REVIEW ARTICLE

Understanding Learning Styles in Undergraduate Nursing Programs of the Kingdom of Saudi Arabia: An Integrative Literature Review

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Abstract:

Background:

In Saudi Arabia, nursing education is developing fast due to high nursing demand. Alongside this development, nurse educators must identify and understand nursing students learning styles to ensure the multidimensional development of students learning experiences. Students' preferred learning style is an essential element in determining students' unique ways of processing new knowledge, information, and skills.

Objective:

This literature review aimed to identify the learning styles of undergraduate Saudi nursing students based on the premises of three learning style models: Kolb's Model, Felder-Silverman Learning, and Visual, Aural, Read/Write, and Kinesthetic (VARK) Learning Styles Inventory.

Methods:

An integrative review of published studies on Saudi nursing students' learning styles was conducted while adhering to predefined eligibility measures. The research strategy for this study was based on online international databases, such as PubMed, Medline, CINAHL, EBSCO, Google Scholar, and Saudi health databases and journals. The keywords used were: "nursing education," "learning style," "learning preference," "academic learning style," "undergraduate nursing students," and "nursing students in Saudi Arabia."

Results:

Seven studies met the inclusion criteria. Most of the reviewed literature reported a prominent preference for kinesthetic, accommodating, converging, visual, and active learning styles in nursing students regardless of their age, gender, and level of education in various universities in Saudi Arabia.

Conclusion:

Students learning styles emphasize the importance of practical experience and students' hands-on practice as the best style that improves nursing students learning experience. The Saudi Arabian education system must adjust to fit students' preferred learning styles and focus on advanced state-of-the-science learning tools in nursing education.

Keywords: Nursing education, Learning style, Undergraduate nursing students, Age, Gender, Level of education.

1. INTRODUCTION

Over the past two decades, the development of the nursing profession in Saudi Arabia has accelerated over several transformational stages [1]. The nursing profession is still in rapid development due to the efforts and measures of the Saudi Ministry of Education (MOE). Moreover, recommendations by

the Saudi Ministry of Health (MOH) have helped prepare and improve nurses' educational and training competencies to improve the quality of nursing care in all health sectors [2]. The latest published statistics by MOH showed that nursing staff represents 41% (83,596) of the MOH workforce. Particularly, Saudi citizens represent approximately 63% of the total healthcare workers [2, 3]. The current plan of the nursing colleges in Saudi Arabia is to graduate approximately 26,200 new nurses by 2027 [2, 3]. Alongside this plan, important

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educational factors such as students' preferred learning styles should not be ignored.

Internationally, nurses are responsible for providing a range of healthcare services, which are supposed to be based on vital nurses' knowledge and skills [4, 5]. Nurses should be prepared to respond to emergencies and provide comprehensive patient-centered care [6]. Also, they must be prepared to provide safe patient care and be involved in enhancing the mental and psychosocial health status of individuals and the community [7]. Therefore, it is the responsibility of nursing education to have a plan to prepare future nurses with the knowledge, information, and skills needed to provide safe, holistic patient care [8].

Accordingly, to achieve the Saudi national plan of graduating approximately 26,200 new nurses by the year 2027 [2, 3], nursing education in Saudi Arabia must be associated with the globally updated nursing education strategies and methods that aim to improve students' knowledge, information, and skills [9, 11]. Therefore, the Saudi strategic plan should be developed based on international nursing education strategies and methods that could potentially guide educators in choosing appropriate teaching strategies that fit students learning styles.

One of the most important elements in nursing education is students' preferred learning style [11 - 13]. Several learning styles are used in education to provide learners with better information to achieve their academic goals [13]. Some individuals prefer to receive information by oral presentation (*i.e.*, verbal learners), whereas others prefer to receive information through pictures (*i.e.*, visual learners). Learners may also prefer to be active participants in small groups or work independently to gain information. The literature suggests that using different learning styles—especially a student's preferred learning style-is significantly associated with improving their academic achievements [13, 14]. For example, several studies were conducted to assess the impact of using different learning styles on the academic achievements of undergraduate students [13 - 17]. Most of the studies found a positive correlation between students preferred learning styles and their academic performance.

Due to rapidly increasing advancements in nursing education curricula in Saudi Arabia, nurse educators are responsible for keeping themselves updated to assist and meet students' learning needs. Of these needs, understanding nursing students' learning styles can be crucial. Indeed, different learning styles and preferences are essential for strategic attainment throughout a demanding nursing degree. A literature review is necessary to gain detailed information regarding Saudi nursing learning styles and preferred learning styles to generate a comprehensive educational tool for nursing educators. Therefore, this literature review aims to offer detailed information about the preferred learning style of Saudi nursing students studying in Saudi Arabia. Specifically, the objectives of this review were to 1) provide a brief overview of Kolb's model, the Felder-Silverman learning style model (FSLSM), and the Visual, Aural, Read/Write, and Kinesthetic (VARK) Learning Styles Inventory, and 2) discuss and compare the most common learning style models that have been used in Saudi nursing education programs in Saudi

Arabia. The results of this study will positively contribute to improving nursing education in Saudi Arabia and other Arab countries. Moreover, it will help Saudi nursing educators to choose the most appropriate teaching methods that fit nursing students' needs.

1.1. Significance of Identifying Students' Learning Styles

Identifying students' preferred learning styles is an important factor for educational success [13]. Identifying undergraduate nursing students learning styles will help educational institutions and educators ensure compatibility in educational patterns between teachers and learners [15]. This knowledge will also help educators overcome potential bias and ensure new information is delivered to all students similarly and efficiently. It will also motivate them to tailor their current teaching methods from how they prefer to teach to how learners prefer to receive information [16]. Furthermore, identifying students' preferred learning styles, incorporating many learning styles, and focusing on the preferred teaching methods are necessary for helping students build self-confidence and manage their learning methods effectively and more productively to achieve their academic goals [13].

Learning styles differ among undergraduate students, and these differences pose a significant challenge for teachers as they strive to meet the educational needs of their students [18, 19]. Moreover, every student prefers distinct and consistent ways to perceive and organize the information so they may quickly retrieve it when needed and use it in the clinical field after graduation. Specifically, students in medical and health colleges use different methods to receive new information depending on their cognitive and memorization abilities and how this information is applied in the healthcare field after graduation [19, 20].

1.2. Overview of Learning Styles

The present literature review was designed to integrate the selected findings contributed by published literature to bridge the gaps identified among different symmetries of Saudi nursing students' preferred learning styles within the nursing education system in Saudi Arabia. This integrative literature review is based on the premises of three learning style models appropriate for investigating the needs of nursing students in the KSA: Kolb's model, FSLSM, and the VARK Learning Styles Inventory.

1.2.1. Kolb's Learning Styles Model

One of the most popular and practiced methods for learning styles was devised by David Kolb (1984). This method demonstrates a comprehensive experience-based learning model that relies on Kolb's learning style inventory system. Kolb's model advocates that experience is indispensable to learning and highlights that as experience is accumulated by a learner, the level of comprehension expands accordingly. For a more elaborate explanation, Kolb divided the span of one's experience into four interconnected experience cycles: concrete experience, reflective observation, abstract conceptualization, and active experimentation, popularly known as the experiential learning cycle [21, 22]. In

brief, throughout the concrete experience cycle, a learner's understandings remain limited to the level of experienced feelings collected while interacting with others. Within the reflective observation cycle, a learner's ability appeals to create an observation window, after which learning is based on observations. When learners enter the abstract conceptualization phase of experience, an in-depth analytical approach often becomes active while conceptualizing observations. The active experimentation cycle implies that the individual learns through active participation in the learning process [22]. During the concrete experience, reflective observation, abstract conceptualization, and active experimentation experience cycles, individuals learn via four different learning styles, namely divergent, convergent, accommodative, and assimilative learning styles, respectively.

1.2.2. Felder-Silverman Learning Style Model

Beyond Kolb's model, additional learning dimensions, such as listening or seeing and processing, were considered by Felder and Silverman (1988), who developed the FSLSM. According to the FSLSM, the learning preferences of students reflect the ways through which they listen, see, and process particular information [23]. Thus, it can be argued that the design of the FSLSM provides an advanced and practical teaching approach for educators. The four essential factors of the FSLSM are (a) active-reflective, (b) sensing-intuitive, (c) visual-verbal, and (d) sequential-global, all of which play a central role in contributing to learners' learning styles and preferences [24]. The FSLSM relies on the assumption that a student can be more attentive toward learning when it occurs through verbal and visual media simultaneously [25]. This model put forth a comparative analysis that advocates learners provided with visual media, such as graphs, diagrams, and images, can actively process the information as compared to learners taught via a verbal medium alone [26]. However, verbal learners indicate excellent listening and responding abilities toward the delivered contents of a lecture. The FSLSM also highlights the verbal learning environment creates space to conceive new ideas and accumulate more information beyond the talk or lecture [25]. Finally, this model attracts attention to disrupted or random learning concepts [27]. The FSLSM indicates that global learners learn best when in groups by collecting materials and information in a disrupted and random manner [27]. However, a systematic and sequential learning style provides an adequate platform to learners, as it encompasses linear series of learning levels for which every step is cohesive and logically built upon the previous one [26].

1.2.3. Visual, Aural, Read/Write, and Kinesthetic (VARK) Learning Styles Inventory

In addition to the other models that have been used to categorize learning styles, the VARK model, devised by Neil Flemings (1987), has been recognized for its critical ability to help learners recognize different learning preferences [17]. Concisely, the VARK model allows educators to identify learners' attraction to visual, auditory, reading, writing, and kinesthetic learning styles. In the VARK model, Flemings established a self-reported inventory that enlisted varied

situations to ascertain preferred learning styles [28], allowing respondents to choose the answers that suit their preferred learning style.

Based on the VARK model, visual learners tend to learn better and faster by seeing handouts, charts, illustrations, diagrams, and videos compared to learners who depend on listening [28]. With the employment of these visual learning tools, the learners grasp a huge amount of information delivered by an instructor as compared to aural learners. On the other hand, visual tools are known to create a more attentive learning environment as compared to verbal lectures. For example, most of the learners in a visuals-based class can be found engaged with content during the entire lecture, whereas, in the case of an aural class, students receive the content tactfully and create their real-time notes, short-cut keys, and memory maps to retain information for the long term. Thus, it can be speculated that aural learners may develop the ability to retain wide knowledge by synthesizing their preferred method of learning.

The VARK model also indicates that reading and writing learners can learn best when they are equipped with displayed content in words or texts [29]. At the same time, the VARK model also asserts that learners can learn better via doing and touching formats. These learners are categorized as kinesthetic learners and characterized by difficulty sitting still for an extended period when learning and instead prefer to physically practice what they learn in class.

2. METHODOLOGY

An integrative literature review was conducted to identify the learning styles of Saudi nursing students based on the premises of three learning style models: VARK Learning Styles, Kolb's model, and FSLSM learning style. The research strategy for this study was based on online international databases, such as PubMed, Medline, CINAHL, EBSCO, Google Scholar, and Saudi health databases and journals. The database search was conducted using the following keywords: "nursing education," "learning style," "learning preference," "academic learning style," "Undergraduate Nursing Students," and "Nursing students in Saudi Arabia". The inclusion criteria were 1) published literature in the English language, 2) peer-reviewed articles, and 3) literature with a focus on using learning styles in nursing education in Saudi Arabia. Discussion articles, letters to the editors, and articles with weak documented references were excluded from this literature review. Moreover, studies that have been conducted in different settings outside of Saudi Arabia were also excluded.

The searching and reviewing process was guided by this research's aim of assessing the background of nursing education in Saudi Arabia and identifying the dominant learning styles among Saudi nursing students. The search of the literature took place in June and July 2021. Each selected article was carefully screened for relevance by reading the title, abstract, purpose, samples, study design, and measurement. The literature search revealed seven full-text peer-reviewed articles Fig. (**1**). shows the flowchart for the selection of studies retrieved from databases.

Search Terms: "Nursing Education", "Learning Style", "Learning Preference", "Academic Learning Styles", "Undergraduate Nursing Students", and "Nursing students in Saudi Arabia"

Records identified through Database search (PubMed, Medline, CINAHL, EBSCO)
(n = 9103)

Additional records identified through other sources (Google Scholar, local Saudi health databases and journals)
(n = 2114)

Record after following inclusion criteria
(n = 419)

Record excluded due to nursing eligibility
(n = 397)

Fulltext articles were assessed for eligibility
(n = 44)

Fulltext articles were excluded due to their settings (n = 37)

Studies included in the literature review
(n = 7)

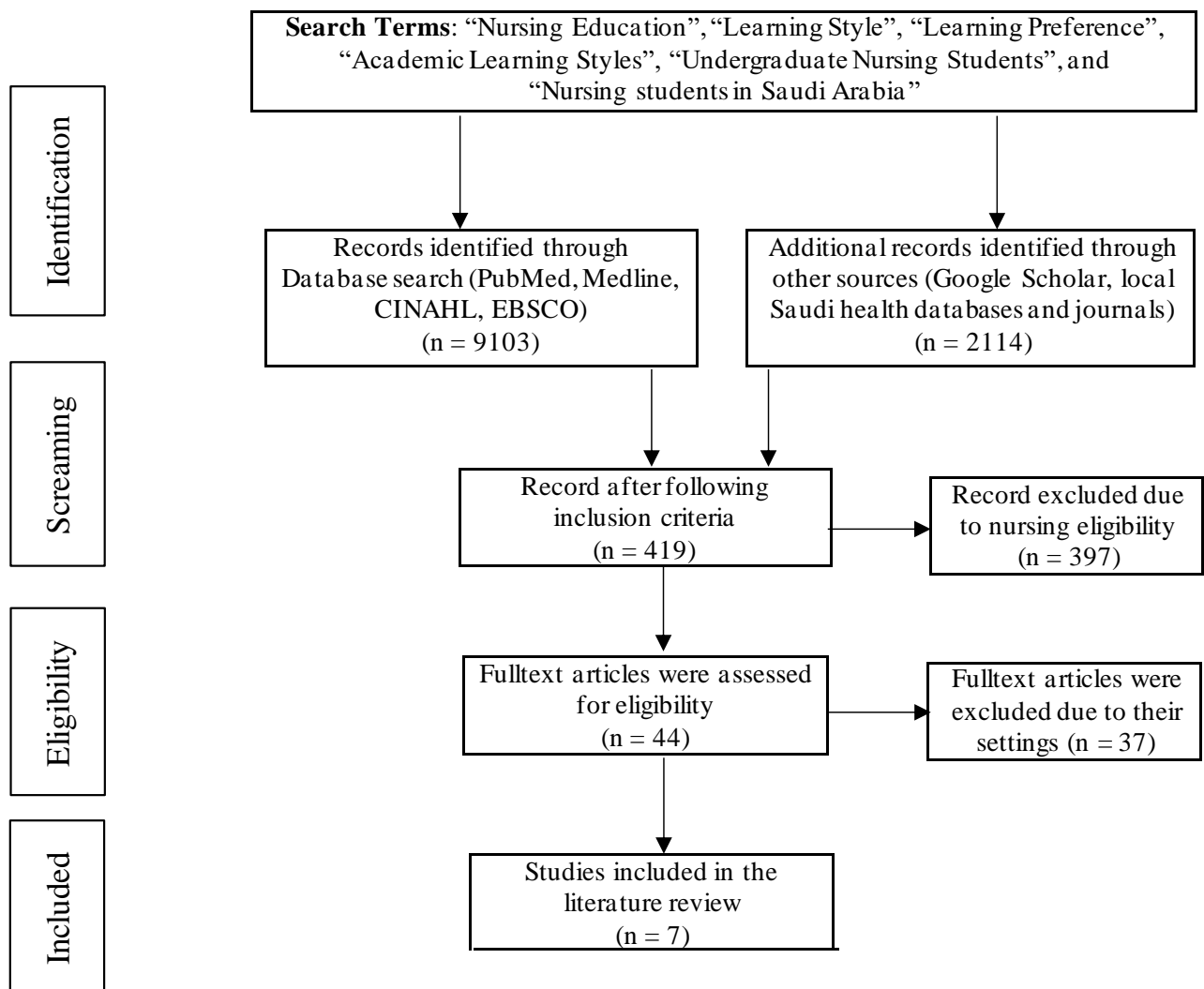Identification

Screaming

Eligibility

Included

Fig (1). PRISMA flowchart for selection of studies retrieved from databases.

3. RESULTS

Published studies in Saudi Arabia were included in this literature review based on study aims, year of publication, and language. Limited published original research articles were found, and those related papers were examined thoroughly. Most selected articles were published in the English language between 2010 and 2020 and assessed Saudi nursing students' learning styles. Based on the inclusion criteria, 7 out of a total of 44 studies were considered in this study (Table **1**).

The contents of the literature were analyzed following Mayring's (2004) methodology [30]. The seven studies were selected for their appropriateness for this literature review, as they aimed to examine Saudi nursing students' learning styles. Based on Mayring's (2004) guidelines [30], the literature review process encompasses and involves broadly four stages: (a) collecting materials/resources, (b) descriptive analysis, (c)

selecting categories, and (d) evaluating the findings of selected studies field [30]. Following the previously described standards, the authors chose to review the selected literature to explore Saudi nursing students' learning styles to identify the literature gaps regarding this topic in Saudi Arabia. After identifying the original research articles, only seven articles were included in this literature review paper. Secondary sources, unrelated articles, and gray literature papers were also withdrawn from this article.

Searching the literature revealed limited sources and a scarcity of published articles regarding the specific objectives of this study. Overall, three learning style models were noted in the searched literature. Therefore, the authors of this study classified the results into three subheadings to present the reviewed literature regarding the three learning style models used in nursing education in the KSA.

Table 1. Nursing Students Learning styles in Saudi Arabia.

Sr. No.	Learning Preferences in Research Article	Major Question(s) in Research Article	Research Design (RD), Dependent Variables (DV) and Operational Definitions (OD)	Size (Nos) and Setting of Samples	Results and Statistical Analyses	Major Findings and Limitations	Ref.
1	Relationship between learning style and readiness for self-directed learning	1-What is the status of nursing students' readiness for self-directed learning and their learning styles?	**RD:** Descriptive cross-sectional correlational design. **DV:** 1-Preferred learning styles. 2-Readiness for self-directed learning. **OD:** 1- Fisher's self-directed learning readiness (SDLR). 2-Visual, aural/auditory, read/write, and kinesthetic (VARK)	**Sample**: 213, female and male undergraduate nursing students. **Setting:** Nursing colleges Taibah University, KSA	**1-Results:** Aural-19.7%, read-write- 8.5%, visual 6.6% and kinesthetic learning styles 25.8% with an overall response rate of 76%. **2- Statistical methods:** (i) Frequency and percentage. (ii) Chi-square. (iii) Unpaired t-test (iv) ANOVA	**Limitations:** (i) Majority of students were female (70%). (ii) One nursing college in one Saudi university. (iii) No causation relationship among the study variables	Aljohni and Fadila (2018). [2]
2	Kinaesthetic	1-What are the most common learning preferences among the nursing students in Saudi Arabia?	**RD:** Descriptive cross-sectional **DV:** Preferred learning styles **OD:** Visual, Aurel, Read/Write and Kinaesthetic (VARK) styles.	**Nos**: 125, females undergraduate nursing students. **Setting:** College of Nursing at Princess Nourah University, KSA.	**1-Results:** Kinaesthetic learning 80.5% with an overall response rate of 45%. **2- Statistical methods:** (i) Frequency and percentage	(i) Similarity in learning styles of Saudi nursing students with other groups of Saudi healthcare students **Limitations-** (i) One gender and (ii) One university sample	Stirling & Alquraini (2017). [28]
3	Self-motivation, self-direction and willingness to adopt learning directions	1-What is relationship between learning styles and the willingness to adopt self-directed learning among nursing students?	**RD:** Descriptive cross-sectional correlational design **DV:** 1-Preferred learning style 2-Willingness for self-directed learning **OD:** 1-Kolb's learning styles inventory 2- Fisher's self-directed learning readiness (SDLR) scale, and the Kolb's learning styles inventory	**Sample:** 230, male and female undergraduate nursing students. **Setting:** College of Nursing, King Saud University, KSA.	**1-Results:** Diverging- 43.9%, assimilating- 26.5%, accommodating-14.8% and converging 14.8% with an overall response rate of 84.7%. **2- Statistical methods:** (i) Frequency and percentage. (ii)-Inferential analysis.	There was no association between the learning styles and self-directed learning ability of educators and nursing students, respectively. **Limitations:** (i) Four-year college at one Saudi university. (ii) Subjective bias due to self-reporting questionnaires.	AbuAssi & Alkorashy (2016). [31]

(Table 3) contd.....

Sr. No.	Learning Preferences in Research Article	Major Question(s) in Research Article	Research Design (RD), Dependent Variables (DV) and Operational Definitions (OD)	Size (Nos) and Setting of Samples	Results and Statistical Analyses	Major Findings and Limitations	Ref.
4	Role of learning styles in stimulating the self-directed learning readiness in nursing students	1-What is the status of nursing students' readiness for self-directed learning? 2-What are the most common learning preferences among the nursing students in Saudi Arabia? 3-What is that relationship between self-directed learning and learning styles?	**RD:** Descriptive cross-sectional correlational design **DV:** 1-Preferred learning style 2-Willingness for self-directed learning **OD:** 1-Kolb's learning styles inventory 2- Fisher's self-directed learning readiness (SDLR) scale, and the Kolb's learning styles inventory	**Sample:** 275, male and female undergraduate nursing students. **Setting:** Nursing department of faculty of Applied Medical Sciences, Al-Jouf University, KSA.	**Results:** Converter- 35.6%, diverger- 25.8%, simulator-25.55%, and accommodator 3.1%, with an overall response rate of 89%. **2- Statistical methods:** (i) Frequency and percentage. (ii) Chi-square. (iii) Unpaired t-test (iv) ANOVA	(i) Self-management 51.3%, desire for learning 48.4% and self-control 59.9%. (ii) There was no association between the level of SDLR and the learning styles among nursing students at Al-Jouf University, KSA. (iii) About 77% of students have high level of SDLR. **Limitations:** (i) Majority of study participants were females (71%). (ii) Four-year college at one Saudi university, (iii) Subjective bias due to self-reporting questionnaires and suspected a ceiling effect as all items are positively scored. (iv) There are no previous studies in Saudi Arabia to compare with or to monitor changes	El-Gilany & Abusaad (2013). [32]
5	Visual, active, sequential and verbal styles with associated demographic variable such as gender, academic achievements including previously earned degrees, current employment status, and working hours/week.	1-What are the most common learning preferences? 2-What is the associations of certain demographic variables with the learning preferences?	**RD:** Descriptive cross-sectional **DV:** Preferred learning styles **OD:** Felder-Silverman learning style model (FSLSM) questionnaire.	**Nos**: 56, undergraduate nursing students. **Setting:** College of Nursing, King Saud University, KSA.	**1-Results:** Visual- 67.9% active- 50%, sequential- 37.5% and verbal- 3.6% with an overall response rate of 66%. **2- Statistical methods:** (i) Frequency and percentage (ii) The Pearson Chi-Square	(i) Employment status and working hours per week have significant association with learning preferences ($\square$ = .022, and $\square$ = .003, respectively). (ii) Gender, GPA and type of student (New/bridging) have no association with the learning preferences among the nursing students. **Limitations:** (i) Small and (ii) One university sample.	Alharbi *et al.* (2017) [33]

(Table 3) contd.....

Sr. No.	Learning Preferences in Research Article	Major Question(s) in Research Article	Research Design (RD), Dependent Variables (DV) and Operational Definitions (OD)	Size (Nos) and Setting of Samples	Results and Statistical Analyses	Major Findings and Limitations	Ref.
6	Relationship between learning style and readiness for self-directed learning	1-What is relation between self-directed learning and learning styles?	**RD:** Descriptive cross-sectional correlational design. **DV:** 1-Preferred learning style 2-Willingness for self-directed learning **OD:** 1-A modified version of the C.I.T.E instrument to asses learning styles. 2-Fisher's self-directed learning readiness (SDLR) scale, and the Kolb's learning styles inventory	**Sample:** 107, female (51.8%) and male (48.2). undergraduate nursing students. **Setting:** Nursing colleges at Najran University. KSA.	**1-Results:** Auditory-Visual-Kinesthetic- 87.3% and social individuals- 84.8% of the student nurses. **2- Statistical methods:** (i) Frequency and percentage (ii) Fisher exact test	79.2% of social individuals (84.8%) were found to have high readiness for self-directed learning. **Limitations:** (i) One nursing college (ii) Large sample size	Elgzar *et al.* (2019). [34]
7	Teachers' responsibility to fulfill the learning requirements of the students	1-What are the most common learning preferences among Medical students (including Nurses) using the VARK questionnaire?	**RD:** Descriptive cross-sectional correlational design. **DV:** 1-Preferred learning styles. 2-Readiness for self-directed learning. **OD:** 1-Preferred learning styles. visual, aural/auditory, read/write, and kinesthetic (VARK)	**Sample**: 100 students from the college of applied and medical science nursing student's majority were Female (70%). **Setting:** Majmaah University, KSA.	**1-Results:** 92% preferred single mode of learning style with visual (31%), auditory (36%) and kinesthetic (25%) styles. **2- Statistical methods:** (i) Frequency and percentage (ii) Chi-square	**Limitations:** (i) Majority of students were female (46%). (ii) 8% of them preferred two modes in which visual & auditory 2% visual & kinestheticstyle 6%. (iii) One nursing college in one Saudi university.	Shaji (2018) [35]

3.1. Kolb's Learning Styles Model

The literature review revealed only two studies followed Kolb's learning style. These studies examined the learning preference and readiness for self-directed learning styles among nursing students in nursing colleges at Saudi universities [31 - 32]. The researchers used two instruments: Kolb's Learning Styles Inventory and Fisher's Self-Directed Learning Readiness Scale (SDLR). A total of 230 nursing students from KSU, [31] Saudi Arabia and 275 undergraduate nursing students from Al-Jouf University, Saudi Arabia [32] were recruited to investigate students' preferred learning styles and the effectiveness and willingness of the self-directed learning approach on their academic achievement and output. The results showed most participants preferred the diverging learning-style approach and had little interest in the self-directed learning approach. Also, a statistically significant relationship did not exist between the learning styles used and the students' self-directed learning readiness. Therefore, the researchers suggested that it is better for nursing colleges in the

KSA to use many teaching methods for improving and managing nursing students' learning needs effectively [31]. In the other study, the majority of nursing students (77%) had high SDLR levels. The most frequently used learning styles were converger (35.6%), diverger (25.8%), assimilator (25.6%), and accommodator (13.1%). Notably, the average total score of the SDLR subscales, desire for learning, self-control, and self-management did not differ from the studied variables. Also, no relationship was found between learning styles and SDLR scale scores. The researchers indicated that nursing students who had high SDLR scores and preferred the converger learning style experienced positive effects from their undergraduate and continuing nursing education after graduation and employment [32].

3.2. The Felder-Silverman Learning Style Model

The literature review revealed that only one study employed the FSLSM to measure undergraduate nursing students' learning styles and preferences and their relationships

with their demographic data and academic achievements. The study was conducted at King Saud University (KSU) on a randomly selected sample of 56 nursing students [33]. The results indicated that the preferred nursing students' learning styles were visual (67.9%), active (50%), sequential (37.5%), and verbal (3.6%) teaching methods. Also, both students' gender and academic achievements (*i.e.*, GPA) were not significantly associated with their learning preferences. Based on the study's results, the researchers concluded that nursing educators must utilize visual learning to improve students' learning abilities and academic achievements [33].

3.3. The Visual, Aural, Read/Write, and Kinesthetic Learning Styles Inventory

The literature review revealed four studies that investigated nursing students' preferences regarding VARK learning styles. The first study investigated the relationship between learning style and self-directed learning (SDL) readiness among nursing students enrolled in the second semester at the nursing college of Najran University, KSA [34]. The authors adopted different learning styles, including visual numerical, auditory-numerical, visual language, auditory language, social individual, expressive oral, social group, expressiveness written, and auditory-visual-kinetic during data collection. The findings indicated that social individual (84.8%) and auditory-visual-kinetic learning styles (87.3%) had a higher prevalence, with a significantly higher SDL rate (79.2%). Also, self-management during SDL was lower than self-control. Thus, most of the nursing students at Najran University showed greater readiness for SDL, in particular, auditory-visual-kinetic and social individual styles [34].

The second study used a cross-sectional study design [28]. The authors used the VARK model and recruited 125 female nursing students to investigate their preferred learning styles. The results showed that kinesthetic learning styles (80.5%) played a key role in their learning style preferences. On the other hand, the aural (10.6%), reading/writing (4.9%), and visual (2.4%) learning styles were less often preferred. The findings offered a new understanding of the female nursing students' preferred learning styles by emphasizing physical involvement and active demonstration throughout the learning [28].

The third study was a correlational cross-sectional study design with 100 female nursing and other medical students from Majmaah University to determine learning preferences using the VARK questionnaire [35]. The results indicated that the distribution of learning preferences among the nursing students was auditory (36%), visual (31%), and kinesthetic (25%). None of the participants chose all three learning styles, indicating that students have a preferred learning method [35]. Similarly, the fourth study was conducted to identify learning styles and readiness for SDL among nursing students at Taibah University, KSA [2]. A total of 280 students were involved in the study, and three data collection instruments were used: the SDL scale for nursing education, a demographic survey, and the VARK questionnaire. The results suggested that most nursing students preferred the kinesthetic learning style (25.8%), followed by aural (19.7%), visual (6.65), and

read/write (8.5%) learning styles [2]. Within the VARK, the findings indicated a clear preference for the kinesthetic learning style, which is similar to the previous study's findings [28].

4. DISCUSSION

The most crucial element in all areas of education is the learning process [32, 34, 35]. The process of learning is one in which the student actively participates in acquiring information and building knowledge. One of the key elements in enhancing student learning and boosting their abilities, aptitudes, and competencies in nursing education is their learning style preferences [32, 34, 35]. The current literature review aimed to identify the learning styles of Saudi nursing students based on the premises of three learning style models: VARK Learning Styles, Kolb's model, and FSLSM learning style. To date, a few studies have highlighted advances in the patterns and trends developed in the modern nursing education system while considering the ground report on learning style preferences among nursing students studying in nursing institutes in Saudi Arabia. Available literature addresses several concerns, particularly the most preferred learning styles in Saudi Arabia. Currently, the VARK, Kolb's model, and FSLSM of learning style preferences exhibit how individuals differ in their learning preferences. The reviewed learning theories depict the significance of learning style preferences among undergraduate nursing students in Saudi Arabia.

The literature review revealed that the kinesthetic learning style is the most preferred learning style for Saudi nursing students according to the VARK model [2]. According to Stirling and Alquraini (2017), many students prefer kinesthetic learning styles compared to visual learning styles, verbal learning styles, and sequential techniques [28]. The present results were consistent with the conclusions of a survey conducted by Alkooheji and Al-Hattami (2018) in Bahrain [36]. The study in Bahrain demonstrated that the learners preferred multi-modular learning styles, such as visual and kinesthetic learning styles. According to Elgzar *et al*. (2019), in students who prefer the kinesthetic learning style, learning takes place when students are physically active as opposed to listening to lectures or watching demonstrations [34]. Therefore, nursing students with kinesthetic learning styles prefer to have hands-on practice while they are learning. This is suitable for nursing students in training and simulation labs or clinical settings [34].

The reviewed literature showed a clear impact of SDL, concrete experience, and abstract conceptualization on students' learning styles. Studies on Kolb's learning styles [32, 33] depict a similarity in accommodating and converging learning preferences by a majority of Saudi nursing students. As expounded in Kolb's matrix, the two styles are categorized under active experimentations. El-Gilany and Fel (2013) showed a significant trend in students' preference for converter learning styles, for example, abstract conceptualization and abstract thinking [32]. In particular, most of the learners preferred accommodating and converging styles to diverging learning and preferred SDL when dealing with feeling, thinking, and doing tasks rather than watching simultaneously

[32]. Due to the nature of the nursing profession, which requires nurses to be active in clinical settings, accommodating and converging learning preferences are suitable for most nursing students [32]. Students preferring a converging learning style prefer using technology while studying [21, 22]. Therefore, it is recommended to incorporate teaching technology into students learning experiences. This could include increasing the utilization of nursing simulations and virtual learning in nursing curricula. On the other hand, studies in Saudi Arabia revealed otherwise. AbuAssi and Alkorashy (2016) showed that the diverging style was the most frequently used throughout the sampled population, followed by the accommodating and converging styles [31]. Students who prefer diverging styles usually prefer to observe and watch while they are studying instead of actively practicing [32]. Students with diverging styles prefer to think and brainstorm information prior to generating ideas or information [21, 22]. Nursing students can exhibit this learning style during the early education levels, where students need to learn while watching clinical instructors perform certain nursing tasks. Nursing students prefer visual learning styles followed by active learning styles, as identified by Alharbi *et al.* (2017) [33]. To help nursing students learn better, nursing educators should stress the importance of building curricula that focus on visual and active learning styles to improve students' learning process [33].

Notably, the studies reviewed have significant asymmetries among them. In particular, the findings on VARK-based research conducted by Stirling and Alquraini (2017) [28] and Aljohani and Fadila (2018) [2] offer contradictory remarks. All reviewed studies concluded that kinesthetic learning was found to be the most dominant learning style among sampled populations. Kinesthetic learners learn best through physical activities instead of listening or watching. Besides, visual learners were characterized by excellently evaluating, authenticating, and synthesizing information with the help of meaningful signs in graphical presentations. Even though optical efficiencies in learning describe them, the category may not have effectiveness in comprehending videotapes. Most nursing students preferred learning styles examined using VARK preferred kinesthetic learning style, which focuses on students being physically active during the learning process. Similarly, most nursing students preferred learning styles examined using Kolb's model and reported they prefer accommodating and converging learning styles that require them to have hands-on practice while learning. Finally, most nursing students using FSLSM prefer visual and active learning styles that require them to be physically active and have hands-on practice while learning [33].

Thus, it can be argued that the findings of this literature review study are significantly provocative to elevate the standard of education systems in nursing learning institutions in Saudi Arabia. The visual mode of learning was accepted unanimously as the most preferred style among all sampled students. However, the kinesthetic style engages the student who prefers hands-on experience or participatory knowledge; these students learn better by taking physical roles in the learning process.

RECOMMENDATIONS

Since the start of nursing education in Saudi Arabia in the middle of the 20th century, the educational system has been teacher-centered [3, 12]. Gradually, learning approaches have started to shift from teacher-centered to student-centered styles (*e.g.*, SDL). Nursing students need to be actively involved during their learning process. Therefore, the nursing education system needs to adapt and develop suitable strategies to improve nursing students learning experience. Notably, Saudi Vision (2030) focuses on improving nursing education by encouraging the education system to incorporate advanced, feasible, comprehensive, and easily adaptable state-of-the-science-based technologies and education modalities [1, 12]. Nursing programs need to focus on curricula that fit students' needs. Students prefer kinesthetic, accommodating, converging, visual, and active learning styles, which indicates that nurse educators need to increase students' involvement in clinical practice before graduation. Also, nurse educators must design courses that fit nursing students' practical needs.

The findings suggest it is important to encourage nurse educators to use multiple teaching methods and a variety of ways to present information. This may require nurse educators and trainers to move away from their preferred teaching styles and utilize several learning methods, which will positively impact the students' learning [37, 38]. Nurse educators must organize internal workshops and training programs to encourage nursing students to understand and adapt their preferred learning styles to fit their needs. Simultaneously, the upgradation of senior educators by establishing their engagement with technology-based education tools must be recommended.

LIMITATIONS

The current literature review had several limitations. First, there are limited studies that combined the three models and compared students' learning styles. This could be difficult due to the use of three different models that measure students learning styles. Second, a few numbers of studies focused on students in master's and doctoral degree programs in nursing. Most of the studies were on undergraduate nursing students, likely due to a low number of students enrolled in master's and doctoral programs. Thus, it is important for future studies to include graduate nursing students to identify and understand their unique learning styles and learning preferences.

CONCLUSION

The nursing education system in Saudi Arabia is steadily evolving, necessitating flexibility while maintaining maximum quality standards in the learning approaches. Understanding the students' preferred learning styles can be envisioned as the key to enhancing nursing comprehension in Saudi Arabia. The reviewed literature offers significant insights worth emulating to maximize learners' strengths. Given that students prefer various learning styles, nurse educators must address and accommodate this variety to improve and adjust suitable learning methods for motivating and enhancing students' academic performances and outcomes. The findings depict a higher percentage of learners preferring kinesthetic,

accommodating, converging, visual, and active learning styles. These learning styles emphasize the importance of practical experience and students' hands-on practice as the best style that improves nursing students learning experience. The education policies should include a parallel nursing quality assurance program to optimize the interface between teaching and learning patterns in nursing and healthcare institutions across the country.

LIST OF ABBREVIATIONS

VARK = Visual, Aural, Read/Write, and Kinesthetic

FSLSM = Felder-Silverman learning style model

SDL = self-directed learning

CONSENT FOR PUBLICATION

Not applicable.

FUNDING

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

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