empowered, Time Saving, and Academic Success. While the dimension of student satisfaction consists of four items including Overall Satisfaction, Enjoyable Experience, Overall Success, and Recommended to Others. The elearning outcome (4 items) and student satisfaction (4 items) scales ranged from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). A high score indicated a high level of elearning outcome and satisfaction perceived by students.

The Self-Directed Learning Instrument (SDLI) was adapted with permission from Cheng et al. (2010) to measure the perception of self-directed learning ability of students in an elearning environment. The instrument contains 20 items across four dimensions: self-monitoring (4 items), learning motivation (6 items), interpersonal communication (4 items), and planning and implementing (6 items). Minor wordings were amended to a few items (items 6, 11, 18, 19, and 20) to provide clarity in meaning for a measurement suitable for the local context. The domains of the SDLI items were not changed to maintain the core concept of SDL. The SDLI scale uses a 5-point Likert scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) and ranging from 20 to 100 points. The higher the score, the higher the perceived level of SDL abilities among students. A sample of 30 subjects from a local private university was randomly selected for the pilot study. The elearning course evaluation survey scale and SDLI were validated for the relevancy of the tools with I-CVI scores ranging from 0.83 to 1.00 for each item. In addition, the internal consistency index obtained for the elearning outcome, student satisfaction, and SDLI was at Cronbach's Alpha of 0.820, 0.849, and 0.954, respectively, indicating a strong internal consistency coefficient of the instruments for the study (Grove & Gray, 2022).

RESULTS

Background Information

The demographic data consisted of age, gender, marital status, working experience, working position, current clinical area, user experience in the online learning programme, and current grade point average (GPA) in the Bachelor of Nursing Science post registration undergraduate programme. Most of the participants were female nurses (93.4%), holding positions as a staff nurse/charge nurse (83%), posted at critical care areas (43.2%), and had online learning experience (68.5%). While more than half were single (59.8%), with a mean age of 31 years, working experience of nine years, and a GPA score of 3.44.

Results of the Measurement Model

We used PLS-SEM analysis software to assess the convergent validity, discriminant validity, indicator reliability, and internal consistency reliability of the study. Based on the results shown in Table 1, the indicators that have met the standardised indicator loadings of ≥ 0.708 were retained for further

Table 1.

Measurement Model for the Effect of Student Satisfaction on the Relationship Between Self-Directed Learning Abilities and Elearning Outcomes

Construct	Indicator Loadings	Cronbach's alpha	rho_A	CR	AVE
Self-Directed Learning Abilities		0.894	0.895	0.922	0.703
IC1	0.839				
IC2	0.834				
IC3	0.735				
IC4	0.795				
LM1	0.821				
LM2	0.797				
LM3	0.824				
LM4	0.841				
LM5	0.849				
LM6	0.804				
PI1	0.860				
PI2	0.858				
PI3	0.844				
PI5	0.730				
PI6	0.777				
SM1	0.844				
SM2	0.861				
SM3	0.884				
SM4	0.847				
Student Satisfaction		0.850	0.874	0.930	0.870
SS1	0.910				
SS2	0.918				
SS3	0.911				
SS4	0.910				
Elearning Outcomes		0.870	0.871	0.939	0.885
LO1	0.899				
LO2	0.876				
LO3	0.915				
LO4	0.918				

analysis. This indicated that the latent variables explained at least 50% of the indicator's variance (Hair et al., 2021). Of these, one indicator from the SDL abilities (PI4) was removed in the initial stage. Next, internal reliability and convergent validity, and discriminant validity were evaluated. As illustrated in Table 1, the results for Cronbach's alpha (0.850–0.894), rho_A (0.871–0.895), composite reliability (0.922–0.939), and AVE (0.703–0.885) indicated that all remaining indicators and constructs (SDL Abilities, Student Satisfaction, and Elearning Outcomes) met internal reliability and convergent validity. In the subsequent analysis, discriminant validity was assessed using Heterotrait-Monotrait (HTMT) ratio of correlations to determine the extent to which each construct was truly different from other constructs in the study model. The HTMT values (0.703–0.868) suggested discriminant validity between constructs was met based on HTMT0.90 criteria. This indicated that all the retained indicators in this study reflected their respective construct sufficiently. As a result, the reflective model of the study met the internal consistency, convergent validity, and discriminant validity before we could proceed with the structural model measurement.

Results of the Structural Model

In the structural model evaluation, collinearity assessment (VIF < 5), significance and relevance of path coefficients (Bootstrapping), in-sample predictive power assessment (R^2), and out-of-sample predictive power assessment are recommended (Hair et al., 2019). The inner variance inflation factor (VIF) values for the variables SDL Abilities, Student Satisfaction, and Elearning Outcomes were examined for lateral multicollinearity or correlations between indicators. A value of less than 5 from the analysis indicates no lateral multicollinearity problem in the research model.

In this study, three direct hypotheses (H1, H2, and H3) and one indirect hypothesis (H4) were tested. T-statistics for all path analyses were generated using bootstrapping of 10,000 subsamples to test the significant levels of the findings. As shown in Table 2, all the hypotheses were statistically significant with a t-value of ≥ 1.96, p-values of < 0.05, and Boot Confidence Interval Bias-Corrected with no zero value. More precisely, the predictors of SDL Abilities ($\beta = 0.186$, $p < 0.01$) and Student Satisfaction ($\beta = 0.639$, $p < 0.01$) were positively related to elearning outcomes, which explained 60.6% of variances in elearning outcomes at 0.05 level of significance. Therefore, H1, H2, and H3 are supported. To address hypothesis H4, we conducted mediation analysis using bootstrapping analysis. Table 2 shows the indirect effects ($\beta = 0.686$ and $\beta = 0.639$) and significance at t-values of 16.309 and 10.714. The indirect effects at 95% Boot Confidence Interval Bias-Corrected level for H1 ($LL = 0.597$, $UL = 0.760$) and H2 ($LL = 0.515$, $UL = 0.750$), which does not include a zero in between the values indicating that there is a significant

Table 2.

Hypothesis Testing for the Relationship of Self-Directed Learning Abilities on Student Satisfaction and Elearning Outcomes

Hypothesis	Relationship	Std. Beta	Std. Error	t-values	Confidence Interval (BC) LL	UL	p-values	Decision
H1	Self-Directed Learning Abilities Student Satisfaction	0.686	0.687	16.309	0.597	0.760	0.000**	Supported
H2	Student Satisfaction Elearning Outcomes	0.639	0.637	10.714	0.515	0.750	0.000**	Supported
H3	Self-Directed Learning Abilities Elearning Outcomes	0.186	0.188	2.877	0.534	0.714	0.004**	Supported
H4	Self-Directed Learning Abilities Student Satisfaction Elearning Outcomes	0.438	0.437	8.704	-	-	0.000**	Supported

*Note. *$p < 0.05$, **$p < 0.01$, BC = Bias Corrected, UL = Upper Level, LL = Lower Level*

mediation effect in the model. Thus, H4 was supported for the study.

The results of the effect of SDL Abilities ($\beta = 0.686$, $p < 0.01$) showed a positive relationship with student satisfaction in which 47.1% of its variance explained Student Satisfaction. Based on Cohen's (2008) recommendation, the R^2 value of 0.471 for Student Satisfaction and 0.606 for Elearning Outcomes represents a large effect in producing a substantial model for the nursing population of the study. Hence, these findings suggest that the influence of relationships between SDL abilities and student satisfaction are accurate predictors of the model. The final structural model of the study is illustrated in Figure 2.

Since the indirect effect ($0.686 \times 0.639 = 0.438$) and direct effect (0.186) are significant, and the total effect ($0.438 + 0.186 = 0.624$) is pointing towards the same direction (positive), this represents a complementary partial mediation for the study model, which implies that 43.8% of SDL abilities is mediated through student satisfaction. The findings suggest that a 62.4% total effect is predicted for SDL abilities on elearning outcomes through a mediator of student satisfaction in the study population. In summary, the overall impact of elearning success was greater when the mediation effect of student satisfaction was added to the relationship between self-directed learning abilities and elearning outcomes.

DISCUSSION AND IMPLICATIONS

Based on the results of the study, the significant effect of SDL abilities on student satisfaction at the sample universities shows that nursing students are highly motivated to learn, able to self-monitor, aware of their learning needs, and to some extent able to take responsibility for planning and implementation and collaborate learning with others. The findings of this study are consistent with past studies (Al-Adwan et al., 2022; Namgung & Kim, 2022) in which the researchers reported that SDL correlated significantly with student satisfaction. This could be that the higher the level of SDL abilities among nursing students, the higher their satisfaction with the elearning programmes, which leads to better perceived learning outcomes.

Figure 2.
Final Structural Model of the Study
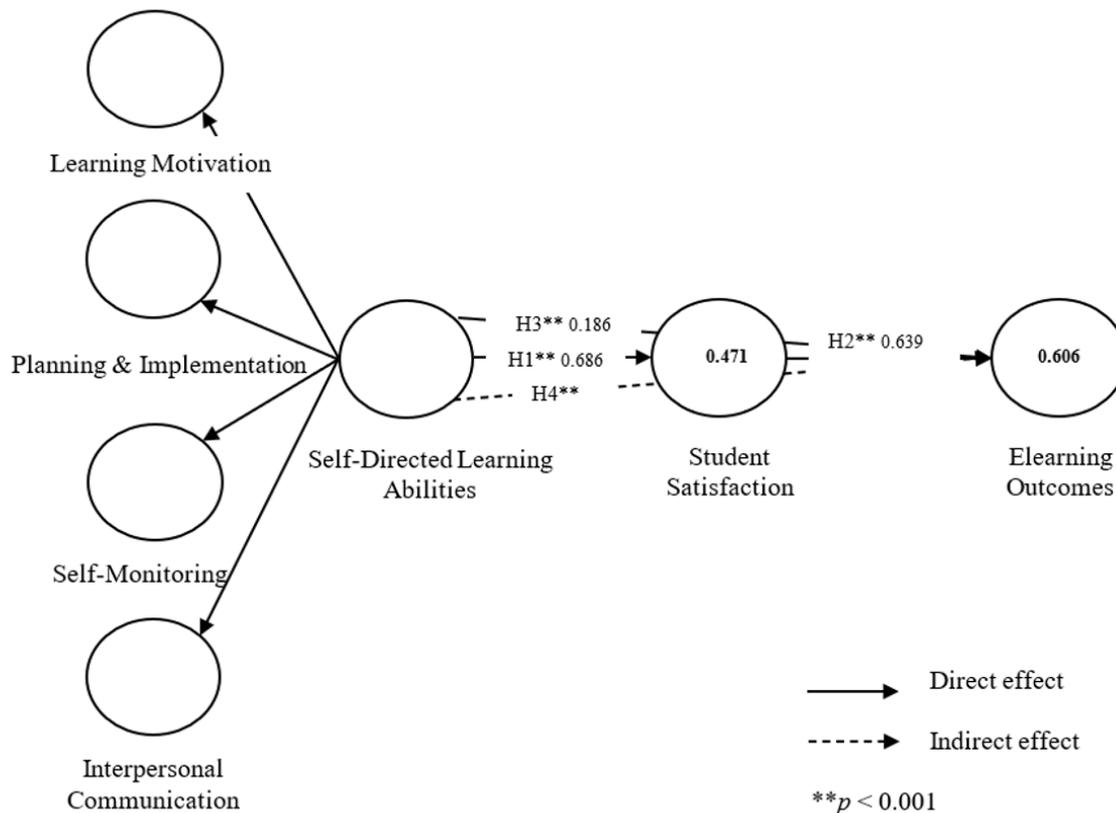
Although most of the students self-reported a moderately high SDL level, the facilitator role of the teacher to guide students to be independent learners is crucial. Facilitators play a vital role in contributing to a positive SDL experience for students (Chang & Maarof, 2023; Wong et al., 2021). Facilitators may adopt the SDLI tool to assess students' SDL status, design better lesson plans and curricula, and implement appropriate teaching strategies for nursing students to foster the growth of lifelong learning abilities among students.

The findings also reveal a positive and significant effect for student satisfaction on elearning outcomes among elearning nursing undergraduates. This is consistent with past studies (Abuhassna et al., 2020; Butt et al., 2023) that show a significant positive effect of satisfaction on learning outcome based on the DeLone and McLean Information System Success model. User satisfaction such as students' experience towards their learning environments, course delivery, faculty support, facilities, and resources are the focus of all educational institutions. Likewise, student satisfaction in elearning programmes is of utmost importance for universities when identifying the known and unknown factors that could impact the benefits for the students in completing their studies. Another possibility may be that students' positive experiences in the universities determine their levels of satisfaction. The elearning experiences may positively affect students' belief that a well-structured course helps them achieve their learning outcomes in terms of academic success. As supported by other researchers, the perception of satisfaction has a very strong impact on learning enhancement (Aljaser, 2019) and academic achievement (Abuhassna et al., 2020). These suggest that the more satisfied the students are in an elearning environment, the higher their elearning outcomes.

In addition, the findings of the study show that SDL abilities play an important role in supporting the learning outcomes of nursing students in the elearning course. The significant relationship between SDL abilities and elearning outcomes indicates that success in an elearning course depends on high learning motivation, active planning and implementation, interpersonal communication, and self-monitoring by learners. These findings are supported by Moon (2023), who reported a correlation between self-directed learning factors and learning motivation that contributed to the success of elearning education. In addition, Chang et al. (2022) revealed that most of the nurses demonstrated a high level of self-directed learning. In our study, participants demonstrate abilities in self-control and self-management, and they have a desire for learning that leads to professional development. Hence, it is important to motivate and provide guidance for nurses to further develop their independent learning skills through higher education.

We concluded that there is a significant mediation effect of student satisfaction on the relationship between SDL abilities and elearning outcomes. The findings are supported by Apu et al. (2023) and Chang and Maarof (2023), who stated that self-directed person would have a positive attitude to learn independently. The researchers concur that SDL proceeds from student satisfaction in achieving academic success. Students who exhibit a strong sense of satisfaction constantly show a high level of self-motivation. As a result, they will put in more effort to plan and implement learning and evaluate their learning process, and they will collaborate actively in learning activities with others to attain their learning goals. Interaction between faculty and students and among peers is one of the significant predictors of students' satisfaction with elearning (Zein et al., 2023). Also, emotional well-being has a mediating role in the effect of SDL on the elearning level among nursing students (Dadgar et al., 2020). Faculty's competency in dealing with emotional support in elearning difficulties plays a substantial role in enhancing the emotional well-being of students. With that, the positive emotional interactions between faculty and students could improve students' participation in the elearning process and lead to better academic achievement.

As supported by Zein et al. (2023), student satisfaction can lead to positive individual achievement in completing a study. Significantly, the findings suggest that if students have a higher ability to self-direct their studies and a positive satisfaction level, they will achieve greater outcomes in using elearning systems. Importantly, faculty need to be aware that their online presence is vital in guiding and supporting students during their learning process. Faculty development is therefore mandatory on various pedagogical methods including SDL, which is appropriate and relevant for online learning programmes (Sharoff, 2019).

The significance of the relationships between SDL abilities, student satisfaction, and elearning outcomes will be useful for all stakeholders involved in higher education institutions such as the policymakers, faculty, administrators, and researchers. The data obtained in this study reveal that SDL abilities have an impact on the level of satisfaction and elearning outcomes among working nurses. This model highlights the importance for faculty to strengthen the application of SDL concepts in higher education. Faculty should focus not only on the quality of pedagogy skills in teaching online but also on how to nurture students to become more independent learners. One of the strategies is to use small group discussions. Such activities not only promote a vibrant environment for active learning but increase interactions and participation among learners (Seymour-Walsh et al., 2020). Based on the positive mediating effect in the model, institutions could further improve student satisfaction and increase the level of SDL abilities of nursing students for the ownership and control of their learning. Learning may be more effective when teachers are focusing on self-guided learning strategies while meeting the needs of online learners.

LIMITATIONS

The study is a quantitative survey using a correlational and predictive design. Hence, the findings of the study are limited to the perceived views of the samples. The findings were analysed based on the self-reported data of the participants that may include a risk of self-assessment bias if participants overrated their ability for self-direction, their GPA scores, and their perceptions of the elearning outcomes.

CONCLUSION

In conclusion, the research framework was found to be a valid and substantial model for the population of the study. The findings of the study reveal that SDL abilities and student satisfaction are the accurate predictors of elearning outcomes, and that there was a significant relationship among all constructs. Student satisfaction was found to be a significant mediator for the relationship between SDL abilities and elearning outcomes. Most of the findings are consistent with the past literature in which SDL abilities and student satisfaction are positively correlated to elearning outcomes among working nurses in elearning, undergraduate nursing programmes in Malaysia. This study highlights the important concepts of SDL in higher education, particularly, in the elearning nursing context. A mixed study design is recommended to explore any potential mediators and to further extend the study model, which will contribute to enhancing nursing education.

DECLARATION OF INTEREST STATEMENT

We declare that there is no conflict of interest that may have inappropriately influenced us in writing this paper.

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