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VARK Model: A Learning Preferences Among BSEd Science Students

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Abstract—This study aimed to examine the learning preferences of BSEd Science students using the VARK Model, which includes four learning modalities: Visual, Aural, Read/Write, and Kinesthetic. Specifically, it focused on identifying the most preferred learning modality among students from different year levels and determining the distribution of unimodal and multimodal learners. The study used a quantitative descriptive research design, with data gathered through the adapted VARK Questionnaire Version 8.01. The results revealed that kinesthetic learning was the most preferred modality among BSEd Science students, showing their preference for activities that involve hands-on experiences, practical exercises, and real-life applications. Furthermore, most students from first year to fourth year were found to be unimodal learners, meaning they tend to prefer one dominant learning modality over a combination of different modalities. Based on these findings, the study concludes that BSEd Science students prefer learning through practical and interactive experiences. Therefore, science teachers may improve the learning process by using teaching strategies that include hands-on activities, demonstrations, and other practical learning experiences.

***Index Terms*—VARK Model, learning preferences, BSEd Science students, kinesthetic learning, aural learning, unimodal learning, multimodal learning, science education, teaching strategies.**

1. Introduction

A. Background of the Study

Understanding how students acquire and process information involves recognizing their diverse learning styles, including visual, auditory, read/write, and kinesthetic. Visual learners benefit from diagrams, charts, and illustrations, which help them comprehend and retain complex concepts, while auditory learners learn more effectively through listening and discussions. Read/write learners, on the other hand, prefer engaging with textual materials such as notes, essays, and written explanations to process information efficiently. Kinesthetic learners grasp concepts best through hands-on activities, experiments, and physical engagement with learning materials (Mane et al., 2015).

Physical activities and hands-on learning opportunities are ideal for kinesthetic learners, as they enhance their comprehension and application of information (Putri & Suryati, 2020). With these varied preferences among learners, it's clear that mixing up teaching strategies is key to meeting these different learning styles, ultimately boosting academic success and creating more inclusive classrooms (Putri & Elizar, 2025).

Multiple modalities can significantly enhance students' learning experiences, according to a recent study, even though traditional educational paradigms often emphasize distinct learning styles, such as visual, aural, and kinesthetic (Abdel et al., 2024). For instance, El-Saftawy et al. (2024) shared findings from a study on applying VARK learning styles to improve skills in parasitology labs, showing that sticking to just one style. This really shows that well-rounded approach that balances various learning styles can significantly improve how engaged students are with the materials.

Hands-on tasks and experiential learning yield the best educational results for kinesthetic learners. Engaging with, manipulating, or experimenting with the learning content enables this set of learners to interact directly with it and grow. They need teaching strategies that involve active participation, like role-playing, practical workshops, and lab exercises (Yusnanyto & Rahayu, 2022).

Understanding student's learning styles is essential for improving the efficacy of instruction, as it enables teachers to adjust their teaching strategies to match the diverse learning needs of their students (El-Saftaway et al., 2024). Teachers can implement a variety of tactics that complement the students' natural information processing styles by incorporating their understanding of learning preferences, which guarantees a more dynamic and productive learning environment (El-Saftaway et al., 2024). Using the VARK model in teaching has shown the perks of employing a broad range of resources, including interactive discussions for auditory learners and visual aids for those who learn better with imagery.

For instance, Jean Piaget's Constructivist Learning Theory makes a significant contribution to understanding diverse learning styles within educational settings. Piaget argued that learners actively construct their own understanding and knowledge of the world through firsthand experiences or by reflecting on those experiences (Piaget, 1972). This theory emphasizes the importance of developmental stages and the value of active, hands-on learning in boosting cognitive growth. It somewhat aligns with the VARK model since it recognizes that students learn in many ways and highlights kinesthetic learning through active exploration and physical interaction

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with the material (Saarsar, 2018).

Fleming and Mills (1992) introduced the VARK model, categorizing group of learners into four main learning styles. Visual learners who grasp information through seeing visual aids like diagrams, charts and videos. Aural learners thrives through from listening to the instructors lectures and discussions. Then we have Read/Write learners, who prefer through reading text and taking down notes. Lastly, Kinesthetic learners who learn best by doing things like experiments, hands-on activities and practical activities. It shown that learners don't just fit into one learning style, they often blend in different approaches whether they preferring a "multimodal" approach rather than sticking to a single way of learning or "unimodal".

Several studies have highlighted the importance of educators being aware of their students learning styles. According to Alabi (2024) suggest that when teachers adapts their teaching methods to fit differently learning styles, it can boost students motivations for learning, engagement and academic outcomes. Although it may not be realistic to fully personalize learning for every student, recognizing the mail learning staples in a group can help teachers to create more inclusive and effective teaching strategies. This research emphasized the value of exploring learning styles preferences in the BSED Science programs to enhance the preparations of future science educators.

Learning styles plays an important role in educational settings, helping to create a more student-centered strategy that connects the gap between educators and learners. According to Abidin (2024) focusing on individual preferences can really enhance participation and stability in the classroom. When students understand their own learning styles, they can take charge of their educational experience. One effective way to do this is through project-based learning. This method encourages students to engage deeply through projects that reflect their individual learning preferences, making the learning process more engaging and relevant to them (Almulla, 2020).

By helping students understand their own learning styles can significantly improve their studies and retain information. When learners are aware of how they absorb information, they become more self-aware and empower them to learn more effectively. According to Emma, (2024) when students recognize their learning preferences, they are more likely to learn independently. This autonomy not only enhances their learning experiences but also sets the foundation for cultivating self-directed learning skills, which is essential to promote self-awareness, which achieving their long-term academic and career goals.

The International Journal of Evaluation and Research in Education utilizes the VARK model to illustrate how it enables teachers to tailor their teaching strategies to meet the diverse needs of students, thereby enhancing learning outcomes through personalised instruction (Kamal et al., 2021). The importance of knowing and matching the teaching strategies to recognize the diverse students' learning styles is essential because, according to the study, using the VARK model makes it easier to identify the students' learning styles, which is necessary to incorporate into teaching strategies and course design (Noor & Ramly, 2023).

The study results clearly stated that with the support of adaptability and inclusive environment in teaching has a greater academic success due to majority of student's response preferred kinesthetics and visuals styles among the VARK learning modalities. Resulting on high achieving students are most likely to utilized multimodal tactics, whereas lower achieving students tended towards unimodal tyles, indicating a strong correlation between academic achievement and learning preferences.

Although many studies have explored VARK learning styles in different fields, none have focused on BSEd Science students. This is a significant gap, especially because science majors engage in hands-on and visually rich learning tasks that may shape how they learn to teach. To address this, the present study aims to identify the VARK learning preferences of BSEd Science students and determine how VARK-aligned strategies might support their development as future science teachers.

It is shown in the study that employing the VARK model in Construction Technology education context that teaching strategies should be adjusted and align based on the students' preferred learning styles (Noor & Ramly, 2023). By understanding and recognizing the most commonly used learning styles, educators can better understand and close the gap, promote high student engagement and success, and by developing flexible and inclusive learning environments that meet to various student learning styles.

The study results clearly stated that with the support of adaptability and inclusive environment in teaching has a greater academic success due to majority of student's response preferred kinesthetics and visuals styles among the VARK learning modalities. Resulting on high achieving students are most likely to utilized multimodal tactics, whereas lower achieving students tended towards unimodal tyles, indicating a strong correlation between academic achievement and learning preferences.

The study by Saleem, et al. (2021) concluded that science teaching pedagogies, such as constructivism and pragmatism, are the most effective approaches for future science educators in creating their learning environments. The researchers recommend these pedagogies for science teachers to serve as a reference in creating effective and appropriate learning activities that wisely utilize and effectively transfer knowledge and information to their students.

Another study conducted to evaluate the preferred learning styles among the BSEd English students using the VARK model (Visual, Aural, Read/Write, Kinesthetic). The researchers finding shows that most of the BSEd English students learn moore effectively on multimodal learning styles which is aural and kinesthetic learning style. The results shows that activities such as lectures, discussions, hands on activities, projects, and role playing where the students learn and understand effectively. Teachers and educators need to adjust and align their teaching strategies to the preferred learning styles of their students, so that they can learn and understand the lesson and discussion better and effectively as suggested by

the researchers. Activities such as group discussion, multimedia presentation, and interactive activities are those effective activities when it comes to effectively absorbing new knowledge and learning among the BSEd English students (Bualat et al., 2023).

The researchers' findings can also be so helpful and applicable to BSEd Science students even though their study primarily focused on BSEd English students. The BSEd science course mainly involves visual materials, experiments, projects, and verbal explanations. Individuals who significantly benefit from understanding the diverse learning styles and preferences of their students are the future educators, specifically those who teach science majors. Future science educators can utilize their students learning style preferences to create an engaging, more dynamic, and accessible learning environment for the most of the students. For instance, science instructions like hands on experiment can be more successful, and can be utilized for those students who preferred kinesthetic learning style, audio for explanations are used for students who preferred aural type of learning.

By acknowledging on how the students try to adopt the diverse types of learning styles based on their surrounding environment, personal and learning needs is essential due to teachers can be able to create their instructional strategies to align to each student's preferred learning styles, resulting in highly enhanced learning students understanding and retention. Through the variety of students learning preferences can ultimately enhance the educational results of the students. Those variety of learning preferences encompass visual, auditory, read/write, and kinesthetic, by addressing these diverse styles can help the students to reach their maximum potential by creating an inclusive and more effective learning environment.

To reduce bias and provide precise insights, this study's dependability and credibility was improved by quantitative approach into how customizing teaching strategies can improve the student achievement.

B. Framework of the Study

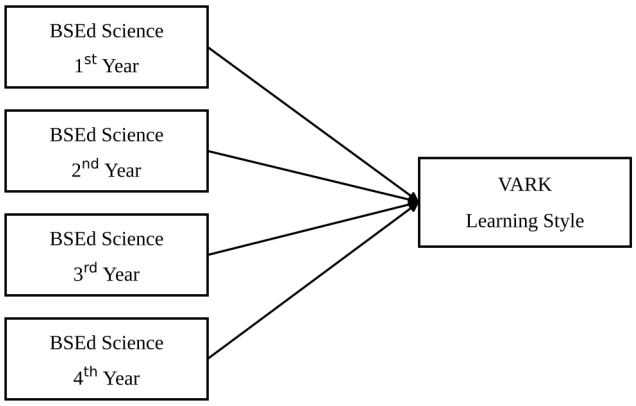


Fig. 1. The conceptual model of the study.

The Constructivist Learning Theory is a learning philosophy developed by Jean Piaget, a Swiss developmental psychologist. According to Piaget (1970), constructivism posits that learners actively construct their own comprehension and knowledge about the world, through experiences and reflection on those same experiences.

According to Piaget (1970), constructivism stresses that learning is not a passive process. Interaction, experience, and internalization are key ways to build learning. Active participants use prior knowledge to make sense of new information. Learning occurs as students assimilate information into their existing cognition or adjust their thinking to accommodate new experiences.

Fleming (1987) proposed the VARK Model, which encompasses Visual, Aural, Read/Write, and Kinesthetic learning modalities, identifying preferred learning styles. Learners understand information in diverse and varied ways, and they also possess diverse backgrounds and experiences. This model aligns with the principles of constructivism.

In the constructivist perspective, learning should be tailored to match the specific needs of each learner. The VARK model reinforces this by promoting teaching methods that align with each learner's favored style. This adaptability fosters meaningful learning, which is a fundamental principle of constructivism.

On the other hand, students prefer to absorb all information through written words. These students prefer to read and write to gain and retain knowledge, whereas kinesthetic learners prefer hands-on experiences and physical activity to learn and understand concepts (Cabual, 2021). These students benefit from interactive and exciting learning activities such as labs, fieldwork, and other movement-based activities.

This study emphasized the importance of recognizing each learner's individuality and uniqueness, and adapting teaching strategies accordingly, thereby firmly establishing its foundation in constructivist learning theory. It supports the claim that learning is more effective when teaching strategies align with how students naturally acquire knowledge. Therefore, better academic achievement, increased engagement, improved retention, and more effective instructional design can result from understanding the VARK preferences of BSED Science students.

This study's framework was supported in Neil Fleming's VARK Model, the most acknowledged approach to determining and tailoring to learners' preferred learning styles for acquiring and processing information on a specific topic.

This model is divided into four types: Visual, Aural, Read/Write, and Kinesthetic, which are classified as the primary learning modalities. Students who learn best through diagrams, charts, graphs, and other visual presentations are Visual learners. For Aural learners, who can absorb and benefit from listening to audio or spoken explanations, discussions, and other verbal instructions. As for the Read/Write learners, they preferred materials in written form, such as textbooks, online articles, and handouts. In contrast, Kinesthetic learners best absorb information through hands-on experiences, including experiments, laboratories, projects, and physical engagement learning activities. By identifying learners' preferred learning modalities, the VARK Model provides teachers with essential insights into using instructional methods that suit students' diverse learning styles (Fleming & Baume, 2006).

C. Statement of the Problem

This study examined the VARK learning style preferences of BSEd Science students to better understand how they prefer to learn and process information. Identifying these preferences can help improve teaching strategies and support student learning. Specifically, the study seeks to answer the following questions:

1. What are the predominant VARK learning style preferences among BSEd Science students:
   1.1 first year
   1.2 second year
   1.3 third year
   1.4 fourth year?
2. What is the distribution of unimodal versus multimodal learning style preferences among BSEd Science students:
   2.1 first year
   2.2 second year
   2.3 third year
   2.4 fourth year?

D. Significance of the Study

Knowing the students' preferred learning style can have a significant impact to the students' academic performance since in the science curriculum mostly uses abstract concepts where it usually requires both theoretical and practical applications, resulting to more deeper comprehension and effective teaching strategies. There is also a high possibility that this study can provide gathered information that can potentially improve the students' motivation, engagement, and academic success in science subjects. The school institutions and curriculum planners may benefit and use the result of this study to further improve the inclusive learning environment the not only focused on enhancing the students academic performance but also promotes the professional development among the BSEd science students as future science teachers and educators. Teachers and educators can ensure the environment is not solely focused on formal settings but also to accessible and inclusive learning environments that is relevant to the variety of learning styles that exist.

E. Definition of Terms

Throughout this study, the researchers used the following terminology. Participants should be able to comprehend the definitions below:

Academic Performance in Science. It refers to self-reported academic performance refers to the academic performance of BSED science students as reported by themselves in science-related courses. It is not operationally defined through a specific metric (e.g., GPA, specific exam scores).

Aural. It is a learning preference that refers to the information acquired by students through auditory channels, such as lectures, group discussions, verbal explanations, and audio recordings. Learners often process and consume knowledge by articulating the lessons or ideas aloud (VARK Learn Limited, 2025).

BSED Science Students. It refers to the target group for assessing VARK learning style preferences is the Bachelor of Secondary Education students majoring in science.

Constructivist Learning Theory. It refers to a learning philosophy that emphasizes learners actively constructing their knowledge through experience and reflection. Thus, in this study, constructivism provides the theoretical framework that underpins the investigation of the diverse learning preferences of students, which impact learning outcomes (ELM Learning, 2024).

Kinesthetic. It refers to those students learn through direct physical activity with content, including role playing, fieldwork, simulations and laboratory experiments. These activities are under this modality, it supports students learning through experiential interaction (Perkins & Salgado, 2025).

Multimodal Learner. It refers to those students who utilize two or more VARK learning modalities to learn in a diverse context, it enhances inclusive instructional practices and adaptability (Gangadharan et al., 2025).

Read/Write. It refers to this kind of learning modality characterizes those students learn more in textual materials to consume knowledge, the learners who uses this preference engage more with written documents, note taking activities, manuals, and list effectively, mostly used by the learners to consume knowledge through rewriting (Fahim et al., 2021).

Unimodal Learners. It refers to a single learning style that students who primarily rely on learning. The unimodal used in this study represents those students who score significantly in one learning modality only (Fleming & Baume, 2006).

Visual. It refers to a learning style where the students learn through visual representation of different information that includes diagrams, symbolic structures, and flow charts. This mode facilitates comprehension through enabling the students to understand spatial and relational patterns (Alabi, 2024).

2. Research Method

In this section, the researcher presented the research method of this study. Under the research method are the research design, research environment, research participants, sampling technique, research instrument, data gathering, statistical treatment, and ethical considerations. These components ensure that the methodology is systematic and aligned with the study, thereby increasing the validity and reliability of the results.

A. Research Design

The research utilized a descriptive quantitative design. According to Creswell (2009), descriptive research aims to describe the characteristics of a population, situation, or phenomenon in an orderly manner. It is not concerned with making cause-and-effect connections, but instead focuses moderately on providing an accurate report of what exists.

A limitation of the descriptive design is the inability to control for variables, which means that the research findings cannot be used to establish causality (Cohen et al, 2019). The suitability and practicality to those studies who involve a large amount of respondents, because it allows the researchers to collect large amounts of data on preferences, behavior, and attitudes more effectively which is one of its strengths.

The study aimed to identify the diverse and preferred learning styles of science major students in the college

department and illustrate it by utilizing the VARK model. The researchers was moderately observed and report the gathered data and does not attempt to maneuver and control the variables.

The descriptive research design was be used in this study systematically to gather information and data about the diverse and preferred learning styles of science major students without changing the results of the data. By administering the VARK questionnaire, the researchers will gather data on whether the science major students prefer visual, aural, read/write, and kinesthetic modes of learning. The design is suitable because it allowed the researchers to describe and interpret the existing data patterns of preferred learning styles among the respondents. This way, the study provided a clear understanding of the students' dominant and combined learning styles, which can later be used as a basis for creating teaching strategies tailored to their needs.

B. Research Environment

The study was conducted in two higher education institutions within Zamboanga Del Sur, which were selected for this study because both institutions offer the Bachelor of Secondary Education major in Science (BSEd Science), making them the most suitable settings for examining the VARK learning preferences of future science teachers. Unlike other schools in the area that offer mainly Bachelor of Science (BS) programs focused on scientific content rather than teacher preparation, these two colleges provide specialized training that combines science subjects with pedagogy. This makes the phenomenon more relevant and observable, as BSEd Science students regularly engage in lectures, laboratory activities and teaching-related tasks where visual, aural, read/write and kinesthetic learning preferences naturally emerge. Choosing these institutions, allows for a more accurate understanding of the learning styles of pre-service science educators and how these preferences can guide more effective instructional strategies.

C. The Research Participants

The participants in the study were college students enrolled in the Bachelor of Secondary Education program who major in science. The head and faculty teachers in the college of education was also be included to help determine the supporting data on teaching for the researchers.

D. Sampling Technique

The study employed the automatic inclusion method, which means that only individuals who meet the specified criteria are included as respondents. A type of a non-probability sampling technique which the participants are selected based on specific requirements that meet and related to the study. All the students of Bachelor of Secondary Education (BSEd) majoring in science were automatically included in the study since the study aimed to identify their preferred learning styles. This kind of technique was suitable since it ensured that only the respondents or students are the only one who can provide valuable information that is relevant part of the study. As it directly chose the group that suited the research's purpose, it made the collection of data and information easier and more focused.

E. Data Gathering Techniques

To ensure the ethical conduct of this study, the researchers formally sought permission to survey the school from the Vice President for Academic Affairs (VPAA), primarily because the study involved activities outside the main campus. Once approval is granted, further authorization will be requested from the Dean of the College of Teacher Education, Arts, and Sciences (CTEAS). Then, the researchers requested formal permission to conduct the study from the Dean of the College of Education at J.H. Cerilles State College. Upon approval, coordination is made with the respective instructors and advisers of the Bachelor of Secondary Education (BSEd) Science students to facilitate the data collection process.

The instruments for gathering the data in this study was the VARK questionnaire 8.01, it's a primary and standardized instrument designed to evaluate the students' preferred learning styles across the modalities, including Visual, Aural, Read/Write, and Kinesthetic. The survey questionnaires were printed and distributed to the target respondents during a scheduled session, either in person, depending on the availability and accessibility of the students.

Before answering the questionnaire, respondents are informed about the study's real purpose and assured that their data are kept confidential. Also, they are being presented with informed consent from each participant. They are given ample time to complete the questionnaire without pressure. After the responses are collected, the data are compiled, organized, and encoded in a spreadsheet for analysis.

F. Statistical Treatment of Data

To identify whether students have single-modal or multi-modal VARK preferences, the researchers looked at how closely each student scores in the four learning style categories including Visual, Aural, Read/Write, and Kinesthetic. If a student shows a clear preference for just one category, they are considered single-modal. But if their scores are strong in two or more categories, they fall under multi-modal, meaning they learn best using a combination of different styles.

In this study, the responses of BSEd Science students were analyzed using descriptive statistics. Since the data included categorical information such as the students' preferred learning styles based on the VARK model, these statistical methods

Table 1
Number of participants by school and year level

Participating schools	Numbers of participants			
	1st year	2nd year	3rd year	4th year
School 1	24	36	36	39
School 2	6	10	6	5
Total	30	46	42	44

helped the researchers interpret the results more clearly and systematically. To determine the predominant VARK learning style preferences among BSEd Science students according to year level (first year, second year, third year, and fourth year), the researchers used mode and percentage distributions. These statistical tools showed the number of students who prefer each learning style (Visual, Auditory, Read/Write, and Kinesthetic) and the proportion they represent within each year level.

Furthermore, to determine the distribution of unimodal and multimodal learning style preferences among BSEd Science students across the different year levels, the responses were categorized into unimodal preferences (single learning style) and multimodal preferences (combination of two or more learning styles). Mode and percentage distributions were also used to present how many students fall under each category and the proportion they represent in every year level (Kharb et al., 2013). These statistical measures helped the researchers identify patterns in learning style preferences among BSEd Science students.

G. Research Instrument

The VARK Questionnaire 8.01 served as the primary instrument in this study. This tool is specifically designed to assess students' preferred learning styles, categorizing them as either unimodal or multimodal learners. The questionnaire consisted of multiple items in which participants could select more than one response per question, allowing for a more accurate understanding of their learning preferences. The researchers adapted this instrument to fit the specific context of the study while ensuring proper acknowledgment is given to the original author. Additionally, the official scoring guidelines of the VARK questionnaire were followed to accurately identify each student's dominant or combined learning styles, ensuring the results are valid and reliable for the research purpose.

Inside of the classroom where it takes place, the BSEd Science students from first year to fourth year answered or utilized the VARK Questionnaire to ensure consistency and well instructions are provided by the researchers. The questionnaire remained in English, but for further clarification, it may be provided in Filipino or Cebuano to guarantee a clear understanding of each item.

H. Ethical Considerations

In conducting this study, the researchers ensured compliance with ethical standards that protect the rights, privacy and overall well-being of all participants.

Confidentiality. The researchers strictly followed the provisions of the Data Privacy Act of 2012 or the Republic Act No. 10173 that all the gathered and collected data from the participants are treated with high confidentiality. The

Table 2
The predominant VARK learning style preferences among bsed science first year students

Student	Visual	Aural	Read/Write	Kinesthetic	Predominant learning style
1	3	6	6	14	Kinesthetic
2	6	8	13	11	Read/Write
3	10	11	7	11	Aural, Kinesthetic
4	5	9	4	9	Aural, Kinesthetic
5	6	11	9	13	Kinesthetic
6	11	8	8	3	Aural
7	6	10	11	12	Kinesthetic
8	10	10	8	12	Kinesthetic
9	10	8	11	14	Kinesthetic
10	6	8	3	13	Kinesthetic
11	3	8	8	6	Aural, Read/Write
12	5	10	12	14	Kinesthetic
13	3	10	4	12	Kinesthetic
14	7	7	5	11	Kinesthetic
15	7	13	7	14	Kinesthetic
16	7	16	11	11	Aural
17	12	12	5	9	Visual, Aural
18	6	9	10	7	Read/Write
19	2	12	5	11	Aural
20	4	5	10	9	Read/Write
21	4	7	6	11	Kinesthetic
22	6	10	8	12	Kinesthetic
23	14	10	15	11	Read/Write
24	4	4	3	8	Kinesthetic
25	8	12	4	13	Kinesthetic
26	3	7	3	3	Aural
27	9	7	5	5	Visual
28	6	6	3	1	Visual, Aural
29	8	6	6	9	Kinesthetic
30	10	4	7	7	Visual
Total	**201**	**264**	**217**	**296**	**Kinesthetic**

researchers guarantee the safety of the participants personal data or identifying information, it would not be shared to any third party or unauthorized individuals. The names and other identifying information about the participants are removed during the data collections and transmission process (Alvarez, 2023).

Voluntary Participation. All the participation of the students in the study are entirely voluntary. Before participating, each participant was fully informed by the researcher about their rights to withdraw and decline from the research at any time, should the participant choose to do so based from personal reasons (Alvarez, 2023).

Informed Consent. All the students who participated in answering questions were given a clear explanation about the study's purpose, their role in the research, and the procedures in answering the questions. Before the respondents answered the questions, they were allowed to ask questions to the researchers, and they were only allowed and included if they fully understood the details, based on the signed consent form, which states their participation is a voluntary agreement. Both

Table 3
The predominant VARK learning style preferences among BSEd science second year students

Student	Visual	Aural	Read/Write	Kinesthetic	Predominant learning style
1	8	5	5	8	Visual, Kinesthetic
2	2	9	1	8	Aural
3	2	5	4	4	Aural
4	5	11	9	13	Kinesthetic
5	1	12	8	12	Aural, Kinesthetic
6	4	10	4	10	Aural, Kinesthetic
7	9	7	3	11	Kinesthetic
8	8	9	6	8	Aural
9	4	4	6	10	Kinesthetic
10	8	7	6	6	Visual
11	5	9	7	10	Kinesthetic
12	3	5	6	8	Kinesthetic
13	1	10	14	15	Kinesthetic
14	6	6	6	7	Kinesthetic
15	6	8	5	12	Kinesthetic
16	7	9	9	10	Aural
17	11	11	9	10	Visual, Aural
18	2	13	9	4	Aural
19	8	13	10	9	Aural
20	10	5	8	4	Visual
21	4	6	3	3	Aural
22	5	12	8	8	Aural
23	3	8	2	3	Aural
24	5	3	3	10	Aural
25	9	6	3	11	Aural
26	4	11	6	10	Aural
27	10	10	9	8	Visual, Aural
28	7	15	4	12	Aural
29	7	7	6	6	Aural, Read/Write
30	7	8	9	11	Visual
31	4	8	8	7	Aural, Read/Write
32	5	14	8	14	Aural, Kinesthetic
33	12	6	9	7	Visual
34	8	15	11	15	Aural, Kinesthetic
35	9	10	10	14	Kinesthetic
36	6	5	4	10	Kinesthetic
37	3	6	7	7	Read/Write, Kinesthetic
38	12	10	3	13	Kinesthetic
39	4	9	6	13	Kinesthetic
40	4	10	5	11	Kinesthetic
41	3	9	9	12	Kinesthetic
42	5	5	5	7	Kinesthetic
43	1	5	4	7	Kinesthetic
44	7	10	8	11	Kinesthetic
45	4	6	7	3	Read/Write
46	6	10	7	5	Aural
Total	**264**	**392**	**299**	**417**	**Kinesthetic**

the expert and the students' validators all agreed to take part in the research after clearly understanding the study's purpose and their responsibilities (Alvarez, 2023).

3. Result and Discussion

This section provided the results and discussion on the variables in the study titled, "VARK model: A Learning Preferences Among BSED Science Students." More specifically, it analyzes students' learning preferences, which are classified into Visual, Aural, Read/Write, and Kinesthetic (VARK), and how these preferences impact their performance in BSED Science subjects. The analyses consider distribution of students in the four learning modalities, the overall levels of learning preferences, and the relationship between preferred learning style and academic performance.

The first step in designing suitable instructional strategies is to recognize students' learning preferences, which ultimately contributes to their success. According to the VARK Model, there are four categories of learning preferences, which are Visual, Aural, Read/Write, and Kinesthetic. Each category corresponds to a different sensory mechanism for taking in and processing information.

The Predominant VARK learning style preference for BSEd Science First-Fourth Year students.

When establishing the primary VARK learning style preference for BSEd Science students, it helps teachers understand how to modify their teaching style. This study looks at various learning styles for different year levels. VARK

Table 4
The predominant VARK learning style preferences among BSEd science third year students

Student	Visual	Aural	Read/Write	Kinesthetic	Predominant learning style
1	4	2	3	8	Kinesthetic
2	3	5	5	6	Aural, Read/Write
3	4	6	7	10	Aural
4	5	9	2	8	Aural
5	4	16	2	13	Aural
6	5	6	7	9	Kinesthetic
7	5	10	5	10	Aural, Kinesthetic
8	10	10	6	12	Visual, Aural
9	6	2	1	7	Kinesthetic
10	4	4	2	7	Kinesthetic
11	10	6	10	6	Visual, Read/Write
12	7	9	3	10	Kinesthetic
13	4	6	2	4	Aural
14	4	3	2	7	Kinesthetic
15	3	6	5	7	Kinesthetic
16	2	13	2	14	Kinesthetic
17	2	6	5	8	Kinesthetic
18	2	5	1	8	Kinesthetic
19	6	9	8	10	Kinesthetic
20	3	6	7	8	Read/Write
21	2	5	2	6	Kinesthetic
22	1	4	6	5	Read/Write
23	3	1	5	6	Kinesthetic
24	7	8	1	7	Aural
25	5	4	5	3	Aural, Read/Write
26	6	7	6	5	Visual, Read/Write
27	8	4	8	3	Visual, Read/Write
28	2	9	7	7	Aural
29	6	3	4	3	Visual
30	7	6	8	5	Read/Write
31	8	6	6	6	Visual
32	9	5	6	7	Visual
33	5	13	9	2	Aural
34	3	5	4	4	Aural
35	9	10	8	9	Aural
36	10	11	8	10	Aural
37	10	7	4	5	Visual
38	2	4	4	6	Kinesthetic
39	2	4	4	6	Kinesthetic
40	2	5	5	4	Aural, Read/Write
41	5	4	6	5	Read/Write
42	6	2	3	4	Visual
Total	**211**	**266**	**204**	**290**	**Kinesthetic**

Table 5
The predominant VARK learning style preferences among BSEd science fourth year students

Student	Visual	Aural	Read/Write	Kinesthetic	Predominant learning style
1	8	5	5	8	Visual, Kinesthetic
2	2	9	1	8	Aural
3	2	5	4	4	Aural
4	5	11	9	13	Kinesthetic
5	1	12	8	12	Aural, Kinesthetic
6	4	10	4	10	Aural, Kinesthetic
7	9	7	3	11	Kinesthetic
8	8	9	6	8	Aural
9	4	4	6	10	Kinesthetic
10	8	7	6	6	Visual
11	5	9	7	10	Kinesthetic
12	3	5	6	8	Kinesthetic
13	1	10	14	15	Kinesthetic
14	6	6	6	7	Kinesthetic
15	6	8	5	12	Kinesthetic
16	7	9	9	10	Aural
17	11	11	9	10	Visual, Aural
18	2	13	9	4	Aural
19	8	13	10	9	Aural
20	10	5	8	4	Visual
21	4	6	3	3	Aural
22	5	12	8	8	Aural
23	3	8	2	3	Aural
24	5	3	3	10	Kinesthetic
25	9	6	3	11	Kinesthetic
26	4	11	6	10	Aural
27	10	10	9	8	Visual, Aural
28	7	15	4	12	Aural
29	7	7	6	6	Read/Write, Kinesthetic
30	7	8	9	11	Visual
31	4	8	8	7	Aural, Read/Write
32	5	14	8	14	Aural, Kinesthetic
33	12	6	9	7	Visual
34	8	15	11	15	Aural, Kinesthetic
35	9	10	10	14	Kinesthetic
36	6	5	4	10	Kinesthetic
37	3	6	7	7	Read/Write, Kinesthetic
38	12	10	3	13	Kinesthetic
39	4	9	6	13	Kinesthetic
40	4	10	5	11	Kinesthetic
41	3	9	9	12	Kinesthetic
42	5	5	5	7	Kinesthetic
43	1	5	4	7	Kinesthetic
44	7	10	8	11	Kinesthetic
Total	**268**	**317**	**303**	**341**	**Kinesthetic**

preference and learning activity results are illustrated in Tables 2 to 9 for students in the first year to fourth year.

The results presented in Table 2 showed that Kinesthetic (K) was the predominant learning style among the first-year BSEd Science students, as it obtained the highest total score of 296. In terms of distribution, a total of 18 students exhibited a preference for Kinesthetic learning, with 16 identified as purely Kinesthetic and 2 showing it in combination with other styles such as Aural. This indicated that most of the respondents preferred learning through hands-on experiences and active engagement. Meanwhile, Aural (A) was also commonly preferred, with 9 students demonstrating this style, including 4 who were purely Aural and 5 who combined it with other learning styles. Visual (V) learning was observed in 4 students, with 2 having it as their sole preference and 2 in combination with other styles. On the other hand, Read/Write (R) was also present among 5 students, including 4 pure and 1 combined preferences. These findings showed that although Kinesthetic learning was the most dominant, a number of students also utilized Aural, Visual, and Read/Write styles, indicating the presence of varied and multimodal learning preferences among the respondents.

The VARK Model of Learning, created by Neil Fleming, may assist with the interpretation of the findings of this study, as it suggests learning preferences are categorized in one of the following four ways: visual, aural, reading/writing, and kinesthetic (Fleming, 2001). In this study, a majority of respondents chose kinesthetic learning styles, which may suggest they engage best in learning activities that involve direct, experiential, and hands-on activities. For VARK learners, it is reasonable to explain that the variance in learning styles in this study was due to the variance in learning activities that were presented to the respondents on the survey.

Furthermore, kinesthetic learning style may be explained by the experiential learning style posited by Kolb (1984). Kolb identified learning experiences as a continuum of four modes: (1) absorbing experiences, (2) processing experiences, (3) reflecting on experiences, and (4) acting on experiences. Learning is most effective when an individual is actively engaged in the continuum. For this study, the strong kinesthetic learning responses in the items relating to application, practice, and real-life situations suggest that students learn better when they are actively engaged in a learning activity.

The results presented in Table 3 showed that Kinesthetic (K) was the predominant learning style among the second-year BSEd Science students, as it obtained the highest total score of 417. In terms of distribution, a total of 26 students exhibited a preference for Kinesthetic learning, with 19 identified as purely Kinesthetic and 7 showing it in combination with other styles such as Aural or Read/Write. This indicated that most of the respondents preferred learning through hands-on experiences and active engagement. Meanwhile, Aural (A) was also widely preferred, with 19 students demonstrating this style, including 12 who were purely Aural and 7 who combined it with other learning styles. Visual (V) learning was observed in 7 students, with 4 having it as their sole preference and 3 in combination with other styles. On the other hand, Read/Write (R) was the least represented, with only 4 students showing preference for it, including 1 pure and 3 combined. These findings showed that although Kinesthetic learning was the most dominant, a significant number of students also incorporated Aural, Visual, and Read/Write styles, reflecting varied and multimodal learning preferences among the respondents.

Support from many prior studies using the VARK model to assess learning styles and preferences confirmed the predominant kinesthetic learning style findings in Table3. The VARK model, designed by Neil Fleming, is a widely used model for identifying learning styles in one of four modalities: visual, aural, read/write, and kinesthetic (Fleming, 2001). Students in the current study were primarily kinesthetic across several VARK model learning styles, particularly in applied tasks, performing tasks, and engaging in real-life tasks.

According to Peyman et al. (2014), when students chose a specific sensory modality, it influenced their cognitive processing and understanding of information. The study noted the situational variability of learning styles, which reaffirmed the current study focus setting on predominately kinesthetic learning while the absences of aural were in preference (Peyman et al, 2014).

The results presented in Table 4 showed that Kinesthetic (K) was clearly the most predominant learning style among the third-year BSEd Science students, as it obtained the highest total score of 290. In terms of distribution, a total of 16 students exhibited a preference for Kinesthetic learning, with 15 identified as purely Kinesthetic and 1 showing it in combination with other styles such as Aural, Visual, or Read/Write. This indicated that the majority of the respondents preferred learning through hands-on activities, actual practice, and direct engagement. Aural (A) followed as the next most common preference, with 15 students demonstrating this style, including 10 who were purely Aural and 5 who combined it with other learning styles. Visual (V) was observed in 9 students, with 6 having it as their sole preference and 3 in combination with other styles. On the other hand, Read/Write (R) was the least represented, with 10 students showing a preference for it, including 4 purely Read/Write and 6 combined. These findings suggested that while kinesthetic learning was the most dominant among the group, a number of students still utilized multiple learning styles, indicating diverse and multimodal learning preferences.

Along the same lines, a study of undergraduate medical students using the VARK questionnaire showed that in students with unimodal learning preferences, aural (auditory) learners were the largest group at 45.5%, followed by kinesthetic learners at 33.1%, indicating that verbal instruction and hands-on engagement are learning modes that this cohort holds in high regard. The findings from this study and Urval et al (2014) are similar. Kinesthetic learning was dominant in the performance-based items, and aural was present in the items requiring explanation and verbal interaction. The same applies to the descriptive study focused on medical and dental students. Kinesthetic was the most preferred unimodal learning style, and students stressed that learning through interaction and touch (kinesthetic) enhanced comprehension and retention of the material, which justifies the highly observed responses for kinesthetic in the current study (Ayesha Fahim et al., 2021).

The results presented in Table 5 indicated that Kinesthetic (K) was the predominant learning style among the fourth-year BSEd Science students, having obtained the highest total score of 341. In terms of distribution, a total of 26 students exhibited a preference for Kinesthetic learning, with 19 identified as purely Kinesthetic and 7 showing it in combination with other styles such as Aural, Visual, or Read/Write. This suggested that most of the respondents favored learning through hands-on activities, active participation, and practical application of knowledge. Aural (A) followed as the next most common learning style, with 18 students demonstrating this preference, including 11 who were purely Aural and 7 who combined it with other styles. This indicated that listening and verbal interaction also played an important role in the students' learning process. Visual (V) was observed in 7 students, with 4 having it as their sole preference and 3 in combination with other styles, reflecting that some learners relied on visual aids such as diagrams and illustrations. Meanwhile, Read/Write (R) was the least represented, with 3 students showing a preference for it, including 0 purely Read/Write and 3 combined with other

Table 6
The distribution of unimodal versus multimodal learning style preferences among BSEd science first year students

Year level learning preferences	Frequency	Percentage %
Uni-modal	25	83.3
Multi-modal	5	16.7

Table 7
The distribution of unimodal versus multimodal learning style preferences among BSEd science second year students

Year level learning preferences	Frequency	Percentage %
Uni-modal	36	78.3
Multi-modal	10	21.7

learning styles.The findings showed that although kinesthetic learning was the most dominant among the fourth-year students, a number of learners still exhibited multiple learning preferences, indicating a diverse and multimodal pattern of learning.

A descriptive study which involved 1,473 undergraduate medical and dental students, which examined the VARK learning styles, showed that learning styles which operated at the multimodal level were more predominant in comparison to the learning styles at the unimodal level, with the special case of the kinesthetic mode, which was the least preferred unimodal mode, while other modes were more preferred (Fahim et al., 2021). This state of affairs which has been covered in other studies suggested that learners most frequently incorporated kinesthetic preferences in multimodal profiles and were more inclined towards instances of learning that involved activities and applied experiential learning, which aligned with the findings in the study that showed strong kinesthetic responses across various items (Fahim et al., 2021).

The Distribution of Unimodal Versus Multimodal Learning Style Preferences among BSEd Science Students.

The researchers first organized the collected data according to the respondents' year level. Each respondent's answers were then manually tallied based on the VARK learning preference categories. Following this, the researchers determined whether each respondent exhibited a unimodal or multimodal learning preference. This classification was based on how the respondents scored across the four learning style categories: Visual, Aural, Read/Write, and Kinesthetic. A respondent was classified as unimodal if a clear preference for only one category was observed. In contrast, a respondent was categorized as multimodal if two or more categories showed equally strong or highest scores, indicating a preference for multiple learning styles. After the classification process, the researchers counted the number of students under each category (unimodal and multimodal). The percentage distribution was then computed by dividing the frequency of each learning preference category by the total number of respondents and multiplying the result by 100. This method was used to determine the proportion of students in each learning preference category, thereby allowing for clearer comparison and interpretation of the data.

Based on Table 6, it can be seen that the large majority 83.3% of BSEd Science first-year students showed an inclination towards unimodal learning with only 5 respondents 16.7% who have a preference for multimodal learning. This shows the students' inclination towards a single learning mode with little or no preference towards other alternative learning modes. A similar finding was observed by Kamal et al. (2021). Their study showed 86.8% of healthcare science students preferred unimodal learning and only 13.2% preferred multimodal learning. Such findings suggest that it is rather common for students belonging to science-related fields to prefer a single mode of learning.

Likewise, unimodal learning preference was observed among the respondents in Chen et al. (2022). They studied 148 Malaysian university students including 117 students from the science faculty, and most of the students preferred unimodal learning with kinesthetic learning as the most preferred learning style. This finding implies that a substantial number of students from science disciplines are able to assimilate and process the information more effectively when they are given active, practical and experiential learning tasks.

Table 7 showed that the majority of the BSEd Science second-year students preferred the unimodal learning style, with 36 respondents (78.3%). In contrast, only 10 respondents (21.7%) preferred the multimodal learning style. This indicated that most students tended to focus on one dominant learning mode compared to several learning modes. This claim is also supported by Kamal et al. (2021), who stated that 86.8% of students in healthcare science preferred unimodal learning, and only 13.2% preferred multimodal learning. This study also showed that single-mode preference is more common in students.

The majority (78.28%) of BSEd Science students are unimodal learners, while a smaller group (21.74%) are multimodal learners based on the VARK learning preference. This indicates that most of the students, especially kinesthetic and aural learners, primarily utilize one single learning mode to process and comprehend information. Chen et al. (2022) conducted research to study 148 university students in Malaysia and this is consistent with their findings. This study pointed out that most university students use a single learning mode and that kinesthetic learning styles are most preferred. The findings also indicate that most students learn better through direct, experiential, and active learning, particularly in science.

Table 8 shows that the majority of BSEd Science third-year students preferred unimodal learning 37 students or 88.1%, while only 5 students or 11.9% preferred multimodal learning. This means that most respondents depended on a single sensory modality than a combination of many modes to process information. This pattern has been found in the wider literature

Table 8
The distribution of unimodal versus multimodal learning style preferences among BSEd science third year students

Year level learning preferences	Frequency	Percentage %
Uni-modal	37	88.1
Multi-modal	5	11.9

Table 9
The distribution of unimodal versus multimodal learning style preferences among BSEd science fourth year students

Year level learning preferences	Frequency	Percentage %
Uni-modal	40	91
Multi-modal	4	9

that unimodal preference has often been predominant among students in science and health-related disciplines (Kamal et al., 2021).

A closely related research by Kurian and Gowda (2023) among 100 first-year undergraduate medical students in India, found that 84% preferred unimodal learning. Their results strongly supported the presented result since the majority of students in their sample also belonged in the unimodal category, which was comparable to 88.1% third-year BSEd Science students in the current study.

Rezigalla and Ahmed (2019) also highlight that unimodal learning across all academic levels show a persistent reliance on a single dominant learning mode. This is in contrast to the multimodal preference which was limited and most predominantly observed in first year students suggesting that the sustenance of multiple learning styles is not deeply rooted in medical education. In addition, such a study shows that students have a diverse range of learning preferences which aligns with the idea that a significant number of students narrow their interest to a single learning modality rather than diverse combination of modalities.

According to Table 9, most BSEd Science fourth-year students preferred unimodal learning, with 40 students, accounting for 91%, while 4 students, representing 9%, preferred multimodal learning. This showed most participants used one preferred sensory modality for processing and understanding information rather than multiple modes. This is consistent with previous studies that showed unimodal preference was dominant among higher education students, especially in science and health-related fields (Wong et al., 2017).

Unimodal learning prevalence among first-year pharmacy students is perhaps due to the personal nature of learning styles and their reliance on experience and setting. Elkalmi et al. (2015) stated that learning styles are personal and may evolve due to different factors, like one's setting and exposure. Additionally, there will be over-reliance on one preferred mode of learning due to misalignment of teaching style and the learner's preferred style. The same researchers reported that learning preferences were not significantly influenced by gender, place of residence, number of siblings, or parental income. Their findings corroborated the current study, as their sample's proportion of unimodal learners was even slightly higher, although still very similar to the 91% among fourth-year BSEd Science students.

This confirms the findings of David et al. (2024) as they suggest that growing majority of unimodal learning preference to health professional students can be due to the individualistic nature of learning styles, where students learn using one dominant modality of learning which is aided by their cognitive preference. Learning preference is determined by prior experiences and the environment, and students who have limited exposure to different teaching styles tend to develop and sustain a unimodal learning preference. Moreover, health professional programs emphasize learning which is determined by high information processing. This makes reliance on one learning preference even worse in students. This has been observed to be a dominant kinesthetic learning preference which is a reflection a practical hands-on approach which health related disciplines tend to promote and fosters unimodal rather than multimodal learning.

4. Summary of Findings, Conclusion, and Recommendations

This section presented the summary of the findings, the conclusions based on the results of the researchers' study entitled "VARK Model: A Learning Preferences among BSEd Science Students" and the recommendations are derived from the findings.

A. Summary of Findings

The following are the major findings of the study based on the data gathered and obtained from the participants during the survey.

1) What are the predominant VARK learning style preferences among BSEd Science students

The findings indicated in table 2 that first-year students predominantly preferred a Kinesthetic learning style

The results showed in table 3 that second-year students predominantly preferred a Kinesthetic learning style.

The findings revealed in table 4 that third-year students exhibited a preference for kinesthetic learning styles.

The results indicated that fourth-year students predominantly preferred a Kinesthetic learning style.

2) What is the distribution of unimodal versus multimodal learning style preferences among BSEd Science students

The findings in Table 6 revealed that first-year BSEd Science students are predominantly unimodal learners, comprising 83.3% of the respondents, while only 16.7% exhibited multimodal preferences.

As shown in Table 7, the majority of second-year BSEd Science students demonstrated a unimodal learning preference

at 78.3%, whereas 21.7% were identified as multimodal learners.

Table 8 indicated that most third-year BSEd Science students were unimodal learners, accounting for 88.1%, with a smaller proportion of 11.9% classified as multimodal.

The results in Table 9 showed that fourth-year BSEd Science students largely preferred a unimodal learning style, with 91%, while only 9% demonstrated multimodal learning preferences.

B. Conclusion

Based on the findings, it can be concluded that first-year BSEd Science students predominantly prefer a Kinesthetic learning style, indicating a strong inclination toward hands-on activities, real-life application, and direct engagement. Second-year students also predominantly exhibit a Kinesthetic learning style, suggesting that they learn best through practical experiences complemented. Third-year students also demonstrate a learning preference for Kinesthetic styles, which indicates that they learn more effectively through interaction and experiential, hands-on activities. Fourth-year students predominantly favor a Kinesthetic learning style, emphasizing learning through active participation, practical engagement, and real-life application of knowledge.

Most students demonstrated a unimodal learning preference, meaning they relied on one dominant learning style. A smaller group of students showcased multimodal preferences, suggesting that they learned better when different methods were combined. This variation in learning styles highlighted the importance of incorporating teaching strategies that emphasize interactive and experiential learning, especially those that involve discussion. Additionally, employing a variety of teaching approaches was deemed significant to address the diverse needs of all learners.

C. Recommendations

1) For the Teachers. They are encouraged to implement aural and kinesthetic teaching strategies, such as interactive discussions, clear verbal instruction, and hands-on activities, to enhance student engagement and understanding. The integration of visual and written materials is also recommended to address diverse learning preferences.

2) For the Students. They should identify their dominant learning styles and adopt appropriate strategies, such as active participation in discussions for aural learners and engagement in practical activities for kinesthetic learners.

3) For the School administrators. They are advised to provide professional development opportunities focused on varied instructional strategies and to allocate resources that support interactive and experiential learning environments.

4) For the Future Researchers. They may consider using larger and more diverse samples, as well as examining additional variables such as academic performance, teaching methods, and technology integration, to further validate and expand the findings.

References

[1] A. A. Abdel Latif, A. M. ShamsEldeen, M. A. Alghamdi, A. M. Mahfoz, and B. E. Aboulhoda, "Influence of applying VARK learning styles on enhancing teaching skills: Application of learning theories," *BMC Med. Educ.*, vol. 24, Art. no. 1034, 2024.

[2] Z. Abidin, "Effective classroom management as a quick solution to improve student participation and motivation in the learning process," *Zabags Int. J. Educ.*, vol. 2, no. 2, pp. 75–88, 2024.

[3] M. Alabi, "The role of learning styles in effective teaching and learning," 2024. [Online]. Available: https://shorturl.at/yPQ6V

[4] W. Alfarsi, A. H. Elaghoury, and S. E. Kore, "Preferred learning styles and teaching methods among medical students: A cross-sectional study," *Cureus*, vol. 15, no. 10, Art. no. e46875, Oct. 2023.

[5] S. S. Ali, J. Ali, W. Khan, P. A. Shah, I. Ahmad, and Q. A. Khan, "Assessment of learning styles preferred by medical students using VARK questionnaire," *Eur. J. Pharm. Med. Res.*, vol. 10, no. 10, pp. 11–18, Oct. 2023.

[6] I. M. Alkhasawneh, M. T. Mrayyan, C. Docherty, S. Alashram, and H. Y. Yousef, "Problem-based learning (PBL): Assessing students' learning preferences using VARK," *Nurse Educ. Today*, vol. 28, no. 5, pp. 572–579, Jul. 2008.

[7] M. A. Almulla, "The effectiveness of the project-based learning (PBL) approach as a way to engage students in learning," *SAGE Open*, vol. 10, no. 3, pp. 1–15, Jul.–Sep. 2020.

[8] J. O. D. Alvarez and L. G. Baraquia, "Development and validation of e-learning modules in Science 8 for blended modality through Genyo e-learning," *Int. J. Acad. Multidiscip. Res.*, vol. 7, no. 4, pp. 198–213, Apr. 2023.

[9] J. G. Ariem and E. M. Cabal, "Science teachers' teaching styles, students' learning styles and their academic performance in the secondary public schools of Zambales," *Int. J. Multidiscip.: Appl. Bus. Educ. Res.*, vol. 2, no. 10, pp. 951–959, Oct. 2021.

[10] M. A. Asiry, "Learning styles of dental students," *Saudi J. Dent. Res.*, vol. 7, no. 1, pp. 13–17, Jan. 2016.

[11] R. Basu, T. Roy, and P. Pradhan, "Association of learning styles with academic achievements in first year professional MBBS students of a medical college in Eastern India: A cross sectional study," *J. Clin. Diagn. Res.*, vol. 18, no. 6, pp. 1–5, Jun. 2024.

[12] B. Bazán-Perkins and J. A. Santibañez-Salgado, "Relationship between the learning gains and learning style preferences among students from the School of Medicine and Health Sciences," *BMC Med. Educ.*, vol. 25, no. 1, Art. no. 71, 2025.

[13] L. Brennan, "Flexible assessment of student learning using VARK framework," *Nurse Educ.*, 2024.

[14] R. J. N. A. Bualat, J. A. G. Lucero, C. F. Zamora, F. E. S. Arcamo, and A. J. D. Tantog, "Embarking on VARK: A case study on students' preference in learning English," *Int. J. Acad. Multidiscip. Res.*, vol. 7, no. 7, pp. 53–67, Jul. 2023.

[15] N. A. Chaudhry, A. Ashar, and S. A. Ahmad, "Association of visual, aural, read/write, and kinesthetic (VARK) learning styles and academic performances of dental students," *Pak. Armed Forces Med. J.*, vol. 70, no. Suppl. 1, pp. S58–S63, 2020.

[16] A.-H. Chen, S. N. W. Mohd Salaomi, and A. N. Ahmad Nazri, "Unimodal & kinesthetic learning styles predominate in both science and non-science university students in Malaysia using VARK," *J. Acad.*, vol. 10, no. 1, pp. 61–71, 2022.

[17] L. Cohen, L. Manion, and K. Morrison, *Research Methods in Education*, 8th ed. London, UK: Routledge, 2018.

[18] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3rd ed. Thousand Oaks, CA, USA: SAGE Publications, 2009.

[19] S. M. David, R. E. Ilesanmi, V. F. Hanson, and V. Edwin, "Learning preference of health care professional students at a multicultural university in the United Arab Emirates," *New Emirates Med. J.*, vol. 5, Art. no. e02506882298077, 2024.

[20] D. Diestro and J. L. Faelangco, "Exploring the scientific skills and learning styles of future science mentors: A springboard in engaging effective science teaching pedagogy," *EPRA Int. J. Res. Dev. (IJRD)*, vol. 7, no. 8, pp. 185–190, Aug. 2022.

[21] R. M. Elkalmi, A. K. M. Alshami, A. Ahmad, M. U. Khan, N. S. Ab Rahman, and R. M. Alkoudmani, "Assessment of learning style preferences of pharmacy students: Findings from public university of Malaysia," *Indian J. Pharm. Educ. Res.*, vol. 49, no. 4, pp. 266–271, Oct.–Dec. 2015.

[22] ELM Learning, "Constructivist learning theory," ELM Learning, 2024. [Online]. Available: https://elmlearning.com/hub/learning-theories/constructivism/

[23] E. El-Saftawy, A. A. Abdel Latif, A. M. ShamsEldeen, M. A. Alghamdi, A. M. Mahfoz, and B. E. Aboulhoda, "Influence of applying VARK learning styles on enhancing teaching skills: Application of learning theories," *BMC Med. Educ.*, vol. 24, no. 1, Art. no. 1034, 2024.

[24] L. Emma, "The role of learning styles in effective teaching and learning," ResearchGate, 2024. [Online]. Available: https://www.researchgate.net/publication/385553766_The_Role_of_Learning_Styles_in_Effective_Teaching_and_Learning

[25] I. Etikan, S. A. Musa, and R. S. Alkassim, "Comparison of convenience sampling and purposive sampling," *Amer. J. Theor. Appl. Stat.*, vol. 5, no. 1, pp. 1–4, 2016.

[26] A. Fahim *et al.*, "Identification of preferred learning style of medical and dental students using VARK questionnaire," *BioMed Res. Int.*, vol. 2021, Art. no. 4355158, 2021.

[27] N. Fleming and D. Baume, "Learning styles again: VARKing up the right tree!" *Educ. Dev.*, vol. 7, no. 4, pp. 4–7, Nov. 2006.

[28] N. D. Fleming and C. Mills, "Not another inventory, rather a catalyst for reflection," *To Improve the Academy*, vol. 11, no. 1, pp. 137–155, 1992.

[29] S. Gangadharan, K. Al Mezeini, S. Gnanamuthu, and K. Al Marshoudi, "The relationship between preferred learning styles and academic achievement of undergraduate health sciences students compared to other disciplines at a Middle Eastern university utilizing the VARK instrument," *Adv. Med. Educ. Pract.*, vol. 16, pp. 13–28, 2025.

[30] M. A. M. Harapan, M. Masriyah, and H. Suharyati, "Improving learning outcomes of kinesthetic learners through a differentiated learning approach," *Int. J. Sustainable Dev. Future Soc.*, vol. 2, no. 2, pp. 70–75, 2024.

[31] J. E. Hernandez, N. Vasan, S. Huff, and C. Melovitz-Vasan, "Learning styles/preferences among medical students: Kinesthetic learner's multimodal approach to learning anatomy," *Med. Sci. Educ.*, vol. 30, no. 4, pp. 1633–1638, Dec. 2020.

[32] N. E. W. Jailani, S. Suratman, S. Maniam, and A. A. Ali, "Assessment of undergraduate pharmacy student learning styles using the VARK questionnaire," *Malays. J. Med. Health Sci.*, vol. 19, no. Suppl. 12, pp. 7–14, 2023.

[33] A. A. Kamal, M. Shaikh, and A. Hussain, "Learning style preferences of first-year medical students at King Saud University, Saudi Arabia," *Int. J. Eval. Res. Educ.*, vol. 10, no. 1, pp. 255–261, Mar. 2021.

[34] L. Khanal, J. Giri, S. Shah, S. Koirala, and J. Rimal, "Influence of learning style preferences in academic performance in the subject of human anatomy: An institution based study among preclinical medical students," *Adv. Med. Educ. Pract.*, vol. 10, pp. 343–355, 2019.

[35] P. Kharb, P. P. Samanta, M. Jindal, and V. Singh, "The learning styles and the preferred teaching–learning strategies of first year medical students," *J. Clin. Diagn. Res.*, vol. 7, no. 6, pp. 1089–1092, Jun. 2013.

[36] D. A. Kolb, Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs, NJ, USA: Prentice-Hall, 1984.

[37] N. Kurian and N. R. V. Gowda, "Assessment of learning styles using VARK model in first year undergraduate medical students," *Indian J. Clin. Anat. Physiol.*, vol. 10, no. 3, pp. 168–172, 2023.

[38] "Learning styles through visual, auditory and kinesthetic (VAK) scale," *Indian J. Forensic Med. Toxicol.*, vol. 14, no. 4, 2020.

[39] W. L. Leite, M. Svinicki, and Y. Shi, "Attempted validation of the scores of the VARK: Learning styles inventory with multitrait–multimethod confirmatory factor analysis models," *Educ. Psychol. Meas.*, vol. 70, no. 2, pp. 323–339, Apr. 2010.

[40] S. C. Liew, J. Sidhu, and A. Barua, "The relationship between learning preferences (styles and approaches) and learning outcomes among pre-clinical undergraduate medical students," *BMC Med. Educ.*, vol. 15, Art. no. 44, Mar. 2015.

[41] V. Mane, J. Markam, R. F. Williams, and M. Khobragade, "VARK pattern of learning style preferences among students," *Nat. J. Res. Community Med.*, vol. 4, no. 2, pp. 199–206, Apr.–Jun. 2015.

[42] S. H. Mohammed and L. Kinyo, "The role of constructivism in the enhancement of social studies education," *J. Crit. Rev.*, vol. 7, no. 7, pp. 249–256, 2020.

[43] S. N. Mohd Noor and M. K. Amri Ramly, "Bridging learning styles and student preferences in construction technology education: VARK model analysis," *Int. J. Acad. Res. Progressive Educ. Dev.*, vol. 12, no. 3, 2023.

[44] N. Ojeh, N. Sobers-Grannum, U. Gaur, A. Udupa, and M. A. A. Majumder, "Learning style preferences: A study of pre-clinical medical students in Barbados," *J. Adv. Med. Educ. Prof.*, vol. 5, no. 4, pp. 185–194, Oct. 2017.

[45] L. A. Palinkas, S. M. Horwitz, C. A. Green, J. P. Wisdom, N. Duan, and K. Hoagwood, "Purposeful sampling for qualitative data collection and analysis in mixed method implementation research," *Adm. Policy Ment. Health*, vol. 42, no. 5, pp. 533–544, Sep. 2015.

[46] H. Peyman *et al.*, "Using VARK approach for assessing preferred learning styles of first year medical sciences students: A survey from Iran," *J. Clin. Diagn. Res.*, vol. 8, no. 8, pp. GC01–GC04, Aug. 2014.

[47] J. Piaget, "Development and learning," *J. Res. Sci. Teach.*, vol. 2, no. 3, pp. 176–186, Sep. 1964.

[48] J. Piaget, Science of Education and the Psychology of the Child. New York, NY, USA: Orion Press, 1970.

[49] I. J. Prithishkumar and S. A. Michael, "Understanding your student: Using the VARK model," *J. Postgrad. Med.*, vol. 60, no. 2, pp. 183–186, Apr.–Jun. 2014.

[50] K. Putri and Elizar, "Implementing a differentiation approach in teaching to accommodate diverse learning styles of primary school students: A systematic literature review," *J. Lesson Learn. Stud.*, vol. 8, no. 1, pp. 119–128, 2025.

[51] N. W. S. Putri and N. K. Suryati, "Analysis of the style of learning based on visual, auditorial, kinesthetic on students of computer system," *Int. J. Educ. Curric. Appl.*, vol. 3, no. 1, pp. 43–47, Apr. 2020.

[52] A. A. Rezigalla and O. Y. Ahmed, "Learning style preferences among medical students in the College of Medicine, University of Bisha, Saudi Arabia (2018)," *Adv. Med. Educ. Pract.*, vol. 10, pp. 795–801, 2019.

[53] M. Rob and F. Rob, "Dilemma between constructivism and constructionism: Leading to the development of a teaching learning framework for student engagement and learning," *J. Int. Educ. Bus.*, vol. 11, no. 2, pp. 273–290, 2018.

[54] N. A. Rone, N. A. A. Guao, M. S. Jariol, Jr., N. B. Acedillo, K. R. Balinton, and J. O. Francisco, "Students' lack of interest, motivation in learning, and classroom participation: How to motivate them?" *Psychol. Educ.: Multidiscip. J.*, vol. 7, no. 1, pp. 636–645, 2023.

[55] P. Saarsar, "Exploring the constructivist approach in education: Theory, practice, and implications," *Int. J. Res. Anal. Rev. (IJRAR)*, vol. 5, no. 2, 2018.

[56] A. Saleem, H. Kausar, and F. Deeba, "A new paradigm in teaching and learning environment," *Perennial J. Hist.*, vol. 2, no. 2, pp. 403–421, Jul.–Dec. 2021.

[57] K. Shah, J. Ahmed, N. Shenoy, and S. N., "How different are students and their learning styles?" *Int. J. Res. Med. Sci.*, vol. 1, no. 3, pp. 212–215, 2013.

[58] S. Sirisilla, "Descriptive research: Definition, types, and flaws to avoid," Enago Academy, Feb. 20, 2023. [Online]. Available: https://www.enago.com/academy/descriptive-research-design/

[59] J. Snowman and R. R. McCown, *Psychology Applied to Teaching*, 14th ed. Stamford, CT, USA: Cengage Learning, 2015.

[60] R. P. Urval, A. Kamath, S. Ullal, A. K. Shenoy, N. Shenoy, and L. A. Udupa, "Assessment of learning styles of undergraduate medical students using the VARK questionnaire and the influence of sex and academic performance," *Adv. Physiol. Educ.*, vol. 38, no. 3, pp. 216–220, Sep. 2014.

[61] VARK Learn Limited, "The VARK modalities," VARK – A Guide to Learning Preferences, 2020. [Online]. Available: https://vark-learn.com/introduction-to-vark/the-vark-modalities/

[62] VARK Learn Limited, "Aural strategies," VARK – A Guide to Learning Preferences, 2025. [Online]. Available: https://vark-learn.com/strategies/aural-strategies/

[63] VARK Learn Ltd., "Research statistics on VARK learning preferences," VARK – A Guide to Learning Preferences, 2025. [Online]. Available: https://vark-learn.com/research-statistics/

[64] R. S. Y. Wong, H. L. Siow, V. Kumarasamy, and N. S. F. Suhaimi, "Interdisciplinary and inter-institutional differences in learning preferences among Malaysian medical and health sciences students," *J. Adv. Med. Educ. Prof.*, vol. 5, no. 4, pp. 164–171, Oct. 2017.

[65] R. Yusnanto and A. Rahayu, "Application of learning video based on visual, auditory, and kinesthetic learning styles to increase thermodynamics learning motivation at Grade XI in high school," in *Proc. 3rd Tarumanagara Int. Conf. Appl. Soc. Sci. Humanit. (TICASH 2021)* (Adv. Soc. Sci., Educ. Humanit. Res., vol. 655), Atlantis Press, 2022.