

The relationship between virtual simulation, critical thinking, and self-directed learning abilities of nursing students in Riyadh, Saudi Arabia (#84058)

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The relationship between virtual simulation, critical thinking, and self-directed learning abilities of nursing students in Riyadh, Saudi Arabia

Hanan F. Alharbi ^{Corresp., 1}, Amjad Alsubaie ², Rahaf Gharawi ², Rawan Ba Mazroo ², Shaikhah Alajaleen ², Munerah Alsultan ², Munira Alsaleem ², Nora Alsubihi ², Norah Alsahli ², Nashwa Alqahtani ², Raghada Rayzah ²

¹ Maternity and Child Health Nursing Department, College of Nursing, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

² College of Nursing, Princess Nourah bint Abdulrahman University. Riyadh, Riyadh, Saudi Arabia

Corresponding Author: Hanan F. Alharbi
Email address: hfallharbi@pnu.edu.sa

Objective: The use of virtual simulation in nursing education is an effective approach for improving nursing critical thinking and self-learning abilities, but the previous studies were limited to providing the required evidence that supports the association. This study aimed to assess the relationship between virtual simulation and critical thinking disposition and self-directed learning abilities among nursing students. **Methods:** This is a descriptive correlational, non-experimental study. It was conducted among 201 third- and fourth-year nursing students at the Princess Nourah bit Abdulrahman University, Saudi Arabia. A non-probability convenience sampling technique was used to select the participants; then, an online, adapted questionnaire was sent to the participants, the data from which was analyzed by SPSS. **Results:** The study findings showed that virtual simulation benefited nursing students. Most participants (56%) agreed that it helped them to think critically, and approximately 27% strongly agreed. It also enhanced their self-directed learning abilities, and the majority of the students agreed that they often review the way nursing practice is conducted. Furthermore, the results showed a significant, positive relationship between virtual simulation and the critical thinking disposition of nursing students (p-value = 0.03; correlation coefficient = 0.65), a strong positive relationship with self-directed learning abilities of nursing students (p-value = 0.004; correlation coefficient = 0.78), and a strong positive relationship between critical thinking disposition with self-directed learning abilities of nursing students (p-value = 0.01; correlation coefficient = 0.72). **Conclusion:** There are significant relationships between virtual simulation and the critical thinking disposition and self-directed learning abilities of nursing students. Furthermore, virtual simulation made the students practice critical thinking and self-learning, so, they simulate events and try to seek out and solve the problems.

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Abstract

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Objective: The use of virtual simulation in nursing education is an effective approach for improving nursing critical thinking and self-learning abilities, but the previous studies were limited to providing the required evidence that supports the association. This study aimed to assess the relationship between virtual simulation and critical thinking disposition and self-directed learning abilities among nursing students.

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Methods: This is a descriptive correlational, non-experimental study. It was conducted among 201 third- and fourth-year nursing students at the Princess Nourah bit Abdulrahman University, Saudi Arabia. A non-probability convenience sampling technique was used to select the participants; then, an online, adapted questionnaire was sent to the participants, the data from which was analyzed by SPSS.

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Results: The study findings showed that virtual simulation benefited nursing students. Most participants (56%) agreed that it helped them to think critically, and approximately 27% strongly agreed. It also enhanced their self-directed learning abilities, and the majority of the students agreed that they often review the way nursing practice is conducted. Furthermore, the results showed a significant, positive relationship between virtual simulation and the critical thinking disposition of nursing students (p -value = 0.03; correlation coefficient = 0.65), a strong positive relationship with self-directed learning abilities of nursing students (p -value = 0.004; correlation coefficient = 0.78), and a strong positive relationship between critical thinking disposition with self-directed learning abilities of nursing students (p -value = 0.01; correlation coefficient = 0.72).

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Conclusion: There are significant relationships between virtual simulation and the

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critical thinking disposition and self-directed learning abilities of nursing students. 25
 Furthermore, virtual simulation made the students practice critical thinking and self- 26
 learning,so, they simulate events and try to seek out and solve the problems. 27

Keywords: Critical thinking, virtual simulation, self-directed learning, relationship, 28
 nursing students. 29

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Introduction 31

The recent development in healthcare systems requires nurses to be well prepared to 32
 deal appropriately with complicated clinical circumstances in the work settings, 33
 especially in the era of COVID-19 and forward [1]. So, it is necessary to prepare nursing 34
 students to be competent in advanced technology skills, critical thinking disposition, 35
 and self-directed learning (SDL) abilities [2, 3]. 36

Several previous studies have approved that high-fidelity simulation in nursing 37
 education effectively enhanced nursing students' critical thinking in different nursing 38
 fields, such as pediatrics, as shown in one study by Shin and Kim 2014 [4], and the 39
 multiple exposures for simulation in the nursing education coursework results in the 40
 gain of critical thinking skills and its subcategories [5]. Furthermore, virtual simulation 41
 helps nursing students to practice nursing skills in an environment that is close to a 42
 clinical setting without affecting patient safety. According to the literature, virtual 43
 simulation is an efficient method that carries no risks to patient safety [6]. 44

In nursing education, directed self-learning (DSL) allows learners to find significance 45
 and reason in their learning and to take responsibility for the preparation, execution, and 46
 assessment of their learning [7]. It generates a significant improvement in the level of 47

knowledge acquisition and overall performance [8, 9]. 48

Several methods have been used by nursing educators to grow critical thinking among 49

students. Virtual simulation is one of these utilized methods [10] and provides an 50

exceptional learning opportunity for nursing students with the significant achievement 51

of the learning outcomes [11]. 52

Virtual simulation in nursing education has provided an enhancement in nursing 53

students' learning abilities, as illustrated in an integrative review of the educational 54

characteristics related to virtual simulation in the field of nursing education by Shin H. 55

et al., 2019 [12] and another study by Foronda et al. (2020) reported that virtual 56

simulation is an excellent educational tool for encouraging the learning process to reach 57

the desired outcomes [11]. Still, the previous studies were limited to providing solid 58

evidence to support the association between virtual simulation and students' critical 59

thinking or self-learning abilities [13, 14]. 60

Through the use of virtual simulations, nursing students can hone their critical thinking 61

skills and SDL abilities. These simulated environments provide those students with 62

various challenges and scenarios to explore and analyze [15, 16]. Students are actively 63

encouraged to think independently and creatively as they work through the simulations. 64

This learning environment helps nurture their capacity to think critically and develop 65

the skills necessary to face the real world [17, 18]. Additionally, it allows students to 66

create a sense of self-discipline and SDL, as they can work through the simulations 67

independently. With virtual simulation, nursing students can develop the skills they need 68

to become successful in the future [19, 20]. 69

There are different studies conducted across the globe on simulation effectiveness in the 70

medical field. However, there are not many studies done on virtual simulation 71
effectiveness in the nursing field, including the Middle Eastern countries, so the current 72
study was designed to assess the relationship between virtual simulation with critical 73
thinking and the SDL of nursing students at PNU, Riyadh, Saudi Arabia. 74

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Materials and Methods 76

Study Design: 77

This is a descriptive correlational, non-experimental study. It was used to investigate 78
the correlation between the variables of virtual simulation, SL abilities, and critical 79
thinking skills among nursing students. 80

Study Setting: 81

This study was done at the College of Nursing, Princess Nourah bint Abdulrahman 82
University (PNU), Riyadh, Saudi Arabia. 83

Study Population: 84

The population included in the current study is the third- and fourth-year nursing 85
students at PNU, Riyadh, Saudi Arabia. 86

The inclusion criteria were third and fourth-year nursing students from PNU who 87
experienced simulation at least once. The exclusion criteria were the first and second- 88
year nursing students at PNU who did not experience the simulation. 89

Sampling and sample size: 90

The sampling technique in the present research was non-probability convenience 91

sampling, and the sample size in the study was 201, which was calculated based on the Epi Info program calculation. The level of confidence is 99%, and the sampling error is 1%.

Data collection technique:

The data was collected on critical thinking disposition and SDL abilities from nursing students who experienced virtual simulation at least once. The data were gathered using a google forms questionnaire distributed in various ways. Afterward, the aim and content of the study were clarified to the participants, and informed consent was collected before data collection.

Instruments of data collection:

This study has adopted three scales for measuring virtual simulation, critical thinking disposition, and SDL abilities; the first tool was for virtual simulation, which was adopted from a tool used by Ryan-Wenger, Elfrink Cordi, Leighton, Doyle, and Ravert (2012). It comprises 13 sub-items with a score of 0, 1, or 2 [21]. The second tool was for critical thinking disposition, which has 27 sub-items validated by Yoon 2004 [22]. The third tool was adopted from Fisher et al. (2001) to measure SDL abilities and is composed of 40 items [23].

Tools validity:

The reliability and validity test has been applied to the simulation effectiveness tool to determine the extent to which items in the tool were related to each other by Cronbach's co-efficiency Alpha ($\alpha = 0.954$). So, it can be concluded that the tool has a high level of reliability. Test of the instrument's validity was conducted using Pearson Product

Moment Correlations using SPSS. The significant value obtained by the Sig (2-tailed) < 0.05 and the internal consistency ($r = 0.890$, $p\text{-value} < 0.001$) indicated that the items of the tool were valid.

The reliability of the critical thinking disposition tool was done to determine the extent to which items in the tool were related to each other by Cronbach's alpha ($\alpha = 0.946$). Therefore, the tool has a high level of reliability. Test the validity of the instrument was conducted using Pearson product-moment correlations using SPSS. From the significant value obtained by the Sig (2-tailed) < 0.05 and the internal consistency ($r = 0.962$, $p\text{-value} < 0.001$), the items of the tool were considered valid.

The reliability of the SDL ability scale tool was done to determine the extent to which items in the tool were related to each other by Cronbach's alpha ($\alpha = 0.971$). The tool results indicate a high level of reliability. The instrument's validity was tested using Pearson's product-moment correlations using SPSS. Based on the significant value obtained by the Sig (2-tailed) < 0.05 and the internal consistency ($r = 0.980$, $p\text{-value} < 0.001$), so it can be concluded that items of the tool were valid.

Statistical analysis

The data were analyzed by the Statistical Package for Social Science (SPSS)-version 22 with Microsoft Excel program. The findings were presented as mean and standard deviation ($\bar{X} \pm SD$) or as frequency and percentage (no. and %).

Ethical considerations

Ethical approval from the Institution of Review Board (IRB) approval was obtained from PNU (No. H-01-R-059, 21-0043), Riyadh, Saudi Arabia. The participants' written consent to take part in the research was obtained prior to their participation. The students were informed

of their right to withdraw from the study at any time.

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Results:

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Results summary:

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Table 1 shows the demographic characteristics of the studied nursing students; their academic year was approximately similar in the two years. Nearly 51% of the participants were third-year students, and 49% of the participants were fourth-year students. They were all female and Saudi; their age was either 20 or 21 years.

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Table 2 represents the distribution of simulation effectiveness of the studied students. Participants were asked if the simulation experience instructor's questions helped them to think critically. Approximately 56% of participants agreed, and 27% strongly agreed with the statement. Nearly 53% of the participants agreed that the simulation experience challenged their thinking and decision-making skills and helped them develop a better understanding of the issues related to medication "effects, side effects, etc." More than half the participants agreed that they developed an understanding of the pathophysiology of the simulated condition, unlike the 8% who disagreed. 57% of the participants agreed, and 26% strongly agreed that the simulation helped them to predict changes that might happen to real patients.

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Table 3 presents the critical thinking disposition of the studied participants. 59% agreed that they look for a piece of information to solve a problem, that they tend to solve problems by a collection of data and a systematic organization, and that they have a

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reputation for being rational. 56% agreed that they willingly solve problems and explain the reasons if they do not agree with others, and 54% agreed that they judge objectively. Over 80% agreed that they are trying to know how unknown things work, with half of the participants agreeing that they see the world with a questioning mind. 52% agreed that when they confront a problem, they try hard to find an answer until a solution is found. More than half agreed that they continually evaluate whether their thought is right or not. The majority agreed that when they are questioned, they think twice before answering, while 47% agreed that they don't rush to judgment.

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Table 4 reflects the distribution of the SDL ability of the studied students. The majority of the participants in the study agree with 57% that they often review the way nursing practice is conducted. 57% of participants agreed that they evaluated their performance. Nearly 53% agreed that they are open to new learning opportunities, while nearly 52% agreed that they prefer to direct their learning. Almost 50% agreed that they enjoy learning new information and need minimal help to find information. About 54% agreed that they can find out information for themselves and they critically evaluate new ideas. About half the participants agreed that they would ask for help in learning when necessary and they would learn from their mistakes. Almost all the participants agreed that they need to know why, "the rationale."

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Table 5 demonstrates the level of simulation effectiveness. Most of the participants had high to moderate levels of simulation effectiveness. Ninety-three participants (46%) had a high level of simulation effectiveness, and ninety-four of the participants, nearly 47%,

had a moderate level of simulation effectiveness. Only 7% of participants reported a low level of simulation effectiveness. It also showed the level of critical thinking disposition of the studied students. The majority of the participants had a moderate level of critical thinking disposition. There were 32% who had a high level of critical thinking disposition, and 64% had a moderate level of critical thinking disposition. A minority of participants revealed a low level of critical thinking disposition. The level of SDL ability scale of the studied students. Nearly half ($n = 99$) had a high level of SDL abilities, and 97 participants (48%) had a moderate level of self-learning ability. The minority reported a low level of SDL abilities.

Table 6 shows the relationships between virtual simulation, critical thinking skills, and SDL abilities of nursing students at PNU. A positive, strong relationship between virtual simulation and the critical thinking disposition of nursing students was found with a significant correlation ($p\text{-value} = 0.03$; correlation coefficient = 0.65), a positive, strong relationship between virtual simulation and the SDL abilities of nursing students was observed with significant correlation ($p\text{-value} = 0.004$; correlation coefficient = 0.78), and a positive strong relationship between critical thinking disposition and SDL abilities of nursing students was observed with significant correlation ($p\text{-value} = 0.01$; correlation coefficient = 0.72).

Discussion

Virtual simulation is becoming increasingly popular as a learning tool in nursing education. It can be used to teach and assess critical thinking disposition and SDL abilities in nursing

students, as well as provide a safe environment to practice clinical decision-making. This 207
study assessed the relationship between virtual simulation with critical thinking skills and 208
SDL abilities of nursing students at PNU. 209

This study explored the relationship of virtual simulation with nursing students' critical 210
thinking disposition and SDL abilities. Based on the findings, it appears that both critical 211
thinking and SDL of the nursing students were significantly correlated with virtual simulation. 212

A similar study has been conducted in Indonesia to investigate the impact of virtual simulation 213
on critical thinking, and it showed that critical thinking was strengthened and increased with 214
the virtual simulation [24], and the Spanish simulation environment has resulted in 215
improvement in critical thinking abilities of nursing students [2]. On the other hand, a Korean 216
study about the extent of the simulation effect on the self-learning ability of nursing students 217
conducted by Cho & Hwang (2019) concludes that there are little to no differences and the 218
same level of ability of self-learning among nursing students was maintained after the 219
simulation [25] and on the impact of virtual simulation on critical thinking and SDL which 220
showed no statistically significant difference were observed after application of virtual 221
simulation, and there is no increase or decrease with the existence of virtual simulation [26]. 222

The simulation helps nursing students to gain confidence in their abilities and to learn how to 223
respond to various situations. It can also help them to develop problem-solving skills and 224
critical thinking skills, as well as to become better communicators [27]. It can also help reduce 225
stress and anxiety in nursing students, allowing them to practice their skills and knowledge in 226
a safe environment before facing real-life situations. Simulation is also an effective way to 227
teach students how to prioritize tasks and how to work as part of a team [28]. In the current 228
study, the top-ranked item of simulation benefit was that it helped students to predict changes 229

that may happen to a real patient; they learned the health assessments and performed them in 230
laboratories in nursing schools. However, virtual simulations offer the possibility to practice 231
with real cases [29, 30]. The virtual nursing simulation includes an assessment that students 232
may have found useful for their assessment knowledge and skills [31]. The third-ranked item 233
on simulation effectiveness was that participating in simulation helped students to develop a 234
better understanding of the medication that was in the simulated clinical experience. The goals 235
of planning and applying simulation education are to help students to better the content of the 236
class and to become better in clinical practice [32]. In this sense, the application of virtual 237
simulation to nursing science has been successful for the student learning experience [33]. 238
The critical thinking skills and SDL abilities improved significantly in the current study, and 239
scores on one sub-scale of SDLabilities, “gathering resources for learning,” also significantly 240
correlated with virtual simulation. Those findings implicate that virtual simulation resources 241
for nursing interventions could be a proactively effective approach in nursing education. This 242
is a very relevant finding because of the need to exert continuous effort to seek nursing 243
resources and knowledge to improve care for patients by nursing professionals. Furthermore, 244
a similar study reported that nursing professionalism implicates searching and finding relevant 245
information. The competence related to professional nursing ability was enhanced by virtual 246
simulation in this current study [34]. 247
This study has several limitations; it was done only on female participants and in one 248
university. Thus, the results cannot be generalized. More extensive research with different 249
educational institutions and larger samples, including females and males, is warranted. 250
Further, replication of this study using other nursing student samples, like those found in 251
various universities and public higher education institutions, would aid in generalizing 252

findings. Another limitation was that this study used non-probability convenience sampling techniques to select the students from one place, which restricts its generalizability.

Conclusion

In conclusion, the study showed significant relationships between virtual simulation with critical thinking disposition and SDL abilities among nursing students. Besides, virtual simulation affected nursing students and made them develop critical thinking and self-learning abilities so that they simulate events and try to seek out and solve the problems. Most of the students stated that it had benefited their learning and that they experienced an environment close to a clinical setting. Virtual simulation could be helpful to nursing educators to maximize learning among students due to its education characteristics, provision of opportunities to synthesize nursing knowledge, and effective learning environment.

Acknowledgment

The authors express their gratitude to Princess Nourah bint Abdulrahman University Researchers Supporting Project number (PNURSP2023R441), Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

Funding Statement

This work is supported by Princess Nourah bint Abdulrahman University Researchers Supporting Project number (PNURSP2023R441), Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

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Table 1 (on next page)

Table1

Table 1 *Demographic characteristics of the studied students (n=201)*

Items		No.	%
Academic year	Third year	102	50.7%
	Fourth year	99	49.3%
Gender	Female	201	100%
Age	20 years	75	37.3%
	21 years	126	62.7%
Nationality	Saudi	201	100%

Table 2(on next page)

Table 2

Table 2 Distribution of Simulation effectiveness of the studied students (n=201)

Items	Strongly agree		Agree		Neither		Disagree		Strongly Disagree	
	No.	%	No.	%	No.	%	No.	%	No.	%
The instructor's questions helped me to think critically	55	27.4 %	112	55.7 %	15	7.5%	8	4.0 %	11	5.5 %
I was challenged in my thinking and decision-making skills	63	31.3 %	106	52.7 %	12	6.0%	12	6.0 %	8	4.0 %
I developed a better understanding of the pathophysiology of the conditions in the simulated clinical experience	50	24.9 %	89	44.3 %	33	16.4 %	16	8.0 %	13	6.5 %
I am able to better predict what changes may occur with my real patients	52	25.9 %	115	57.2 %	15	7.5%	8	4.0 %	11	5.5 %
I developed a better understanding of the medications that were in the simulated clinical experience	52	25.9 %	108	53.7 %	21	10.4 %	9	4.5 %	11	5.5 %

Table 3(on next page)

Table 3

1

Items	Strongly agree		Agree		Neither		Disagree		Strongly disagree	
	No.	%	No.	%	No.	%	No.	%	No.	%
I continually look for pieces of information related to solving a problem	47	23.4%	119	59.2%	20	10.0%	6	3.0%	9	4.5%
I willingly solve a complicated problem	34	16.9%	113	56.2%	28	13.9%	16	8.0%	10	5.0%
I'm trying to understand how the unknown things work	58	28.9%	111	55.2%	12	6.0%	9	4.5%	11	5.5%
When I confront a problem. I try hard to find an answer until solving it	68	33.8%	105	52.2%	13	6.5%	8	4.0%	7	3.5%
I explain reasons if I don't agree with others	60	29.9%	114	56.7%	17	8.5%	5	2.5%	5	2.5%
When I am questioned, I think twice before I give my answer	61	30.3%	97	48.3%	20	10.0%	14	7.0%	9	4.5%
I don't rush to judgment	45	22.4%	95	47.3%	34	16.9%	14	7.0%	13	6.5%
I continually evaluate whether my thought is right or not	48	23.9%	110	54.7%	20	10.0%	16	8.0%	7	3.5%
When I see the world, I see it with a questioning mind	63	31.3%	102	50.7%	18	9.0%	10	5.0%	8	4.0%

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3 **Table 3: Distribution of critical thinking disposition of the studied Students (n=201)**

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Table 4(on next page)

Table 4

1

2 **Table 4: Distribution of SDL abilities of the studied Students (n=201)**

Items	Strongly agree		Agree		Neither		Disagree		Strongly Disagree	
	No.	%	No.	%	No.	%	No.	%	No.	%
I am open to new learning opportunities	63	31.3%	106	52.7%	21	10.4%	2	1.0%	9	4.5%
I enjoy learning new information	76	37.8%	100	49.8%	12	6.0%	5	2.5%	8	4.0%
I evaluate my own performance	70	34.8%	114	56.7%	13	6.5%	0	0.0%	4	2.0%
I can find out information for myself	65	32.3%	108	53.7%	15	7.5%	3	1.5%	10	5.0%
I need minimal help to find information	52	25.9%	100	49.8%	30	14.9%	12	6.0%	7	3.5%
I prefer to plan my own learning	63	31.3%	105	52.2%	23	11.4%	3	1.5%	7	3.5%
I prefer to direct my own learning	62	30.8%	104	51.7%	25	12.4%	4	2.0%	6	3.0%
I often review the way nursing practices are conducted	52	25.9%	115	57.2%	20	10.0%	8	4.0%	6	3.0%
I need to know why	70	34.8%	111	55.2%	11	5.5%	3	1.5%	6	3.0%
I critically evaluate new ideas	68	33.8%	108	53.7%	12	6.0%	9	4.5%	4	2.0%
I will ask for help in my learning when necessary	74	36.8%	97	48.3%	15	7.5%	6	3.0%	9	4.5%
I learn from my mistakes	78	38.8%	102	50.7%	15	7.5%	2	1.0%	4	2.0%

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Table 5(on next page)

Table 5

Table 5: Level of simulation effectiveness, CT disposition and SDL abilities of nursing students at PNU

Variable	Items	No.	%
Level of Simulation effectiveness	Low	14	7%
	Moderate	94	46.8%
	High	93	46.3%
Level of critical thinking disposition	Low	7	3.50%
	Moderate	129	64.20%
	High	65	32.30%
Level of self-directed learning ability	Low	5	2.5%
	Moderate	97	48.3%
	High	99	49.3%

Table 6(on next page)

Table 5

Table 6: The relationship between VIRTUAL SIMULATION, CT skills, and SDL abilities of nursing students at PNU

	Virtual Simulation	Critical Thinking disposition	SDL abilities
	r(p)	r(p)	r(p)
Virtual Simulation	1		
Critical Thinking disposition	0.65 (0.03)	1	
SDL abilities	0.78 (0.004)	0.72 (0.01)	1