

The Relationship between Systems Thinking Pattern and Attitudes towards Clinical Practice as Perceived by Nursing Students

Abeer Yehia Mohamed Souda⁽¹⁾, Nevine Hassan Abd- El-Aal⁽²⁾, Wafaa Hassan Mostafa⁽³⁾

(1) Clinical Instructor of Nursing Administration, Faculty of Nursing, Damnhour University, Egypt

(2) Professor of Nursing Administration, Faculty of Nursing, Damnhour University, Egypt

(3) Assistant Professor of Nursing Administration, Faculty of Nursing, Damnhour University, Egypt

Abstract

Background: Systems thinking (ST) is a crucial component of nursing education and practice. It helps nursing students understand the nature of the situations they face in clinical areas, view topics from a broad perspective, and make the right decision in complicated situations. Furthermore, it is an intrinsically motivating factor that encourages nursing students to have favorable attitudes towards their clinical practice. **Aim:** To determine the relationship between systems thinking and attitudes towards clinical practice as perceived by nursing students. **Design:** A descriptive correlational research design was utilized to conduct this study. **Setting:** This study was conducted at all scientific departments at Faculty of Nursing, Damanhour University. **Subjects:** Probability simple random sample from students (n=365) enrolled in the second, third, and fourth academic year in the Faculty of Nursing, Damanhour University 2022-2023, who were available during the time of data collection. **Tools:** two tools were used. Tool one: "Systems thinking pattern survey". Tool two: "Attitudes towards clinical practice questionnaire". **Results:** The results of this study revealed that there were statistical significant differences between faculty of nursing students in the three academic years regarding their levels of ST pattern (p=0.041). Also, more than two-thirds of the faculty of nursing students (69%) perceived moderate level of systems thinking pattern. Concerning levels of attitudes towards clinical practice and its dimensions, namely enthusiastic attitude and querulous attitude there were no statistical significant differences among faculty of nursing students in the three academic years (p=0.074, p=0.456, p=0.111), respectively. Also, the majority of the faculty nursing students (85%) perceived fair overall attitudes towards clinical practice mainly in the 3rd and 4th academic years (84.7%, 89.6%), respectively. **Conclusion:** The finding of this study concluded that, there was a high statistical significant correlation between the overall systems thinking pattern and the overall attitudes towards clinical practice as perceived by faculty nursing students in the three academic years (r=0.210, p<0.001). **Recommendations:** Conduct frequent training programs and a series of workshops on systems thinking for academic professors, clinical instructors, and faculty of nursing students to increase their systems thinking knowledge and skills.

Keywords: Systems thinking, Attitude, Clinical practice, Nursing students.

Introduction

Today's with rapid and continuous changes in our world, all educational institutions aim to be competitive by affecting their students' thinking and attitudes and making them able to understand things around them conceptually and functionally (Shaked & Schechter, 2020). To make a progress in education and health care system, individuals should consider the complexity of situations and issues they may face at any time (Beebe, 2021). Therefore, there is a need for a new thinking approach as systems thinking (ST) which takes into account any situation elements as a whole, how it works together, and how they influence each other (Shaked & Schechter, 2017).

According to Arnold & Wade (2015), ST is defined as: "a set of synergistic analytic skills used to improve the capability of identifying, understanding, and predicting behavior to produce the right way of thinking". While, Mehran et al., (2018) defined ST as "a vital ability for students to learn to identify all features and operations of the represented scientific

phenomena, as well as the relationships between one element and another and across concepts". Moreover, it is viewed by Elsawah, Ho, & Ryan (2022) as "a necessary talent for comprehending complicated problem solving and decision making linked with many of today's issues confronting individuals".

Systems thinking is a unique way of approaching systemic behavior. It has been applied to an extensive variety of fields and disciplines as it has great strengths in fixing complex problems that are not solvable using traditional thinking. Therefore, it is considered an active strategy to manage complicated issue domains as it focuses on how constituent parts of a system relate to the whole system over time. (Monat & Gannon, 2015; Ehrlich, 2022). By understanding and thinking in this way, individuals will be able to create a different set of tools for approaching each situation they may face (Green, Molloy & Duggan, 2021).

Systems thinking has a lot of potential and utility for nursing students since it can be utilized to tackle difficult problems that are not solved using

traditional thinking. In addition, it could help them to give the cautionary principle the weight it deserves to be able to make informed decisions. Because ST can highlight associated uncertainties, it decreases the danger of missing crucial costs, effort, and time (Mahsoon & Dolansky, 2019; Langdalen, Abrahamsen, & Selvik, 2020). It can be helpful in increasing students' thinking levels which can strongly affect their positive predispositions to learn and that may influence their learning outcomes including clinical practice attitudes (Capuno et al., 2019; Ke et al., 2020).

According to Vargas-Sánchez et al., (2016), attitude is defined as: “How a person observes and evaluates something or someone, a predisposition or a tendency to respond positively or negatively to a specific idea, object, person, or situation”. Furthermore, it was viewed by Gomendio (2017) as “the inclination to act positively or adversely on a specific object, circumstance, institution, concept, or person”. Clinical practices are practices that allow students to learn by practicing/experiencing in a real-world context and that let them communicate with healthy and sick people utilizing professional knowledge and skills, as well as problem-solving and decision-making skills (Donelan et al., 2013; Cafiero, 2013). Tesfaye, Alemu, & Mekonen (2020) mentioned that “the clinical practice is a method for students to learn how to apply theoretical and practical information in a clinical setting”.

Nursing students' attitudes towards clinical practice have two dimensions namely: enthusiastic attitude and querulous attitude. The enthusiastic attitude (future-oriented perspective) refers to the exciting perspective toward clinical practice and its critical role. In this dimension, students believe that clinical practice is an important part of a class and can help them to decide on their future careers. In addition, they saw observation-based clinical practice as a necessary aspect of their education. While, the querulous attitude (critical perspective) refers to uneasy sensations and dissatisfaction with their clinical practice due to hospital staff's patronizing attitude and action. They also believe that they are extra workers and their main role in practice is observation with no actual activities assigned (Ha, 2015; Takase et al., 2019).

Up to the researcher's knowledge, few attempts have been made nationally to examine the relationship between systems thinking and attitude towards clinical practice as perceived by nursing students. It is hoped that this study will provide more focus on ST to help nursing students and graduates to predict what will happen, be able to manage and solve complex problems that may occur in the health care settings and improve the quality of patient care. Consequently, having professional nurses who can be competitive in health care delivery systems.

Significance of the study

Most of the nursing students may have no complete understanding of the nature of the situations they face in the clinical area, the value of others' opinions, and the forces that they must be proficient in, also they may be unable to view topics from an abroad perspective nor make the right decisions in complicated problems. Following a study conducted in South Korea about study trends on resilience of nursing students, Cho & Baek (2020) represented that proactivity in problem-solving and system thinking were factors affecting nursing students' resilience at a level of 71.4%. Furthermore, a prior study conducted in Ghana by Awuah-Peasah et al., (2013) about students' attitude toward clinical work found that most of nursing students were coming late or absent from clinical work without seeking permission, use mobile phones during clinical working hours, in addition; they didn't show commitment to clinical work. Therefore, this study aims to investigate the relationship between systems thinking and attitudes towards clinical practice as perceived by nursing students.

Aims of the Study

This study aimed to determine the relationship between systems thinking pattern and attitudes towards clinical practice as perceived by nursing students at Damanhour University.

Research question

What is the relationship between systems thinking pattern and attitudes towards clinical practice as perceived by nursing students at Damanhour University?

Materials and Method

Design: A descriptive, correlation research design was used to conduct this study.

Setting: This study was conducted at all scientific departments of the Faculty of Nursing, Damanhour University which includes nine scientific departments namely: Nursing Administration, Medical and Surgical Nursing, Pediatric Nursing, Gerontology Nursing, Community Health Nursing, Obstetric and Gynaecological Nursing, Psychiatric and Mental Health Nursing, Critical Care and Emergency Nursing, and Nursing Education.

Subjects: Probability simple random sample from students (n=365) enrolled in the second, third, and fourth academic year in the Faculty of Nursing, Damanhour University 2022-2023, who were available during the time of data collection, also, they were willing to participate in this study. They were divided as follows: second-year students (n=80), third-year students (n=170), and Fourth-year students (n=115) based on proportion allocation method (14.6% of the total students from each previously

chosen academic year). First-year students and Technical Health Institute students in the second year were excluded from this study because their numbers were unavailable in the academic year 2021-2022 at the students' affairs department. Furthermore, at the beginning of the academic year 2022-2023 (during data collection) their numbers were not fixed as they were vulnerable to either increase or decrease later.

Tools: The study used two tools for data collection:

Tool I: Systems thinking pattern survey. It was developed by Johnson, (2021). It was adapted by the researcher according to Egyptian nursing students' culture to assess students' systems thinking, it is composed of 28 items. Examples of these items included: "when making a decision, I find it easy to change perspectives to increase understanding" and "I can look at a situation and identify the best places to intervene for improved results". Responses of the students were measured on a 3-point Likert rating scale includes: (0) false, (1) uncertain, and (2) true. The reversed scores were applied for negative statements. The overall score level ranged from (0 to 56) and was categorized as follows: low score of systems thinking from (0-28), moderate score of systems thinking from (29-43), and high score of systems thinking from (44-56). The overall score was also, calculated according to mean percent score as follows; low systems thinking pattern < 50 %, moderate systems thinking pattern 50 % < 75 %, and high systems thinking pattern \geq 75 %.

Tool II: Attitudes towards clinical practice questionnaire. It was developed by Ha, (2015). Furthermore, it was adapted by the researcher according to Egyptian nursing students' culture to assess nursing students' attitudes towards clinical practice. It consists of 43 items grouped under two main dimensions namely: enthusiastic attitude (29 items) and querulous attitude (14 items). Responses of the students were measured on a 5-point Likert rating scale ranging from (1) strongly disagree to (5) strongly agree. The overall score level ranged from (43 to 215) and was categorized as follows; negative attitudes towards clinical practice from (43-129), fair attitudes towards clinical practice from (130-173), and positive attitudes towards clinical practice from (174-215). The overall score was also, calculated according to mean percent score as follows; negative attitudes towards clinical practice < 50 %, fair attitudes towards clinical practice 50 % < 75 %, and positive attitudes towards clinical practice \geq 75 %.

In addition, demographic characteristics questionnaire was developed by the researcher related to the nursing students such as: age, gender, arrangement among siblings, marital status, and previous work.

Method

1. An official permission was obtained from the Dean of Nursing Faculty, Damanhour University for data collection.

2. The two tools were translated into Arabic by the researcher and were submitted into both Arabic and English languages to a jury of five experts in the field of the study to test its content validity and translation. Accordingly, the necessary modifications were done based on their opinions.

3. A pilot study was carried out on 10% of the total sample size (n=36) of nursing students, who were excluded from the study subjects; to check and ensure the clarity of items feasibility of the tool and to identify obstacles and problems that may be encountered during data collection. Based on the findings of the pilot study, no modifications were done.

4. Reliability analysis: The two tools were tested for their reliability by using Cronbach's alpha correlation coefficient test to measure the internal consistency of items. The two tools were proved to be reliable where $r=0.717$ for tool I (Systems Thinking Survey) and $r=0.881$ for tool II (Attitudes towards Clinical Practice Questionnaire) at a statistical significance level ≤ 0.05 .

Data collection:

- Data were collected from the faculty nursing students at all scientific departments through the distribution of self-administered questionnaires after explaining the aim of the study using the previously mentioned tools. Instructions were given after obtaining informed consent from the study subjects before the distribution of the questionnaires.

- The questionnaires were completed in the presence of the researcher to ensure the objectivity of students' responses, non-contamination of their opinions, and to check that all items were answered.

- Answering the questionnaires took approximately from 15-20 minutes. Data collection took a period of two months starting from the beginning of October 2022 to the end of November 2022 three days per week. All questions were answered and explanations were given accordingly.

Ethical considerations:

- The research approval was obtained from the ethical committee at the Faculty of Nursing-Damanhour University prior to the start of the study.

- A written informed consent was obtained from the study subjects after an explanation of the aim of the study.

- Privacy and the right to refuse to participate or withdraw from the study at any time were ensured during the study.

- Confidentiality and anonymity regarding data collected were maintained.

Statistical Analysis:

Suitable statistical analysis tests were used to identify significant relations and to answer the research question. After collecting data, they were revised, coded, transferred into the designed format, to be fed to the computer using statistical IBM SPSS

(Statistical Package for the Social Sciences) software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation (SD), and median. Significance of the obtained results was judged at the 5% level.

Categorical data were described in forms of frequencies, percent, and mean with SD. Cronbach's Alpha was done to assess the reliability of the systems thinking survey and attitudes towards clinical practice questionnaire using Cronbach's Alpha test. Chi-square test was done for categorical variables, to compare between different groups. Student T-Test is a parametric statistical test that used for normally distributed quantitative variables, to compare between two studied categories. (ANOVA) is a parametric statistical test that used to compare the mean for two quantitative data of more than two independent groups that follow a normal distribution. Pearson coefficient was done to measure the correlation between systems thinking pattern and attitudes towards clinical practice as perceived by nursing students. Linear regression was done to detect the most affecting factor for affecting attitudes towards clinical practice

Results

Table 1 shows that there were high statistical significant differences between faculty of nursing students in the three academic years regarding their age ($p < 0.001$, mean \pm SD = 20.93 ± 1.12). Also, there were high statistical significant differences between faculty of nursing students regarding their previous work ($p = 0.001$), while there were statistical significant differences between them regarding their arrangement among siblings ($p = 0.010$). On the other hand, there were no statistical significant differences between faculty of nursing students in the three academic years regarding their gender and marital status ($p = 0.067, p = 0.123$), respectively. Regarding age, it reveals that the vast majority of faculty of nursing students in the three academic years (90.1%) were in the age group ranging from 20 to less than 25 years old, mainly in the 3rd and 4th academic years. In relation to gender, it illustrates that more than two-thirds of faculty of nursing students (71.8%) were females, while 28.2% were males. Also, it illustrates that nearly one-third of faculty of nursing students (32.6%) were the first among their siblings, and 29.9% were the second among their siblings. Regarding marital status, the vast majority of faculty nursing students (87.4%) were single. More than half of them (58.1%) had no previous work.

Table 2 indicates that there were statistical significant differences between faculty of nursing students in the three academic years regarding their levels of ST pattern ($p = 0.041$). This table also reveals

that more than two-thirds of the faculty of nursing students (69%) perceived moderate level of ST pattern, while, 21.1% perceived high level and 9.9% perceived low level of it. Faculty of nursing students in the 4th academic year had a higher percentage of moderate level of ST pattern (77.4%), compared to the same level of faculty nursing students in the 2nd and 3rd academic years.

Table 3 states that there were no statistical significant differences among faculty of nursing students in the three academic years regarding their levels of overall attitudes towards clinical practice and its dimensions, namely enthusiastic attitude and querulous attitude ($p = 0.074, p = 0.456, p = 0.111$), respectively. Also, this table reveals that the majority of the faculty nursing students (85%) perceived fair overall attitudes towards clinical practice mainly in the 3rd and 4th academic years (84.7%, 89.6%), respectively. Regarding the enthusiastic attitude dimension, this table clarifies that nearly two-thirds of the faculty of nursing students in the three academic years had positive attitudes towards clinical practice (62.5%). Also, it reveals that faculty of nursing students in the fourth-year had a higher percentage of positive attitudes towards clinical practice (70.4%) regarding this dimension compared to the same level of faculty of nursing students in the 2nd and 3rd academic years. Regarding querulous attitude dimension, nearly three-quarters of the faculty nursing students in the three academic years had negative attitudes towards clinical practice (74.8%), while faculty of nursing students in the fourth-year had a higher percentage of negative attitudes towards clinical practice (76.5%) regarding this dimension compared to the same level of faculty of nursing students in the 2nd and 3rd academic years.

Table 4 illustrates that there was a high statistical significant weak correlation between the overall ST pattern and the overall attitudes towards clinical practice as perceived by the faculty of nursing students in the three academic years ($r = 0.210, p < 0.001$). Regarding attitudes towards clinical practices dimensions, there was a high statistical significant moderate correlation between the overall ST pattern and querulous attitude dimension ($r = 0.253, p < 0.001$). While, there was no statistical significant relation with the enthusiastic attitude dimension ($r = 0.072, p = 0.167$).

Table 5 illustrates that the regression coefficient revealed that ST pattern as independent variable can predict about 4.4% of attitudes towards clinical practice as dependent variable, where the regression model is highly significant ($F = 16.676, p < 0.001$).

Table (1): Demographic characteristics of faculty of nursing students at the Faculty of Nursing, Damanhour University (N=365).

Demographic characteristics	Academic year						Total (n = 365)		Test of Sig.	P
	2 nd year (n = 80)		3 rd year (n = 170)		4 th year (n = 115)					
	No.	%	No.	%	No.	%	No.	%		
Age										
<20	35	43.8	0	0.0	0	0.0	35	9.6	$\chi^2 = 115.254$	<0.001**
20-<25	45	56.2	170	100.0	114	99.1	329	90.1		
25-<30	0	0.0	0	0.0	1	0.9	1	0.3		
Min. – Max.	18.0 – 22.0		20.0 – 22.0		20.0 – 29.0		18.0 – 29.0		F= 200.036	<0.001**
Mean ± SD.	19.66 ± 0.73		20.86 ± 0.66		21.91 ± 0.94		20.93 ± 1.12			
Gender										
Male	15	18.8	49	28.8	39	33.9	103	28.2	$\chi^2 = 5.413$	0.067
Female	65	81.2	121	71.2	76	66.1	262	71.8		
Arrangement among siblings										
Single	4	5.0	11	6.5	6	5.2	21	5.8	$\chi^2 = 29.847$	0.010*
1 st	32	40.0	47	27.6	40	34.8	119	32.6		
2 nd	14	17.5	65	38.2	30	26	109	29.9		
3 rd	18	22.5	22	12.9	23	20.0	63	17.3		
4 th	11	13.8	17	10.0	7	6.1	35	9.6		
5 th	0	0.0	7	4.2	4	3.5	11	3.0		
6 th	1	1.2	1	0.6	1	0.9	3	0.8		
7 th	0	0.0	0	0.0	1	0.9	1	0.3		
8 th	0	0.0	0	0.0	2	1.7	2	0.4		
9 th	0	0.0	0	0.0	1	0.9	1	0.3		
Marital status										
Single	74	92.5	147	86.5	98	85.2	319	87.4	$\chi^2 = 8.179$	0.123
Married	5	6.3	23	13.5	16	13.9	44	12		
Widowed	0	0.0	0	0.0	1	0.9	1	0.3		
Divorced	1	1.2	0	0.0	0	0.0	1	0.3		
Previous work										
Yes	24	30.0	66	38.8	63	54.8	153	41.9	$\chi^2 = 13.153$	0.001**
No	56	70.0	104	61.2	52	45.2	212	58.1		

 χ^2 : Chi square test

F: for ANOVA test

*: Statistical significant difference at $p \leq 0.05$ **: high statistical significant difference at $p \leq 0.001$

Table (2): Levels of systems thinking pattern among faculty of nursing students (N=365).

Systems thinking pattern	Academic year						Total (n = 365)		χ^2	P
	Second-year (n = 80)		Third-year (n = 170)		Fourth-year (n = 115)					
	No.	%	No.	%	No.	%	No.	%		
Low	7	8.8	16	9.4	13	11.3	36	9.9	9.985	0.041*
Moderate	54	67.4	109	64.1	89	77.4	252	69.0		
High	19	23.8	45	26.5	13	11.3	77	21.1		

Low: < 50 %

Moderate: 50% - < 75%

High: ≥ 75 χ^2 : Chi square test*: Statistical significant difference at $p \leq 0.05$

Table (3): Levels of attitudes towards clinical practice among faculty nursing students (N=365).

Attitudes towards clinical practice	Academic year						Total (n = 365)		χ^2	P
	Second-year (n = 80)		Third-year (n = 170)		Fourth-year (n = 115)		No.	%		
	No.	%	No.	%	No.	%				
Enthusiastic Attitude										
Negative	0	0.0	0	0.0	1	0.9	1	0.2	7.162	0.074
Fair	33	41.2	70	41.2	33	28.7	136	37.3		
Positive	47	58.8	100	58.8	81	70.4	228	62.5		
Querulous Attitude										
Negative	56	70.0	129	75.9	88	76.5	273	74.8	3.588	0.456
Fair	24	30.0	37	21.8	25	21.7	86	23.6		
Positive	0	0.0	4	2.3	2	1.8	6	1.6		
Overall Attitude										
Negative	1	1.2	7	4.1	2	1.7	10	2.7	7.207	0.111
Fair	63	78.8	144	84.7	103	89.6	310	85		
Positive	16	20.0	19	11.2	10	8.7	45	12.3		

Negative: < 50 %

Fair: 50% - < 75%

Positive: \geq 75 χ^2 : Chi square test*: Statistical significant difference at $p \leq 0.05$

Table (4): Correlation between systems thinking pattern and attitudes towards clinical practice (N=365).

Attitudes towards clinical practice	Systems thinking pattern							
	Second-year (n = 80)		Third-year (n = 170)		Fourth-year (n = 115)		Total (n = 365)	
	R	P	R	P	R	P	R	P
Enthusiastic Attitude	0.090	0.428	0.075	0.333	0.111	0.239	0.072	0.167
Querulous Attitude	-0.075	0.510	0.319	<0.001**	0.338	<0.001**	0.253*	<0.001**
Overall Attitude	0.039	0.733	0.236	0.002*	0.326	<0.001**	0.210*	<0.001**

r: Pearson coefficient value; weak from 0.0 to 0.25; moderate from > 0.25 to 0.5; strong from >0.5 to 1.00.

*: Statistical significant relation at $p \leq 0.05$ **: high statistical significant relation $p \leq 0.001$

Table (5): Simple linear regression analysis of systems thinking pattern and attitudes towards clinical practice as perceived by faculty of nursing students (N=365).

Systems thinking pattern	Attitudes towards clinical practice					
	B	Beta	T	P	95% C.I	
					L.L	U.L
	0.162	0.210	4.084*	<0.001**	0.084	0.240
R²=0.044, F=16.676*, p<0.001*						

B: Unstandardized Coefficients **Beta:** Standardized Coefficients **CI:** Confidence interval

LL: Lower limit **UL:** Upper Limit **R²:** Coefficient of determination

t: t-test value **F:** for ANOVA test ****:** highly significant at $p \leq 0.001$

Discussion

Systems thinking is a core competency in nursing education that can be influenced by personal skills and vision which define an individual's future perspective and the methods for achieving it, such as mental models which include presumptions and images affecting students' comprehension of the world and how they behave, shared vision, and goals they wish to instill and group learning which fosters communication that facilitates achieving goals (Miller et al., 2023). ST pattern aims at understanding the interconnectedness of the different parts of the healthcare system. Also, it helps nursing students to develop higher-order thinking skills and view the world more holistically in order to understand and address complex issues (Randle and Stroink, 2018; Shaked and Schechter, 2019).

Therefore, ST can help nursing students in understanding of health care structures and processes and give them the ability to make informed decisions during their clinical practice (York et al., 2019). Clinical practice is an important component of the nursing profession, as well as nursing students' attitude towards clinical practice, is a major factor for student nurses' clinical learning as positive attitudes towards clinical practice promote effective clinical learning, whereas negative attitudes hinder the acquisition of necessary practical skills (Liyew et al., 2020; Anagor et al., 2021)

Regarding **levels of ST pattern**, the result of the current study revealed that there was a statistical significant difference between faculty of nursing students in the three academic years (2nd, 3rd, and 4th academic years). Also, it revealed that the majority of faculty nursing students perceived a moderate level of ST pattern. This result may be attributed to the fact that faculty of nursing students face frequent complex situations during training in clinical areas and dealing with clinical risks, pay attention to how they think and

behave in unintended consequences, be patient while changing their work to reach to the perfect results, and more keener in understanding different and complex issues from insight into its whole picture.

Furthermore, training in clinical areas with collaborative teams and colleagues helps students change their points of view which increase their understanding while making decisions. Also, acquiring experiences forms a mind strategy in students' memory which helps to enhance their approach for reaching the best level. In addition, the faculty curriculum includes an explanation of critical thinking methods that make faculty of nursing students able to understand cause-and-effect relationships; how, cause, and consensus. Moreover, the faculty rules make students able to understand that change in their usual behavior can affect various accumulations within it as well as make students respect time and discipline.

The result of this study is supported by a study done in Korea by Hwang and Park (2017) about the nurses' systems thinking competency, medical error reporting, and the occurrence of adverse events & a study done in the USA by Dillon-Bleich (2018) about relationships among structural empowerment, systems thinking, level of education, certification, and safety competency who stated that study subjects have a moderate level of ST. Furthermore, it is consistent with the study done in Iran by Moazez et al., (2020) about nurses' perceptions of systems thinking and safe nursing care who found that their study subjects perceived a moderate level, and it was related to seeking everyone's view of the situation and viewing the situation from multiple angles. Additionally, the result of this study is in the same line with the study done in Saudi Arabia by Mahsoon & Dolansky (2021) about safety culture and systems thinking for predicting safety competence and safety performance among registered nurses & the study done in Iran by Kakemam et al., (2022) about the impact of nurses' perceptions of systems thinking on occurrence and

reporting of adverse events who found that their study subjects perceived a moderate level of ST and it was related to experience, working in a team and frequent dealing with complex situations in work units. On the other hand, the result of this study is contradicted by a study done in the USA by **Trent et al., (2017)** about RN-to-BSN students' quality improvement knowledge, skills, confidence, and systems thinking who found that faculty nursing students' level of ST was low.

Moreover, the present study showed that the faculty of nursing students in the 4th academic year had a higher percentage of moderate level of ST pattern compared to the faculty of nursing students in the 2nd and 3rd years. This result could be rationalized by the assumption that the development of the learning process, dealing with different mindsets, communication with different ages and different cultures, experiences gained from interaction with different professors and clinical instructors, and knowledge evolution of faculty patterns and rules which could influence them, impact their views towards different issues, and increases ST pattern level by the time.

This result is supported by a study done in a small liberal arts university located in the northeastern US by **Washington et al., (2014)** to assess systems thinking in undergraduates & a study done in Palestine by **Tripto, Assaraf, & Amit (2018)** to assess the development of high school biology students' system thinking over time who reported that as students advance through their learning process, their ST develops and becomes more complex. In this respect, the study done in the USA by **Moore et al., (2011)** to develop a systems thinking scale stated that "nursing students' ST increases gradually to recognize, understand, and synthesize interactions and interdependencies between their behavior and the complex, unpredictable events in the system in which they interact".

In relation to **levels of attitudes towards clinical practice**, the result of this study indicated that there was no statistical significant difference between the faculty of nursing students in the three academic years regarding their attitudes towards clinical practice as well as its dimensions, enthusiastic attitude and querulous attitude. Moreover, the result of this study revealed that faculty nursing students have perceived a fair level of overall attitudes towards clinical practice. This result could be rationalized as the faculty nursing students learn coping and communication skills program in the first and second academic years which make them confident, able to interact with healthcare providers in the clinical area, and have a sense of belonging to interact with the clinical environment.

This result is parallel with the study done in Pakistan by **Sultan et al., (2022)** about the attitude of undergraduate nursing students towards clinical duties as he found that there was no statistically significant relation between the undergraduate nursing students

groups regarding their attitudes towards clinical duties and illustrated that the studied nursing students perceived positive attitudes towards clinical duties because the clinical instructors treat them well, respect them and communicate with them. Also, it is consistent with the study done in Kenya by **Mugoh & Kamau (2020)** about the influence of students' perception in the clinical areas on the students' learning in Mathare teaching and referral hospital and he found that the majority of them reported that the clinical areas were good. In addition, the finding of this study is parallel with the study done in Nigeria by **Ofili, Ncama, & Moses-Ewhre (2019)** about factors influencing bachelor of nursing science students' attitude towards clinical exposure as he found that nursing students perceived positive attitudes towards clinical exposure and suggested that this may be due to proper clinical supervision and direction from clinical instructors, staff nurses' good behavior with students, and students' readiness to learn.

Moreover, the result of this study is in the same line with the study done in Ethiopia by **Mekonnen (2015)** about students nurses' attitude towards clinical practice and associated factors in Hawassa University as he found that the majority of nursing students have favorable attitudes towards clinical practice due to nursing students' confidence in the nursing profession, adequate preparation of clinical instructors to teach students in clinical practice, and the willingness of staff nurses to help students in clinical practice. On the other hand, the result of this study is contradicted with the study done in Northwest Ethiopia by **Aragaw et al., (2019)** about attitude of nursing and midwifery students towards clinical practice and its associated factors who found that more than half of the study participants had an unfavorable attitude towards clinical practice, and the study done in Ethiopia by **Dilla (2016)** about factors affecting clinical practice competency of undergraduate health science students in Hawassa University who found that the prevalence of clinical practice competency was low among nursing students.

Regarding **dimensions of attitudes towards clinical practice**, the present study revealed that the majority of nursing students perceived a positive level of enthusiastic attitude towards clinical practice. However, the majority of them perceived negative level of querulous attitude towards clinical practice. This result may be attributed to the fact that faculty of nursing students consider clinical practice very important in building their extensive knowledge, new experiences, confidence, and clinical adaptability as it provides them with the opportunity to reflect and learn from their mistakes.

In addition, clinical training in hospitals reduces the gaps between clinical nurses and faculty of nursing students which makes students curious, enthusiastic, and excited about clinical practice and its important role in the future. Moreover, clinical instructors consider faculty of nursing students' different points of view in clinical practice. Also, they

allow students to simulate them, perform nursing care under their supervision, and work in teams to see different job approaches. In this respect, **Alis (2023)** stated that a positive attitude makes individuals focus, absorb information, and recognize different kinds of learning opportunities which, in turn, improve their enthusiasm. Also, **Verplanken and Orbell (2022)** said that attitude-based strategies impact and shape behavior and translate it into long-term habits with some degree of favor or disfavor. Moreover, the result of this study is contradicted with the study done in Korea by **Ha (2015)** about attitudes toward clinical practice in undergraduate nursing students who found that the majority of nursing students perceived querulous attitudes towards clinical practice.

In the matter of **correlation and regression between ST pattern and attitudes towards clinical practice as perceived by faculty nursing students**, the statistical result of the current study revealed that there was a high statistical significant weak correlation between the overall ST pattern and the overall attitudes towards clinical practice as perceived by faculty of nursing students in the three academic years. Further, ST as an independent variable can predict about 4.4% of attitudes towards clinical practice as a dependent variable. This could be justified by the result that there was a high statistical significant moderate correlation between the overall ST pattern and only the querulous attitude dimension. Meanwhile, there was no statistical significant correlation between the overall ST pattern and only the enthusiastic attitude dimension, not both dimensions.

These results may be attributed to the fact that when faculty of nursing students have the ability to recognize and deal with the whole picture of complex relationships, patterns, and situations, this will be reflected in their perceptions, attitudes, and behaviors towards their performance and practice in clinical areas. This finding goes in the same line with the study done in New Zealand by **Maani & Maharaj (2004)** about the links between systems thinking and complex decision making who stated that the degree of a high level of ST, and the consistent use of it throughout the decision-making exercise appear to have the greatest impact on performance. Furthermore, the study result is parallel with the study done in Saudi Arabia by **Mahsoon & Dolansky (2021)** about safety culture and systems thinking for predicting safety competence and safety performance among registered nurses who showed that ST was a predictor of competence, knowledge, and performance.

Moreover, the present study showed that regarding the faculty nursing students in the 3rd and 4th academic years, there was a statistical significant correlation between the overall ST pattern and the overall attitudes towards clinical practice as perceived by them. While, it showed that faculty nursing students in the 2nd academic year had no statistical significant relation between the overall ST pattern and

the overall attitudes towards clinical practice and its dimensions. This result may be due to that, as students' experience in dealing with clinical situations increases and their interactions are changed from rural areas to urban areas, their ST pattern will be change, and their life styles and attitudes towards clinical practice will be affected. In this respect, the study done at Beni-Seuif technical health institute in Egypt by **Salama, Abd-Elazeem, & Hassan (2022)** about nursing students' attitudes toward the nursing profession and its relationship with their achievement motivation stated that nursing students' attitudes enhance every academic year as working activities and dealing with other students increase.

Conclusion

The finding of this study concluded that, there was a high statistical significant correlation between the overall ST pattern and the overall attitudes towards clinical practice as perceived by faculty nursing students in the three academic years. In addition, the majority of faculty nursing students perceived a moderate level of ST pattern and a fair level of attitudes towards clinical practice.

Recommendations

Based on the findings of the current study, the following recommendations are suggested:

A. The faculty administrators should:

- Conduct frequent training programs and a series of workshops on ST for academic professors, clinical instructors, and faculty nursing students to increase their ST knowledge and skills.
- Integrate the ST concept in the faculty theoretical and clinical curriculum to encourage faculty of nursing students to use ST in their scientific and practical lives.
- Integrate the concept of ST into the postgraduate curriculum to raise their awareness towards values, attitudes, and behaviors that are necessary while facing complex issues and making decisions.
- Foster a positive learning culture for nursing students to promote their ST pattern through participating in problem-solving and decision-making processes.

B. The academic professors and clinical instructors should:

- Develop training programs for the faculty nursing students to increase their awareness of ST and its potential consequences on their attitudes.
- Conduct periodic meetings with faculty nursing students by scheduling announced hours of academic guidance professors to discuss the

problems they encounter in clinical areas, discuss ways of solving those problems, and give them opportunities to participate in problem-solving and decision making which will, in turn, influence their ST.

- Provide faculty of nursing students with constructive feedback continuously about their performance in clinical areas to enhance their clinical practice attitude

References

- **Alis. (2023).** A positive attitude will help you to learn. Alberta Supports Contact Centre. <https://alis.alberta.ca/>
- **Anagor, C. R., Lukpata, F. E., Ikechukwu-Okoroezi, J. N., & Obiora, M. U. (2021).** Attitude of Nursing Students Towards Work in the Clinical Learning Environment. *International Journal of Studies in Nursing*, 6(1), 54.
- **Aragaw, Y., Sinishaw, W., Daba, W., & Mekie, M. (2019).** Attitude of Nursing and Midwifery students towards clinical practice and its associated factors in Northwest Ethiopia: a cross-sectional study. *BMC research notes*, 12(1), 1-6.
- **Arnold, R. D., & Wade, J. P. (2015).** A definition of systems thinking: A systems approach. *Procedia computer science*, 44, 669-678.
- **Awuah-Peasah, D., Sarfo, L. A., & Asamoah, F. (2013).** The attitudes of student nurses toward clinical work. *International Journal of Nursing and Midwifery*, 5(2), 22-27.
- **Beebe, C. (2021).** Systems Thinking in Socially Engaged Design Settings. Published Doctoral dissertation, Purdue University.
- **Cafiero, M. (2013).** Nurse practitioners' knowledge, experience, and intention to use health literacy strategies in clinical practice. *Journal of health communication*, 18(1), 70-81.
- **Capuno, R., Necesario, R., Etcuban, J. O., Espina, R., Padillo, G., & Manguilimotan, R. (2019).** Attitudes, Study Habits, and Academic Performance of Junior High School Students in Mathematics. *International Electronic Journal of Mathematics Education*, 14(3), 547-561.
- **Cho, J. H., & Baek, K. H. (2020).** Influence of Proactivity in Problem Solving and System Thinking on Resilience of Nursing Students. *Journal of Digital Convergence*, 18(8), 243-252.
- **Dilla, E. (2016).** Assessment of factors affecting clinical practice competency of undergraduate health science students in Hawassa University, South, Ethiopia. *Annals of Clinical and Laboratory Research*, 4(1), 57.
- **Dillon-Bleich, K. (2018).** Keeping patients safe: the relationships among structural empowerment, systems thinking, level of education, certification and safety competency. Published Doctoral Dissertation, Case Western Reserve University.
- **Donelan, K., DesRoches, C. M., Dittus, R. S., & Buerhaus, P. (2013).** Perspectives of Physicians and Nurse Practitioners on Primary Care Practice. *New England Journal of Medicine*, 368(20), 1898-1906.
- **Ehrlich, A. (2022).** Collective impacts: using systems thinking in project-level assessment. *Impact Assessment and Project Appraisal*, 40(2), 129-145.
- **Elsawah, S., Ho, A. T. L., & Ryan, M. J. (2022).** Teaching systems thinking in higher education. *INFORMS Transactions on Education*, 22(2), 66-102.
- **Gomendio, M. (2017).** Empowering and enabling teachers to improve equity and outcomes for all. *International Summit on the Teaching Profession*, OECD Publishing.
- **Green, C., Molloy, O., & Duggan, J. (2021).** An empirical study of the impact of systems thinking and simulation on sustainability education. *Sustainability*, 14(1), 394.
- **Ha, E. H. (2015).** Attitudes toward clinical practice in undergraduate nursing students: A methodology study. *Nurse education today*, 35(6), 733-739.
- **Hwang, J. I., & Park, H. A. (2017).** Nurses' systems thinking competency, medical error reporting, and the occurrence of adverse events: A cross-sectional study. *Contemporary nurse*, 53(6), 622-632.
- **Johnson, J. E. (2021).** Fostering Systems Thinking as a Basis for Paradigm Change in Learning: Explorations in the Context of Environmental Education. Published Doctoral Dissertation, Washington State University.
- **Kakemam, E., Albelbeisi, A. H., Davoodabadi, S., Azarmi, M., Zolghadr, F., & Mamene, M. (2022).** The impact of nurses' perceptions of systems thinking on occurrence and reporting of adverse events: A cross-sectional study. *Journal of nursing management*, 30(2), 482-490.
- **Ke, L., Sadler, T. D., Zangori, L., & Friedrichsen, P. J. (2020).** Students' perceptions of socio-scientific issue-based learning and their appropriation of epistemic tools for systems

- thinking. *International Journal of Science Education*, 42(8), 1339-1361.
- **Langdalen, H., Abrahamsen, E. B., & Selvik, J. T. (2020).** On the importance of systems thinking when using the ALARP principle for risk management. *Reliability Engineering & System Safety*, 204, 107222.
 - **Liyew, B., Dejen Tilahun, A., & Kassew, T. (2020).** Knowledge, attitude, and associated factors towards physical assessment among nurses working in intensive care units: a multicenter cross-sectional study. *Critical Care Research and Practice*, 2020.
 - **Maani, K. E., & Maharaj, V. (2004).** Links between systems thinking and complex decision making. *System Dynamics Review: The Journal of the System Dynamics Society*, 20(1), 21-48.
 - **Mahsoon, A. N., & Dolansky, M. (2019).** Faculty knowledge, awareness, value, and self-efficacy in teaching systems thinking to nursing students: a pilot study. *Int Arch Nurs Health Care*, 5(2), 126-131.
 - **Mahsoon, A. N., & Dolansky, M. (2021).** Safety culture and systems thinking for predicting safety competence and safety performance among registered nurses in Saudi Arabia: a cross-sectional study. *Journal of Research in Nursing*, 26(1-2), 19-32.
 - **Mehren, R., Rempfler, A., Buchholz, J., Hartig, J., & Ulrich-Riedhammer, E. M. (2018).** System competence modelling: Theoretical foundation and empirical validation of a model involving natural, social and human-environment systems. *Journal of Research in Science Teaching*, 55(5), 685-711.
 - **Miller, A. N., Kordova, S., Grinshpoun, T., & Shoval, S. (2023).** To be or not to be a systems thinker: Do professional characteristics influence how students acquire systems-thinking skills?. In *Frontiers in Education*. 8, 1026488.
 - **Mekonnen S. (2015).** Students nurses' attitude towards clinical practice and associated factors in Hawassa University. Published Doctoral Dissertation, Hawassa University.
 - **Moazez, M., Miri, S., Foroughameri, G., & Farokhzadian, J. (2020).** Nurses' perceptions of systems thinking and safe nursing care: A cross-sectional study. *Journal of Nursing Management*, 28(4), 822-830.
 - **Monat, J. P., & Gannon, T. F. (2015).** What is systems thinking? A review of selected literature plus recommendations. *American Journal of Systems Science*, 4(1), 11-26.
 - **Moore, S., Dolansky, M., Singh, M., Plamieri, P., & Alemi, F. (2011).** The systems thinking scale: A measure of systems thinking. *Case Western Reserve University*, 1-27.
 - **Mugoh, E. K. N., & Kamau, M. W. N. (2020).** Influence of students perception/staff attitude in the clinical areas on student's learning in mathare teaching and referral hospital, Nairobi, Kenya. *American Journal of Nursing Science*, 9(2), 47-54.
 - **Ofli, M. I., Ncama, B. P., & Moses-Ewure, O. D. (2019).** Factors influencing Bachelor of Nursing Science students' attitude towards clinical exposure. *African Journal of Health Professions Education*, 11(4), 145-148.
 - **Randle, J. M., & Stroink, M. L. (2018).** The development and initial validation of the paradigm of systems thinking. *Systems Research and Behavioral Science*, 35(6), 645-657.
 - **Shaked, H., & Schechter, C. (2019).** Exploring systems thinking in school principals 'decision-making. *International Journal of Leadership in Education*, 22(5), 573-596.
 - **Shaked, H., & Schechter, C. (2017).** Systems thinking among school middle leaders. *Educational Management Administration & Leadership*, 45(4), 699-718.
 - **Shaked, H., & Schechter, C. (2020).** Systems thinking leadership: New explorations for school improvement. *Management in Education*, 34(3), 107-114.
 - **Salama, S., Abd-Elazeem, H., & Ali Hassan, H. (2022).** Nursing Students' Attitude toward Nursing Profession and its Relationship with their Achievement Motivation. *Egyptian Journal of Health Care*, 13(4), 951-963.
 - **Sultan, A., Khan, S., Bibi, A., Jamal, H., & Rafeeqe, S. (2022).** Attitude of Under-graduate Nursing Students towards Clinical Duties-A cross sectional study. *Pakistan Journal of Medical & Health Sciences*, 16(07), 139-139.
 - **Takase, M., Niitani, M., Imai, T., & Okada, M. (2019).** Students' perceptions of teaching factors that demotivate their learning in lectures and laboratory-based skills practice. *International journal of nursing sciences*, 6(4), 414-420.
 - **Tesfaye, T. S., Alemu, W., & Mekonen, T. (2020).** Perceived clinical practice competency and associated factors among undergraduate students of medicine and health science collage in Dilla University, SNNPR, Ethiopia. *Advances in Medical Education and Practice*, 131-137.
 - **Trent, P., Dolansky, M. A., DeBrew, J. K., & Petty, G. M. (2017).** RN-to-BSN students' quality improvement knowledge, skills, confidence, and systems thinking. *Journal of Nursing Education*, 56(12), 737-740.
 - **Tripto, J., Assaraf, O. B. Z., & Amit, M. (2018).** Recurring patterns in the development of high school biology students' system thinking over time. *Instructional Science*, 46, 639-680.

- **Vargas-Sánchez, A., Plaza-Mejía, M. Á., & Porrás-Bueno, N. (2016).** Attitude. Encyclopedia of Tourism, 58–62. https://link.springer.com/referenceworkentry/10.1007/978-3-319-01384-8_11
- **Verplanken, B., & Orbell, S. (2022).** Attitudes, habits, and behavior change. Annual review of psychology, 73, 327-352.
- **Washington, M. L., Kurthakoti, R., Halpin, A. L., & Byrd, S. (2014).** Assessing systemic thinking in undergraduates: An exploratory study using a Total Enterprise Business simulation. In Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference, 41,53-63.
- **York, S., Lavi, R., Dori, Y. J., & Orgill, M. (2019).** Applications of systems thinking in STEM education. Journal of Chemical Education, 96(12), 2742-2751.