

## Effect of Scaffolding Learning Strategy on Development Analytical Thinking Skills and Scientific Sense among Baccalaureate Nursing Students

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### Abstract:

**Back ground:** Scaffolding is a teaching strategy that instructors use to demonstrate to students how to solve problems while providing assistance as needed. **Aim of the study:** Explore the effect of scaffolding learning strategy on development analytical thinking skills and scientific sense. **Study design:** A quasi- experimental design. **Setting of the study:** was conducted at the classrooms in Faculty of Nursing at Assiut University. **Subject:** 4<sup>th</sup> year undergraduate baccalaureate nursing students. **Sample size:** convenient sample (60) was used. **Data collection:** I-socio-demographic data for the studied subject, II- scaffolding learning strategy scale, III-Analytical thinking test & IV-scientific sense (cognitive aspect) scale. **Results:** There was a high main score in all skills of scaffolding learning of the studied nursing students after applying this strategy than pre applying it; also, there were improvement in analytical thinking skills and scientific sense. **Conclusion:** There are positive correlation with statistically significance difference among scaffolding learning strategy and analytical thinking skills and scientific sense among baccalaureate nursing students. **Recommendations:** pay attention to the ideas of scaffolding learning strategy.

**Key words:** Analytical Thinking Skills, Baccalaureate Nursing Students, Scaffolding Learning Strategy & Scientific Sense.

### Introduction:

The concept of a zone of proximal development (ZPD), first developed by Soviet psychologist Lev Vygotsky in the 1930s, serves as the foundation for scaffolding in education. The zone of proximal development (ZPD) is the line that separates what students can perform alone from what they need help with (Neden et al., 2018).

Applications of Vygotsky's Zone of Proximal Development include modeling, feedback, questioning, instructing, and cognitive structuring. In order to achieve internalization, these techniques "scaffold" students' learning from outside help to self-learning. Interactions with people who know more than the learner lead to this higher-order learning (Sanders & Welk, 2005).

The teaching method known as "scaffolding" involves teachers giving students a certain kind of support as they learn and become proficient in a novel concept or skill. While employing the

instructional scaffolding process, a teacher could present new knowledge or demonstrate to students how to solve a problem. After that, the teacher progressively steps back and lets the students practice on their own. It might also require collaboration (Gonulal & Loewen, 2020). According to Kim, et al., (2018) scaffolding helps students acquire new skills, closes the knowledge gap between what they already know and what they need to know, and simplifies difficult ideas into digestible portions.

Analytical problem-solving skills enable the exploration of facts and knowledge to produce unique, rational answers. To develop a solution, an analytical person focuses on analyzing the data and using logical reasoning procedures (Prawita & Prayitno, 2022). Your capacity for analytical thought determines your ability to effectively collect data and use it to determine the best solutions for a variety of scenarios. Everyone benefits from analytical thinking. It is applicable to a

range of situations, such as choices on employment, education, and day-to-day living (Areesophonpichet, 2022).

Analytical thinking is crucial in the nursing profession. A considerable amount of analytical thinking is required for daily tasks in nursing practice, such as obtaining pertinent data, resolving unforeseen problems, and applying clinical judgments. These skills are not just essential for professionals; nursing students also need strong critical thinking skills to excel in the classroom and on rotations (Harta et al., 2020). Analytical thinking involves methodically removing concepts to narrow down the possible solutions to a manageable number. One must mentally break down complex information into its constituent parts in order to make the optimal decision (Prawita & Prayitno, 2022).

Many cognitivists believe that it is best to comprehend the nature of knowledge in relation to certain external social realities. Supporters of this viewpoint contend that students must be completely involved in a cycle of active experimentation and analytical debate in order for scientific education to be changed into a sequence of experiences that are inquiry-oriented and project-based (Klein, 2017). The "strive to develop and communicative explanations of observed occurrences based on the harmonization of philosophy and information" is how Morrison and Torzs, (2015) define scientific sense. For scientific sense-making to be supported, education must undergo fundamental changes in addition to the addition of practical and other involvement activities. Without these changes, "innovative" technology applications cannot be successful (Newman et al., 2019).

#### Significance of the study:

By searching on the internet the researchers viewed many the studies about Scaffolding Learning Strategy as the following titles. The firstly it done by Neden, et al., (2018) titled with "Towards agility: Scaffolding anticipative education in social work". And next one titled Scaffolding

technique. The TESOL encyclopedia of English language teaching, done by Gonulal, & Loewen, (2020). The researchers noticed that there were no national studies done in Egypt about scaffolding learning strategy among nursing, but many studies done on preparatory education, So, enthusiastic to conduct this learning strategy among 4<sup>th</sup> year nursing students in Faculty of Nursing at Assuit University.

**Aim of the study:** Explore the effect of scaffolding learning strategy on development analytical thinking skills and scientific sense among faculty of nursing students.

#### Specific objectives:

- Apply scaffolding learning strategy on the study subjects.
- Determine the effect of scaffolding learning strategy on development analytical thinking skills and scientific sense.

#### Research hypotheses:

- There are students' development for analytical thinking skills and scientific sense after application of scaffolding learning strategy.
  - There are relationships among scaffolding learning strategy, analytical thinking skills and scientific sense among studied subject.

#### Subject and Methods:

- **Study design:** A quasi- experimental design was used.
- **Setting of the study:** This study was conducted at the classrooms in Faculty of Nursing at Assiut University.
- **Subject:** 4<sup>th</sup> year undergraduate baccalaureate nursing students in 2<sup>nd</sup> semester (N=300) divided into five groups every one of (60students).
- **Sample size:** convenient sample (60) was used in the present study.

#### Data collection: It includes four tools

\***Study tool (I): Socio-demographic data for the studied subject:** It includes name, age, gender, place of residence.

\***Study tool (II): scaffolding learning strategy scale:**

It developed by (Sanders & Welk, 2005) and it consisted of 18 items classified into six

steps: present the new cognitive strategy (four items), regulate difficulty during guided practice (three items), provide varying context for student practice (two items), provide feedback (five items), increase student responsibility (two items), and provide independent practice (two items). **Scoring system:** The scale had three points (0-2) Likert scale type ranging from undeveloped (0), average (1) and developed (2) and the sum of total grade of the correct answer was computed, if the scores percent of responses were  $\geq 60\%$  it indicated developed skills and scores  $\leq 60\%$  indicated undeveloped skills.

**\*Study tool (III): Analytical thinking test:**

This was developed by the researchers, based on review of current related literature to assess ability of students to develop the following skills: examination and observation, categorization, identification of causes, sequences, and identification of relationships and links. It includes 15 items divided on 5 skills. **Scoring system:** The participants was answered the all questions by choose the correct answer, if correct answer will be scored (one) or if not correct answered will be scored (zero).

**\*Study tool (IV): Scientific sense (cognitive aspect) Scale:** It was designed to assess students ability to acquire cognitive aspect of scientific sense. It includes 12 items divided into 4 dimensions (sense of the problem, summarizing of information, recalling past experience and linking with current and narrative sense) each dimension include 3 items. **Scoring system:** The participants was answered the all questions by choose the correct answer, if correct answer will be scored (one) or if not correct answered will be scored (zero).

**Study Procedure:**

-An official permission was obtained from Dean of faculty of nursing and faculty Vice Dean for education and students affairs and explaining to students the purpose of the study,

and asking them for their oral & written consent to participate.

-Nursing administration department classify the student (300) into basic five groups each group contain of (60 students), each group assign for two teaching staff, and group who assign to the researchers (**convenient sample**) split into six teams of 10 students in the small subgroups to ensuring the nursing students responses in perfect manner and assess effect of application of this strategy. The period of data collection was 3 months from end February 2023 to end May 2023. The researchers assesses nursing students using study tools before and after teaching course (6 topics) by using scaffolding learning strategy.

**Validity:** The face validity of the study tools was done by five expert nursing administration staff (Jury) from Assuit University's Faculty of Nursing. Content validity checked and analyzed using confirmatory factor analysis test to assure (importance, clearness, and accountability of each item on the study tools) and its result was  $\geq 1.8$  for all items of the study tools.

**The reliability** was carried out using the Cronbach's Alpha Coefficient test to nursing student's responses toward scaffolding learning strategy, analytical thinking and scientific sense (0.89).

**A pilot study** was carried out to assess tool understandability, applicability and time estimate of the study tools. Moreover, to identify problems that may be encountered during the actual data collection. It applied on (10%) from total sample of studied students (n=6). Data collected from the pilot study was analyzed and no changes were done, so the students included in the pilot study are included in the total number.

**Implementation Phase:** This model, which developed by (Sanders & Welk, 2005) was applied by the researchers for 4<sup>th</sup> year undergraduate baccalaureate nursing students. It carried out at the second semester (from end February to the end of May 2023) and the nursing students were participating in sessions (two session / week, each session 3 hours).

The studied nursing students divided into 6 groups in which each sub group includes 10 students. *It implemented in three stages:*

**The pre-lesson stage:** in which students are active agents, each student learns the topic of the lesson and prepares a set of questions (a quiz) about it to try to answer. As hard as it is for him, keeps it and writes it down to show it to the researchers later and then do it like that. By forming an opinion on the topic of the lesson, students records observations at specific points, and the researchers are then in the process of this stage includes a variety of pedagogical scaffolds for the lesson elements, which may multiple tests in the same element, and the lesson be measured by researchers.

**During the lesson stage:** the researchers gives a brief explanation of the main points of the lesson and then listens to students to identify the difficult points in the lesson, then show students a set of scaffolds that prepared by the researchers (puzzle, case studies , role

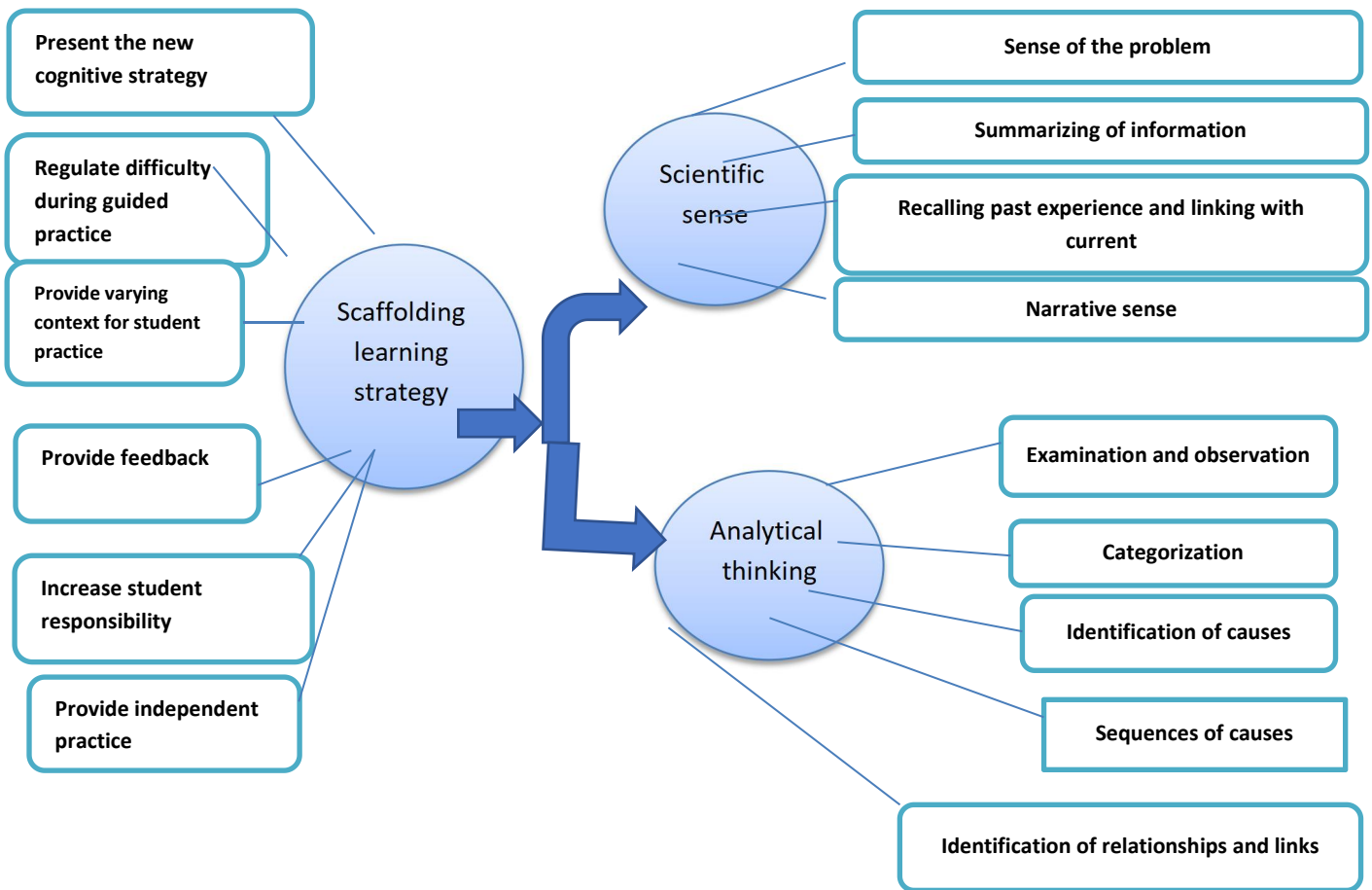
play , peer assessment and critique) for the students, and each student had to choose what was compatible with him, during this stage the student takes control of his learning, the learning environment, and his own experiences and chooses what they suit themselves. Scaffolding is provided on ongoing basis and as needed in form of guidance, direction, and motivation. For example ask students to, read the lesson, define key vocabulary words, then read the lesson as a group and answer a short quiz.

**The end stage of the lesson:** The student does final evaluation, and the researchers also do closing the lesson and final evaluation of the students.

**Evaluation Phase:**

The researchers evaluated the effect of the scaffolding learning strategy model through pre and posttests.

Scaffolding learning strategy Model (Sanders & Welk,2005)



**Ethical considerations:**

Research proposal was approved from ethical committee in the faculty of nursing. There was no risk for study subjects during application of research. The study followed common ethical principles in clinical research. Oral & written consent was obtained from nursing students that were willing to participate in study, after explaining the nature and purpose the study. Confidentiality and anonymity were assured. Study subjects had the right to refuse to participate and or withdraw from the study without any rational any time & Study subject

**Results:**

Figure (1): shows that the highest percentages of studied students as regards their age were 80% under 25yrs old.

Figure (2): Illustrates that the highest percentage of studied nursing students as regard their gender were 60 % male.

Figure (3): Describe that the highest percentage of studied nursing students as regard their place residence were 60 % place in the rural.

Table (1) shows that, the highest mean scores of the studied nursing students in categorization & Identification of relationships and links after applying of scaffolding learning strategy as regard analytical thinking skills, were **(20.27±2.65 & 18.77±1.65)** respectively, Also obvious the highly statistical significant difference between studied nursing students developed in pre and post applying of this strategy a regard to all factors (**P<0.001\*\***)

Table (2) describe that, Mean scores of the studied nursing students as regard to students' scientific sense post applying the scaffolding strategy. The highest mean scores of the studied nursing student in post applying of scaffolding strategy as regard to sense of the problem & narrative sense, were

privacy was considered during collection of data.

**Statistical analysis:**

Data entry and statistical analysis was SPSS 32.0 statistical software package. Data will present use descriptive statistics in the form of frequency, percentages, mean and standard deviation. Pearson correlation analysis can use for assessment of the inter-relationships among quantitative variables, and Spearman rank correlation for ranked ones. Statistical significance will consider at p-value <0.05.

**(20.27±2.65 & 18.77± 1.65)** respectively. Also, there is a high statistical significant difference between studied nursing students developed in pre and post applying this strategy as regard to all factors (**P. value <0.001\*\***).

Table (3) demonstrates that, the distribution of the studied nursing students as regard to students' development in pre-post applying scaffolding learning strategy. The highest mean scores of the studied nursing students in post applying of scaffolding learning strategy as regard to increase student responsibility and provide independent practice, were **(18.77±1.65 & 77.13±6.08)** respectively, Also obvious the highly statistical significant difference between studied nursing students developed in pre and post applying of this strategy a regard to all factors (**P<0.001\*\***)

Table (4) illustrates that, the highest percentages of the studied nursing students were developed as regard to provide independent practice and increase student responsibility after applying scaffolding learning strategy **(96.7% & 93.8%)** respectively. Also, the highest percentages of studied nursing students' level in after applying the strategy were satisfactory

Figure (1): Distribution of personal characteristics data for the studied subjects as regards their age (n=60)

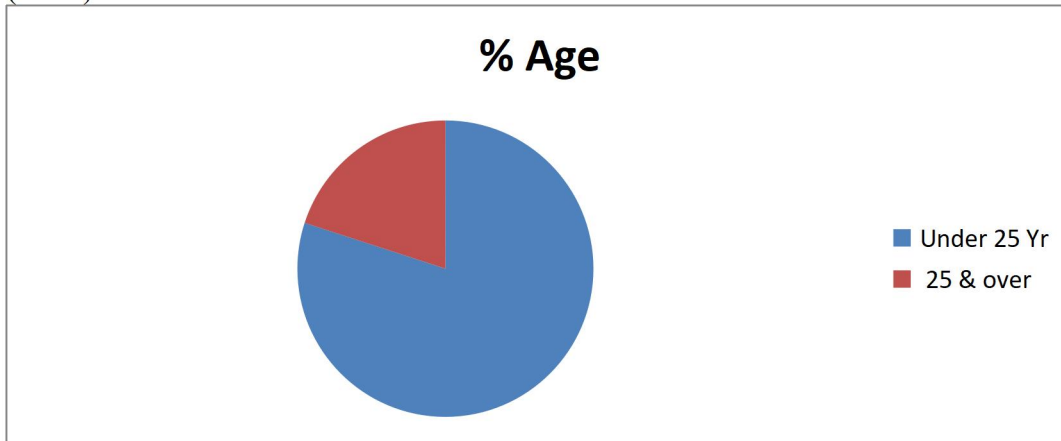


Figure (2): Distribution of personal characteristics data for the studied subjects as regards their gender (n=60)

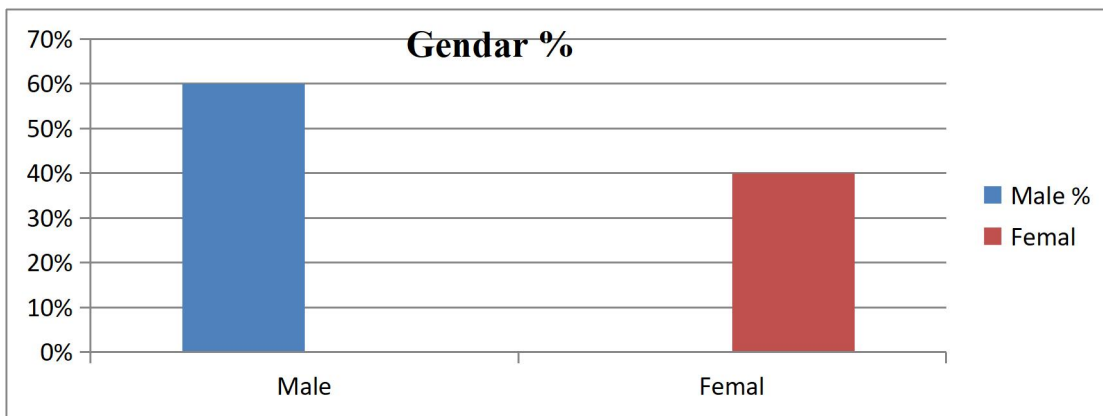
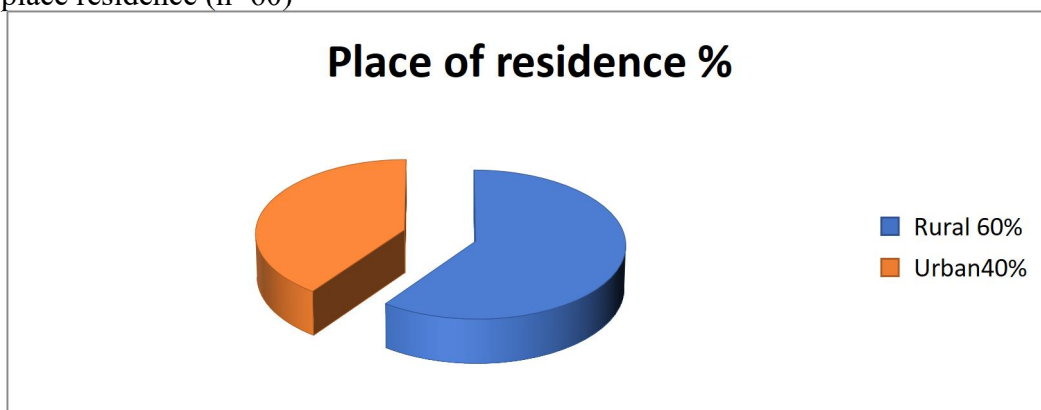


Figure (3): Distribution of personal characteristics data for the studied subjects as regards their place residence (n=60)



**Table (1):- Mean Scores of nursing students regarding analytical thinking skills (n=60)**

Analytical thinking skills	pre	Post	P. value
1. Examination and observation	0.47±0.73	8.93±1.14	<0.001**
2. Categorization	0.83±0.91	<b>20.27±2.65</b>	<0.001**
3. Identification of causes	2.77±0.57	13.7±1.6	<0.001**
4. Sequences of causes	2.43±1.76	15.47±1.01	<0.001**
5. Identification of relationships and links	4.67±1.27	<b>18.77±1.65</b>	<0.001**
<b>Total</b>	<b>11.17±3.71</b>	<b>77.13±6.08</b>	<0.001**

**Table (2):- Mean Scores of nursing students regarding scientific sense (n=60)**

Scientific sense Dimensions	pre	Post	P. value
Sense of the problem	0.73±0.91	<b>20.27±2.65</b>	<0.001**
Summarizing of information	2.87±0.57	13.7±1.6	<0.001**
Recalling past experience and linking with current	2.33±1.76	15.47±1.01	<0.001**
Narrative sense	5.57±1.27	<b>18.77±1.65</b>	<0.001**
<b>Total</b>	<b>12.17±3.71</b>	<b>77.13±6.08</b>	<0.001**

**Table (3):- Mean scores of the studied nursing students as regard to students' development in pre-post applying scaffolding learning strategy (n=60)**

Scaffolding learning strategy	Pre		Post		P. value
	Range	Mean ± SD	Range	Mean ± SD	
Present the new cognitive strategy	0 - 3	0.47±0.73	6 - 10	8.93±1.14	<0.001**
Regulate difficulty during guided practice	0 - 4	0.83±0.91	11 - 22	<b>20.27±2.65</b>	<0.001**
Provide varying context for student practice	1 - 4	2.77±0.57	11 - 16	13.7±1.6	<0.001**
Provide feedback	0 - 5	2.43±1.76	12 - 16	15.47±1.01	<0.001**
Increase student responsibility	3 - 7	4.67±1.27	13 - 20	<b>18.77±1.65</b>	<0.001**
Provide independent practice	<b>6 - 21</b>	<b>11.17±3.71</b>	<b>55 - 84</b>	<b>77.13±6.08</b>	<0.001**

Independent samples T Test,

\*\* Highly statistically significant difference (p&lt;0.01).

**Table (4): Percentage distribution of the studied nursing students' level as regard to scaffolding learning strategy pre-post applying it. (N=60).**

Scaffolding learning strategy	Pre		Post	
	Develop Points		Develop Points	
	(%)	Level	(%)	Level
1. Present the new cognitive strategy	4.7	Unsatisfactory	89.3	Satisfactory
2. Regulate difficulty during guided practice	3.8	Unsatisfactory	92.1	Satisfactory
3. Provide varying context for student practice	17.3	Unsatisfactory	85.6	Satisfactory
4. Provide feedback	15.2	Unsatisfactory	91.8	Satisfactory
5. Increase student responsibility	23.3	Unsatisfactory	<b>93.8</b>	<b>Satisfactory</b>
6. Provide independent practice	13.3	Unsatisfactory	<b>96.7</b>	<b>Satisfactory</b>



## Discussion

According to **Alias (2022)**, scaffolding is a framework that allows the student to pace their education and experience it in manageable portions. Additionally, according to **Murtagh and Webster (2020)**, scaffolding may boost motivation and support the capacity for self-regulation, self-evaluation, and interaction with peers and the teacher. The purpose of the current study was to investigate how faculty of nursing students' development of scientific sense and analytical thinking abilities was impacted by the scaffolding learning technique.

The current study revealed that, the highest mean scores of the studied nursing students in categorization & identification of relationships and links after applying of scaffolding learning strategy as regard to analytical thinking skills. The researchers' point of view is the individual's possession of analytical thinking skills makes him pay attention to details and identify all alternatives possible ways to solve the problem and compare and then identification of relationships and links them before making the right decision. These findings consistent with, **Mohammed & Mahmoud , (2023)** who found students with strong analytical thinking skills can solve problems and arrive at classifications by making decisions while paying attention to the identification of correlations and links.

The present study showed that, the highest mean scores of the studied nursing students in sense of the problem & narrative sense after applying of scaffolding strategy as regard to scientific sense. This might due to the scientific sense provides the technical framework for understanding and addressing health problems, while the narrative sense helps students understand the human side of healthcare. Together, these approaches equip nursing students to provide thorough, compassionate, and effective patient care.

These findings were consistent with, **Higgs, et al., (2018)** who said nursing students receive instruction on how to identify and

characterize health issues using a scientific method, which entails determining quantifiable, observable, and testable problems. This strategy is crucial because it allows them to evaluate patient needs, carry out evidence-based treatments, and make judgments based on factual information. Students who comprehend scientific reasoning are also better equipped to use research techniques, exercise critical thought, and adhere to strict procedures in healthcare settings.

These findings were consistent with **Lorem (2020)**, who represent narrative sense entails comprehending the individual experiences, tales, and emotional circumstances of patients. Nursing students can see patients holistically rather than as a collection of symptoms when they possess this kind of information. Students are better able to establish rapport, relate to the patient's experiences, and provide tailored care when they comprehend the patient's story. It promotes a caring and patient-centered approach by assisting in bridging the gap between objective clinical data and subjective patient experiences.

In addition, according to **Bishop (2019)**, nursing practice necessitates a combination of narrative and scientific thinking. Nursing students gain a broad skill set that improves their capacity to diagnose, treat, and interact with patients by fusing scientific and narrative understanding. Effective communication, moral decision-making, and providing comprehensive healthcare that honors both medical and human aspects all depend on this dual strategy.

As revealed from the current study, the highest mean scores of the studied nursing students in post applying of scaffolding learning strategy as regard to increase student responsibility and provide independent practice. This might be attributed to gradually reducing scaffolding and promoting independent practice, researchers can help students develop the confidence, skills, and self-awareness needed to succeed independently in both academic and real-

world settings. This transition from guided learning to independent practice empowers students to be lifelong learners and prepares them for professional responsibilities.

These findings were in agreement with **Hinson-Williams (2020)** who found that students become active participants in the learning process rather than passive consumers of knowledge as they assume greater responsibilities. This active participation fosters critical thinking and increases comprehension. After the scaffolding phase, students are allowed to work independently, which forces them to actively apply what they have learned and strengthens their knowledge and abilities.

Furthermore, **Reiser, (2024)** who stated that scaffolding is giving students early assistance as they pick up difficult ideas or abilities. Students are encouraged to assume greater responsibility when these assistance are gradually removed, which boosts their competence and confidence. Students' autonomy and self-efficacy are eventually increased as a result of this progressive release, which makes them feel more capable of managing activities independently.

The present study showed that, there were highly statistically significant differences between studied nursing students as regard to students' development, which were satisfied in post applying scaffolding learning strategy in the current study. The researchers' point of view, scaffolding learning strategy does not focus on traditional learning but allows the development of analytical thinking skills and scientific sense for the students through guidance learning.

At the same line, **Taber, (2018)** who found that by offering an organized method that gradually increases students' abilities and confidence in assessing, analyzing, and resolving issues, the scaffolding learning strategy promotes the growth of analytical thinking and scientific sense.

These findings were in agreement with **Sharma & Giannakos, (2023)** who represent that scaffolding enables teachers to divide difficult

ideas or assignments into smaller, more doable steps. This aids pupils in comprehending fundamental concepts before proceeding to more intricate study. Students' analytical thinking is improved and their comprehension becomes more complex as a result of the task's gradual increase in difficulty.

In addition, **Maksić & Jošić (2021)** who said that scaffolding encourages students to approach problems methodically, which is essential to scientific thinking. Scaffolding supports the scientific method by leading them through organized processes including formulating hypotheses, evaluating data, and coming to conclusions. As students learn about data-based reasoning and structured thought processes, this method fosters a scientific sensibility.

Finally, **Hogan & Pressley, (2024)** said that scaffolding creates a safe space where students can think critically without worrying about making a mistake. As students are gradually given responsibility to apply these abilities independently, this support helps them become more confident in their ability to use scientific and analytical procedures, which helps them to refine their analytical thinking over time.

#### **Conclusion:**

There are positive correlation with statistically significance difference among scaffolding learning strategy and analytical thinking skills and scientific sense among baccalaureate nursing students.

**Recommendations:** The researchers recommended the following:

- Paying attention to analytical thinking skills and developing them when teaching the subject
- Urging teaching staff to organize teaching time and pay attention to the ideas of scaffolding learning strategy

- Encourage repeated study research at all classes in this faculty.
- Holding educational programs for the teaching staff in the faculty on the application of the scaffolding learning strategy.
- Organize training courses or workshops based on innovative teaching strategies such as scaffolding.

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