

Learning style preferences and its association with academic achievement of medical students enrolled with new initiative medical education curriculum at Ambo University



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Abstract

Background: How well a learner understands and retains information largely depends on whether the information was received in the learners' preferred learning modality. Even though learning styles expected to influence the way students engage in the learning process and academic achievement, there is limited evidence available in Ethiopia, particularly in medical education.

Objective: To assess whether learning style preferences affect the academic achievement of medical students enrolled with new initiative medical education (NIME) curriculum at Ambo University.

Methods: A cross-sectional study design was employed among 92 medical students. A standard structured questionnaire of VARK (Visual, Aural, Read-Write, Kinesthetic) version 8.1 used to assess the learning style preferences of medical students. The academic achievement obtained from secondary source with grade record review. Descriptive and analytical statistics were used. Kruskal–Wallis one way ANOVA and student t-test were employed to compare the academic achievement with learning style preferences. Chi-square test was used to measure the association between learning style and academic achievement. Pearson correlation was also computed to compare the academic achievement with VARK score. P-value <0.05 was used as the cut of point to determine the statistically significant difference or association.

Result: Medical students more preferred a unimodal learning style (58.7%), with kinesthetic being the most preferred (61.11%). Of the 38 multimodal learning style preferences, 94.74% had preferred a quad-modal (VARK). The VARK score had no statistically significant difference by gender, age, or year of study (P value>0.05). The cumulative grade in both first- and second-year results had no statistically significant difference by learning styles of medical students. But kinesthetic learners had statistically nonsignificant higher median cumulative grade in both first year (CGPA=3.21) and second year (CGPA=3.24) results. The kinesthetic score was also positively correlated with the second-year cumulative grade, statistically significant ($r=0.22$, P value=0.03).

Conclusions: The most common learning style among medical students was unimodal, kinesthetic was the most preferred. There was no statistically significant cumulative grade achievement difference by learning style preferences, but the kinesthetic score had statistically significant positive correlation with second-year cumulative grade. Understanding learning styles is critical for medical students and teachers when planning a learning and teaching strategy, respectively.

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Chapter-1: Introduction

Background

The word learning preferences defined by Dunn et al in 1989 as the conditions that an individual learner would choose if they were able to do so, including environmental, emotional, sociological, and physical factors (1). Learning preferences refer to a person's preferred intellectual method to learning, which has a significant impact on how everyone learns, especially when compared to what teachers anticipate from students (2).

Because of the variety of learning styles in the class, some students will work and learn less efficiently than others in the class if the teacher uses a particular strategy to learning. (2). How well a learner understands and retains information largely depends on whether the information is received in the learners' preferred learning modality (3). A mismatch between the teaching styles of medical educators and the learning styles of students can also make a problem (4).

The variety of teaching methods contributes to the creation of more attractive and beneficial learning environments (5). Moreover, teaching methods tailored to students learning style preferences can improve the students learning performance (6).The knowledge that students have various preferred learning styles will assist medical educators in developing appropriate teaching strategies, exploring opportunities, and improving the educational experience (7).

The awareness of learning style is important for choosing best teaching strategy. Learning style knowledge should have an impact on how educators choose to teach and better identify the needs of their students, as well as raising awareness of the need to distinguish resources not only by difficulty level but also by learning style (2).

This study was conducted among medical students enrolled with new initiative medical education (NIME) curriculum at Ambo University. The NIME program has been launched in Ethiopia in February 2012 with an innovative approach curriculum of medical education in terms of student participation, years of study, competency-based learning, and integration which makes the NIME curriculum different from the conventional curriculum. The program is currently offered at eleven Universities and three hospitals across the country (8). This research adds to our understanding of the most common learning styles and their links to academic success.

Statement of the problem

The use of teaching methods that match student's diverse learning styles has been advocated as effective teaching practices and has the potential to improve learning and performance (9). Numerous literatures indicated learning styles are one of the most important factors for academic achievement (4, 10).

Despite the recommendation that there are benefits to recognizing individual learning style preferences and matching them to teaching strategy, little empirical study has been done to determine the exact form and extent of change that may be predicted in a student's learning (11). According to a meta-analysis of experimental studies based on the Dunn and Dunn Productivity Environmental Preference model, aligning students' learning styles with educational interventions improves academic achievement and attitude improvement (12). However, there are emerging studies that found there is no association between learning styles and academic achievement (7, 13). According to a recent review of the literature, four out of six research revealed there was no association between learning styles and achievement using the VARK model (14). Because there are many definitions for learning style and varied assessment instruments, the study of learning styles and their interpretation should be approached with caution.

Although matching the teaching strategy with learning styles is expected to influence the way students engage in the learning process and academic achievement, there is limited evidence available in Ethiopia particularly in health sciences and medical education. A study conducted in Ethiopia at Mekelle University among undergraduate with various health science students showed that nearly three fourth of medical students (73.5%) preferred a unimodal and 25% of them had a visual learning preference. This study did not find a statistically significant difference in learning style preferences by gender (15). In another study in Ethiopia at Wollega University among preclinical medical students reported read-write as the dominant learning style preference and auditory as the second dominant learning style preference (16).

The magnitude of the preferred learning style of medical students in Ethiopia is not adequately studied. Moreover, how learning style is associated with academic achievement is not well known in the Ethiopia context. Therefore, this study generates evidence by investigating the predominate learning styles and compare with their academic achievement of medical students enrolled with new initiative medical education (NIME) curriculum in Ambo University.

The rationale for the study

The knowledge of the students' learning style help to improve the teaching strategies and optimize the students' learning experiences. Matching diverse learning styles may enhance the students' academic achievement. However, the magnitude of students learning preferences is not well studied in medical students in Ethiopia. It is also not well-known how learning style is associated with students' academic achievement. This study generates information on the dominant learning styles and its relationship with academic achievement. The study findings are expected to guide the medical professional teachers to accommodate various teaching strategies according to the dominant learning style of the students. This study has also implications to show if a particular teaching strategy is dominantly applied. Thus, the study can contribute to the quality of medical education. This study is also useful for other researchers to conduct further study on similar subject area.

Chapter-2: Literature review

Learning theory

A theory is an interrelated concepts that to explain a phenomenon (17-20).Where as the most commonly used definition of learning, Merriam et al. 2007, is “a change in behavior, attitude and skills” (19) in adult learning theory (andragogy). Thus, learning theory explain how people learn. There are various learning theories in education. However, most learning theories are related to each other and can categorized into behaviorism, cognitivism, and constructivism (19, 21).

The behaviorism theory focusses on the observable behavior. In behaviorism theory learning is a “change in behavior” (17). Indeed, the cognition part of the learning process is not considered in the behaviorism. Behaviorism theory is used in competency-based curriculum(21). A reinforcement and feedbacks are an important strategies in behaviorism (17).

The cognitivism theory emphasize on the learning process in the human mind(19). It tells how information acquired, stored and retrieved in the learning process (17). Critical thinking is an important part of learning in cognitivism theory (21).

Constructivism theory explain how a new knowledge is build based on the previous experience. The learner develop a new knowledge based on their previous experience and relate to the other through critical reflection (17). In Constructivism theory the responsibility of learning is the students, and the teacher role is facilitating. Problem based learning (PBL) is one of the examples of Constructivism. The modern education mostly shifts from behaviorism and cognitivism to constructivism (21). The Kolb’s experiential learning is related with the constructivism theory “learning the process of knowledge creation through transformation of experience”. The learning by reflection of experience, conceptualize and experiment. Knowles theory of adult learning (andragogy) related with paradigm of constructivism and humanism theories. Adult learners are a self-motivated and self-directed and learn through problem solving and experience. Learner-centered is the feature of adult learning (21).

The learning theories used as guide for the teaching learning strategy, learning objective and evaluation medical education (17). As the learners have different learning styles and socio-cultural backgrounds accommodating various theories in the learning optimize the benefits (17).

Learning styles models

Education scientist have developed evaluation tools to analyze students' learning preferences and to explain the interrelations between learning and the learning environment (22). The introduction of numerous learning style models has increased awareness of the fact that students learn in a variety of ways and that one teaching technique does not work for all or even most students.

Most commonly used learning style inventories in the review of literature (9) are the VARK learning style inventory, Kolb learning style indicator, Gregorc learning style, Felder–Silverman index of learning styles, and the Dunn and Dunn productivity environmental preference survey.

The VARK learning style model defined learning style as “An individual’s characteristics and preferred ways of gathering, organizing, and thinking about information”. VARK is in the category of instructional preference because it deals with perceptual modes. It is focused on the different ways that we take in and give out information” (9). The VARK learning styles assess four sensory modalities: Visual, Aural, Read-write, and Kinesthetic. Learners are categorized as unimodal if they prefer only one learning style, or multimodal if they prefer two or more learning styles, according to the VARK model. The learning styles of VARK model is described in table 1 below (23, 24).

Table 1: The learning styles in the VARK model

Mode	Learning style
Visual	Learning by seeing at pictures, graphs, videos, and diagram. Preferred to learn by observing
Aural	Learning by listening, discussion, and explanation. Preferred to learn by listening
Read-write	Learning by read-write texts. Preferred to learn by reading and taking note.
Kinesthetic	Learning by practical exercise, cases, and real experience. Preferred to learn by doing, touching and real experiences.

The Kolb experiential learning model defined learning style as “generalized differences in learning orientation based on the degree to which people emphasize the four modes of the learning process Concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and Active experimentation (AE)” (25). The Kolb learning style inventory developed based on experiential learning theory (25, 26).

The Gregorc learning style model defined learning style as “distinctive and observable behaviors that provide clues about the mediation abilities of individuals and how their minds relate to the world and, therefore, how they learn”. This model developed based on the research and Kolb experiential learning cycle. According to Gregoric learning style model “individuals have natural predispositions on four bipolars learning”. Concrete-Sequential (CS), Abstract-Sequential (AS), Abstract-Random (AR), and Concrete-Random (CR) (9).

The Felder and Silverman learning style model defined learning style as “the characteristic strengths and preferences in the ways individuals take in and process information”. It assess learners preference along five bipolars; Active-Reflective, Sensing-Intuitive, Verbal-Visual, Sequential-Global, and Intuitive-Deductive (9).

The Dunn and Dunn learning style model defined the learning style as “how individuals begin to concentrate on, process, internalize and retain new and difficult information” According to Dunn & Dunn, there are five learning style stimuli each with several elements. The five stimuli are environment, emotional, Sociological, Physiological and Psychological (9).

[VARK Learning style studies](#)

The most common learning style preferences in Saudi Arabia studies were multimodal among medical students and Dental students 66.3% and 43%, respectively (13, 27). The auditory model was the predominant single mode of learning preference (5, 13, 27). Similarly, other study among medical students showed that the dominant learning style preference of students was multimodal, and Males and females favored aural and kinesthetic preferences, respectively, among students who preferred unimodal preference (28).

A similar finding was found in Iran study among Dental students, the preferred learning style was multimodal (51.5%). The most common mode from unimodal was aural (24.0%), kinesthetic (15.5%), read-write (8.0%), and visual (1.0%) (29). This consistent with other Iran studies among Dental and Medical students. Among 88 Dental students found that 87 students preferred multimodal learning style (30). In a different Iranian study, 82 out of 141 medical students preferred more than one style (multimodal); 17% preferred two modes (bimodal), 13.5% preferred three modes (tri-modal), and 27.6% preferred four modes (quad-modal) (31).

Eighty-nine students (48.4%) in Iran research ranging from medicine to pharmacy to dentistry to undergraduate nursing and health services management favored a single-modal learning style. The remaining 95 students (51.6%), on the other hand, preferred multimodal learning techniques (32).

In Turkey study among first-year medical students also found that 63.9% of students were preferred multimodality followed by unimodality preference (36.1%). Kinesthetic learners made up 23.3%, auditory learners 7.7%, visual learners 3.2%, and read-write learners 1.9% of the 155 students (7).

In India and Thailand studies multimodal learning styles the commonest preference. In India, most students had a multimodal of learning styles (68.7 %). Aural (45.5%) and kinesthetic (33.1%) were the most common learning modalities for unimodal (33). Another Indian study found multimodal the most common, and kinesthetic learning was the most common unimodal learning (34). In Thailand study medical students had preferred unimodal (35%), bimodal (12.9%), trimodal (18.6%) and a quad modal (43.6%) learning style (35). However, in Malaysia study among preclinical medical students unimodal learning style (81.9%) was the commonest while the remaining 76 (18.1%) used a multimodal learning style. Among the unimodal learners, 30.5% were kinesthetic (36). Another Malaysia study found that 85.8% of medical students had preferred unimodal learning style and of these 65.5% were visual learners (37).

In a USA study among preclinical students including nursing, physician's assistant and physical therapy, multimodal was the commonest and high proportion of kinesthetic learners found from unimodal (38). In West Indies study also showed that with no difference between males (59.5%) and females (60%), multimodal learning style was the predominant preference. The most popular learning styles were read-write (33.8%), followed by kinesthetic (32.5%). Females preferred read-write (34.2%), whereas males preferred kinesthetic (40.5%) (39).

According to a Nigerian study of preclinical medical students, the most common learning style was multimodal (69.6%). 28.2 % of multimodal learners were bimodal, 38.2 % were trimodal, and 33.6 percent were quad modal. Of the 30.45 unimodal learners, 2.5% were visual, 7% aural, 17% read-write, and 3.8 % were kinesthetic (40). However, in Egyptian study the predominate learning styles among medical students was unimodal and visual learners was the highest (41).

In Ethiopia study among various undergraduate health sciences students unimodal learning styles was the most common, and of these 25.3% were visual, 21.40% read-write 14.7% aural, 12% Kinesthetic (15).

Learning style relationship with academic achievement

There is conflicting evidence on the relationships between learning styles and academic achievement. In Saudi Arabia study among medical students showed that there was an association between learning styles with academic achievement; unimodal had a lower mean grade point than those with multimodal (quad-modal) learning style preferences (5). Other Saudi Arabia study also showed that multimodal learners had a higher cumulative grade when compared with unimodal learners (28).

Whereas, in one Iran study a significant association was found between academic achievement and the read-write learning style preference; students who had a read-write preference had a better academic performance (29). In another Iran study, there was no significant association between the mean of final exam score and learning styles of aural, read-write, and kinesthetic. Furthermore, there was no significant correlation between final clinical course results and learning style preferences. However, there was a significant difference in the mean final exam scores between students who preferred visual learning style; they had higher mean scores (30). Another Iran study among dental student also found there was no association between learning styles and academic achievement (42).

However, other studies in the same setting among dental students found that learning style preferences were not associated with academic achievement, marital status, residency, and student learning recourses. There was an association between learning style preferences and students in different teaching curricula (13). Similar findings found in the Turkey study there was no statistically significant difference between the first-semester grade average points and learning styles of medical students (7).

In Malaysia study among medical students learning styles and approaches were significantly associated with learning outcome (36). Another Malaysia study among medical students found statistically higher performance among multimodal learners compared with unimodal learners (37). Whereas in Thailand study on a similar subject indicated that learning styles were not

associated with students' grade point achievement (35). Indian study also reported there was no association between learning styles and academic performance (34).

A USA study showed that study time and course score performance on Anatomy and Physiology were significantly correlated with due to lecture teaching delivery. However, there was no significant association between learning styles and course scores (43). And Time spent on the study was not significantly associated with learning style (43).

Similarly, another study in the same setting found there was no correlation between learning style preference and general biology classes. However, kinesthetic preference was found to have a significant negative correlation in later human anatomy and positive correlation with general physiology classes. The evaluation performance of nursing students in anatomy and physiology revealed negative and positive associations with aural and visual preference, respectively (38).

There were considerable variations in perceived and evaluated learning style preferences in the West Indies, according to research, with the majority of visual and read-write learners properly matching their perceived to their actual learning styles. Learning modality was linked to awareness of learning styles, but not academic performance, age, or gender. Multimodal learning was used by 60.7% of high performers and 56.9% of low achievers (39).

In Nigeria study, when compared to unimodal learning, unimodal learning had a statistically significant greater mean of academic performance. In the four groups of learning styles, there was a statistically significant difference in academic achievement among unimodal learners; Visual learners performed the best, followed by kinesthetic learners. There was also a statistically significant difference in academic achievement among multimodal learners, with quad modal learners having the highest mean performance and trimodal learners having the lowest (40). In Egyptians study among medical students showed there was no statistical difference on academic achievement by different learnings styles groups (41).

Learning style relationship with gender

There are also contradicting findings on the association between sex and learning styles. In Saudi Arabia study found that sex of medical students associated with learning styles. Females preferred more for multimodality than males (77.8% vs. 54.5%) (27). Another Saudi Arabia study also found there was variation in learning style preference by gender (28). Whereas another study in the same

setting found sex was not associated with learning styles among dental students (5). In Turkey study also found that the learning styles did not differ between male and female medical students (7).

Contradiction finding was found in two USA studies on the difference of learning styles and gender. A study among undergraduate physiology students showed male and female students have significantly different learning styles. According to this study, the majority of male students favored multimodal learning (VARK), but the majority of female students preferred unimodal learning style, with a preference for Kinesthetic. As a result, male and female students had very distinct learning styles (44).

In contrast, another study of medical students in the same context found that the quantity and types of modality combinations were not significantly different between women. The female student was more diverse than the male student population, though not significant (45). Similarly, the West Indies study found no difference in multimodal learning strategies between males (59.5%) and females (60%) in the West Indies. Read-write (34.2%) was the preferred sensory modality for females, while kinesthetic was preferred by males (40.5%)(39).

In two Iran studies found there were a relationship between learning styles with gender. There was a significant association between gender and the preference of visual and read-write styles (31). The other study in similar setting also documented that there was a significant relationship between gender and unimodal learning style. Male students favored the kinesthetic learning style more than female students, whereas female students preferred the aural learning type, according to the findings. (32). In addition, there was a significant difference between educational levels and choice of quad modal of VARK styles (31). Another Iranian study, on the other hand, revealed no correlation between male and female students' preferred learning modes (30). A study in India discovered that learning style choice was unrelated with gender or past academic success (33).

In Ethiopia study among undergraduate health science students and in Nigeria study among medical students found that there was no association between learning styles and gender (15, 40).

[Kolb Learning style Inventory](#)

The USA study among clinical laboratory students showed there was no significant difference between the students' examination results and learning styles. (46). Similarly, another study from

the United States found that students' learning styles did not show up to influence learning outcomes, except that divergent learning styles may be associated with learning in a distance environment (47).

The USA study among internal medicine and psychiatry students found that there were associations between learning style and gender (48). In another USA study also found there was no association between the learning style with gender and age (49).

There were no gender-related differences in learning styles, according to Chiles' research. Medical students, on the other hand, modify their preferred learning style from abstract-reflexive to abstract-active (50).

South Korea study among two groups of medical students found that the learning styles differ from generic medical students with other medical students who have various educational backgrounds. (51). However, research in Turkey found that curriculum models and other independent variables had no effect on learning style transformation. Medical students' learning methods may evolve over time (52).

In Iranian research conducted among dental students, it was discovered that students with assimilating and converging learning styles performed better on their educational success, however the difference was not significant ($P > .05$). The findings suggest that the prevailing learning style is not the only factor that influences educational attainment. Rather, it demonstrates students' learning preferences, which teachers should take into account while creating learning opportunities. (53). In another study conducted in Saudi Arabia, no link was observed between students' learning styles and their gender, grade point achievement, or specialty interest (54).

Conceptual framework

This conceptual framework shows the relationship between learning style and academic achievement. However, several factors that not measured can affect the relationship. For example, because of the curriculum, course requirements, and assessment technique, students may acquire a new learning style. The library's learning resources and the learning experience, such as having a previous clinical learning experience, may also influence the learning style. The learning style and academic achievement of students may be related to their gender and age because of personality, learning environment experience and other factors. The academic achievement and learning style may be linked to the study year. For example, students in preclinical and clinical years may not have the same learning style or academic achievement because of different learning environment and experience. Finally, the relationship between learning style and academic achievement may not be observed due to the course nature such as the basic course versus the clinical course, the teaching strategies, the learning strategies, the evaluation methods, and the time spent on study.

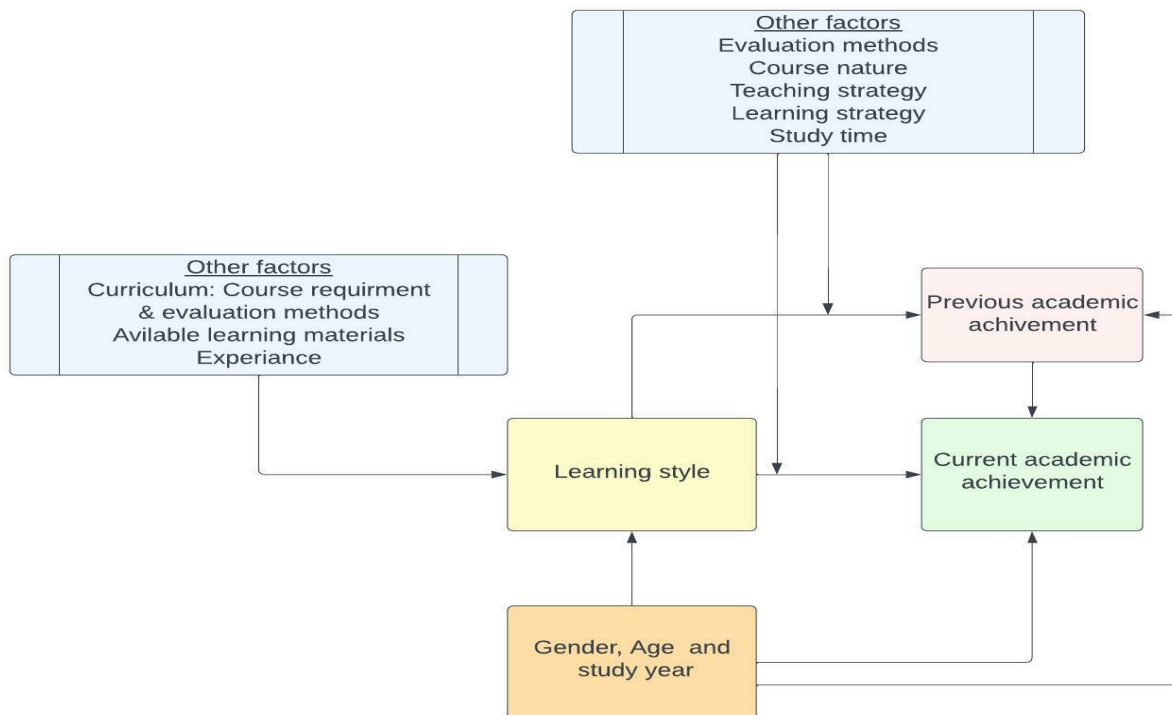


Figure 1: Learning styles relationship with academic achievement

Chapter-3: Objective and Research question

Objectives

General objective

To assess whether learning style preferences affect the academic achievement of medical students enrolled with new initiative medical education curriculum at Ambo University

Specific objectives

1. To assess learning style preferences of medical students
2. To compare learning style preferences medical students by demographic characteristics
3. To compare the academic achievement of medical students by learning style preferences

Research question

Is there a difference on the academic achievement of medical students by learning style preferences?

Chapter-4: Methodology

Study setting and period

Ambo University's College of Medicine and Health Sciences was the site of the research. Ambo University is one of Ethiopia's oldest higher education institutions, having been established in 2011 as autonomous higher education (55). The University currently offers 9 graduate and 39 undergraduate programs, divided among nine colleges/institutes/schools and 37 academic departments. The College of Medicine and Health Science has been starting since 2010 G.C with four departments; Public Health Officer, Nursing, Midwifery, Pharmacy, and the new initiative medicine education (NIME) program has started in 2012. The study was conducted from October 4 -31/2022

Research philosophy

A postpositivist philosophical view was applied in this study. In the postpositivist primarily interested to assess “the cause that influence the outcome” (18). The postpositivist answer hypothesis and research question by empirical observation and measurement of the reality which explained by numeric (18). The aim of this study is to investigate whether learning style affect the academic achievement of medical students which the base for the selection of the research philosophy and the research design.

Methods

Study Design

A cross-sectional study design was employed to assess the learning styles medical students and analyze whether the learning style associated with academic achievement using quantitative research approach.

Population

Regular medical students enrolled with New Initiative Medicine Education curriculum at Ambo University was the population for the study.

Eligibility

All secondary years and above medical students enrolled with New Initiative Medicine Education curriculum in Ambo University was eligible. However, transfer- in/or -out and incomplete academic record students was excluded from the study.

Participants and Sampling

All medical students who met the eligibility criteria invited to be a part of the study. Thus, sample size and sampling technique was not employed.

Variables

Dependent variables

Academic achievement of medical students for the first- and second-year courses was the dependent variable when the comparison of learning style with academic achievement was analyzed. Learning style preference was the dependent variable when the comparison of learning style with demographic characteristics analyzed.

Independent variables

The independent variables are:

- learning style preferences
- Demographic; age and gender
- Study year
- Previous academic achievement
- Previous degree

Data collection tool

Learning style preference was assessed by using a standard structured questionnaire VARK version 8.1. The VARK tool had acceptable internal consistency (Cronbach alpha 0.82) in this study. The academic achievement (semester grade) of two years for all courses was collected from the registrar's document. Other variables such as sex, age, previous academic achievement, and previous profession information were collected from students.

Data collection procedures

Data were collected from primary and secondary sources. A self-administered questionnaire was used to fill the questions using a paper-based form after orientation was given to students. The academic record review was made to obtain the academic achievements.

Statistical analysis and interpretation

Learning style preference data was entered into Epi Info version 7 and exported to Microsoft Excel. The VARK scoring chart done for each choice (a, b, c, d) of 16 questions. The non-identifiable VARK score data were given to VARK company to classify the dominant learning styles of the students based on their algorithm. For statistical analysis, the quantitative data were exported to STATA version 14. To check the data distribution, data exploration was performed using univariate analysis. For continuous variables, descriptive statistics such as mean with standard deviation and median with interquartile range (IQR) were used, and for categorical variables, percentage was used.

Kruskal-Wallis ANOVA was used to examine cumulative grade point achievement statistically significant difference by five groups of learning styles. Kruskal-Wallis ANOVA was used because the sample in five groups learning styles was small and cannot fulfil the one-way ANOVA assumptions. Student t-test statistics was used to compare mean of cumulative grade point achievement by two groups learning styles (unimodal and multimodal). Moreover, a chi-square test was also used to assess the association between learning style and academic achievement when the variables grouped into two groups. The learning styles score was compared by gender and age using student t test. The learning styles score comparison by study year was done by one-way ANOVA. Additionally, the association between two groups of learning styles (unimodal and multimodal) and demographic characteristics was made by chi-square test. The VARK score statistical correlation with academic achievement was computed using Pearson correlation. The P-value less than 0.05 was used to determine the statistically significant difference or association.

Ethical clearance

An ethical clearance letter was obtained from Jimma University Institute of Health Ethical Review Board. A permission was obtained from the department of medicine at Ambo University. An informed consent was asked for participation after disclosure of the information related to the

research objective, benefit, risk, and confidentiality of information. The participant's information was kept confidential and used only for a research purpose. Any personal information is not included in the result of the research. All identifiable information was recoded as unidentifiable code.

The data collection was made according to the national ministry of health and World health recommendations. The data collection was collected in carefully according to COVID-19 protection measurement wearing face mask, and adequate distance between the participants and data collectors in the classroom. The data collectors were trained the standard operating procedure of data collection during COVID-19 pandemic.

Dissemination and Publication plan

The research finding was communicated to Jimma University, Institute of Health since and to different conferences including annual conference conducted at Ambo University. An attempt will be made to publish at an international peer-reviewed journal.

Chapter-5: Result

Demographic and background characteristics

A total of 92 medical students participated, with a response rate of 95.74%. The study included students from second year through sixth year (graduate). Most of the students (87%) were male. The students' median age was 29 years, with 73% of them being between the ages of 25 and 30 years. The mean cumulative grade for the previous degree was 3.46 (± 0.25) (see table 2). Most of the students have a background of health profession (see figure 1).

Table 2: Demographic and background characteristics of medical students

Variables	Frequency	Percent (%)
Gender		
Male	80	86.96%
Female	12	13.04%
Age in year		
25-30	73	79.35%
31-36	19	20.65%
Median (IQR)	29 (2)	
Academic Year		
Second	19	20.65%
Third	25	27.17%
Fourth	23	25.00%
Fifth	16	17.39%
Sixth	9	9.78%
Previous degree cumulative grade point (GPA)		
Mean(\pm Sd)	3.46 \pm 0.25	

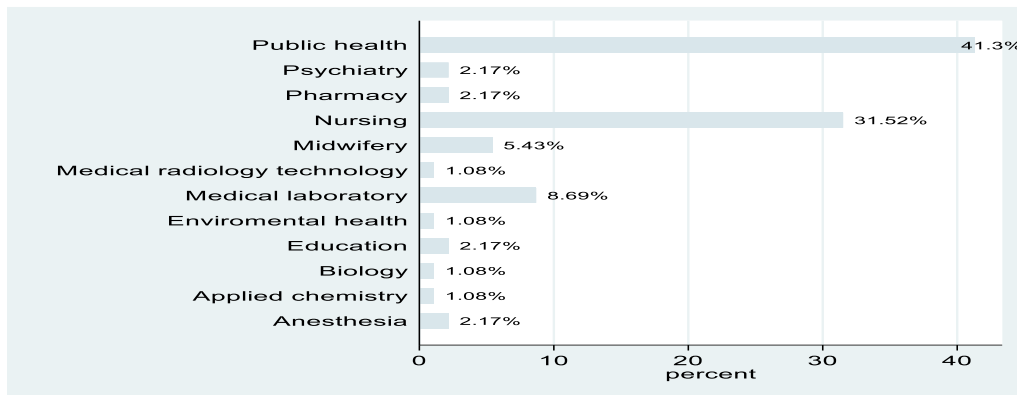


Figure 2: Previous degree profession of medical students

Learning style preferences

Fifty-four medical students (58.70%) had a unimodal learning style whereas the remains 38 medical students (41.30%) had two or more learning styles (multimodal). Kinesthetics accounted for 61% of the 54 medical students with unimodal learning style preference, followed by visual learners (18.51%), aural learners (12.96%), and read -write learners (7.4%). From 38 multimodal medical students, 94.74% had a quad-modal (VARK) and the remaining 5.26% had a bi-modal (VK and RK) (see figure 2).

Learning styles were similarly distributed by gender and age of the student. However, read-write learning style preference was not found among female students and in the third, fifth- and sixth year students (See table 3).

Table 3: Learning styles distribution by demographic characteristics

Variables	Sample	V	A	R	K	Multimodal
Gender						
Male	80	9(11.25%)	5(6.25%)	4(5.00%)	29(36.25%)	33(41.25%)
Female	12	1 (8.33%)	2 (16%)	0	4 (33.33%)	5(41.67%)
Age in year						
25-30	73	8 (10.96%)	6 (8.22%)	3 (4.11%)	25(34.25%)	31(42.47%)
31-36	19	2 (10.53%)	1 (5.26%)	1 (5.26%)	8 (42.11%)	7 (36.84%)
Academic year						
Second	19	3(15.79%)	3 (15.79%)	3(15.79%)	5 (26.32%)	5 (26.32%)
Third	25	3(12.0%)	1 (4.0%)	0	11 (44.0%)	10 (40.0%)
Fourth	23	2 (8.70%)	2 (8.70%)	1 (4.35%)	7 (30.43%)	11(47.83%)
Fifth	16	0	1(6.25%)	0	6 (37.50%)	9 (56.25%)
Sixth	9	2 (22.22%)	0	0	4 (44.44%)	3 (33.33%)
Total	92	10(10.87%)	7 (7.61%)	4(4.35%)	33(35.87%)	38(41.30%)

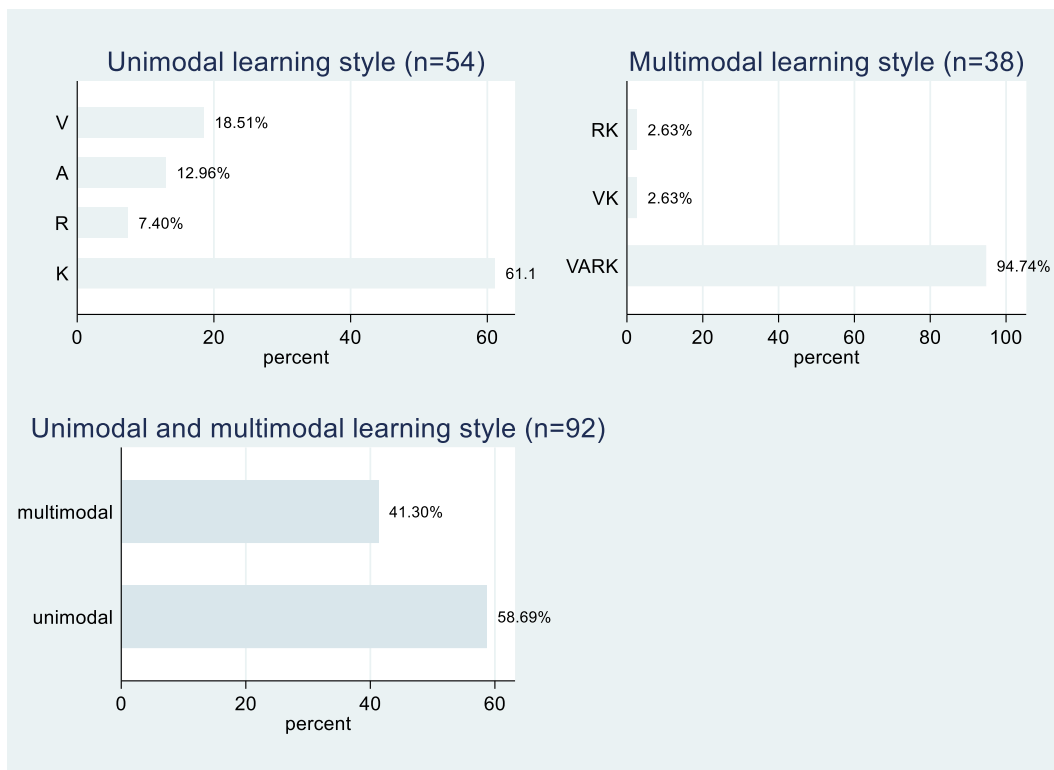


Figure 3: Unimodal and multimodal learning styles of medical students

Comparison of learning styles score by demographic characteristics

The mean of learning style score on the four groups of sensory modalities, Visual, Aural, Read-write, and Kinesthetic, was not statistically significant different by gender, age, and study year of medical students (P value > 0.05) (see table 4).

Table 4: Comparison of learning styles scores by demographic characteristics

Variables	Sample	V score	A score	R score	K score
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Gender					
Male	80	4.46 \pm 2.93	4.61 \pm 2.99	5.21 \pm 2.97	7.96 \pm 3.04
Female	12	4.08 \pm 1.92	4.91 \pm 3.87	4.91 \pm 2.31	7.66 \pm 2.87
P value		0.666	0.753	0.742	0.752
Age in year					
25-30	73	4.52 \pm 2.82	4.52 \pm 3.11	5.38 \pm 2.90	7.95 \pm 3.09
31-36	19	4.00 \pm 2.80	5.15 \pm 3.05	4.36 \pm 2.73	7.78 \pm 2.71
P value		0.476	0.427	0.173	0.828
Academic year					
Second	19	3.63 \pm 2.13	4.47 \pm 3.13	5.05 \pm 2.63	6.57 \pm 2.77
Third	25	4.52 \pm 3.00	4.32 \pm 3.19	4.88 \pm 2.89	8.64 \pm 2.44

Fourth	23	4.21 ±3.39	4.60 ±3.39	5.17 ±2.88	8.08 ±3.50
Fifth	16	4.93 ±2.54	5.75 ±3.25	5.81 ±3.18	7.75 ±3.41
Sixth	9	5.33 ±2.44	4.11 ±1.36	5.11 ±3.33	8.66 ± 2.34
P value		0.545	0.629	0.902	0.208
Total	92	4.41 ±2.81	4.65 ±3.10	5.17 ±2.88	7.92 ±3.00

After grouping the learning styles into two groups; unimodal and multimodal, the chi-square test indicates that there was no statistical association between learning styles with gender (P value=0.978), age (P value=0.657) and study year (P value=0.421) (see table 5).

Table 5: The association between learning styles and demographic characteristics

Variables	Sample	Unimodal	Multimodal	Chi-square	P value
Gender					
Male	80	47 (58.75%)	33 (41.67%)	0.0007	0.978
Female	12	7 (58.33%)	5 (41.67%)		
Age in year					
25-30	73	42 (57.53%)	31 (42.47%)	0.1967	0.657
31-36	19	12 (63.16%)	7 (36.84%)		
Academic year					
Second	19	14 (73.68%)	5 (26.32%)	3.89	0.421
Third	25	15 (60.0%)	10 (40.0%)		
Fourth	23	12 (52.17%)	11 (47.83%)		
Fifth	16	7 (43.75%)	9 (56.25%)		
Sixth	9	6 (66.67%)	3 (33.33%)		

Academic achievement

The mean cumulative grade of medical student for the first and second academic year was 3.14 (±0.40) and 3.15 (±0.38), respectively. There was no statistical significance mean difference in both first- and second year cumulative grade achievement by gender (P value =0.59 & 0.86) and study year (P value=0.6 & 0.64). However, there was a statistical significance mean difference (0.24) in first year cumulative grade achievement by age category groups (P value =0.022). The mean first year cumulative grade for medical students aged 25 -30 years and 31 – 36 years was 3.20 (±0.41) and 2.94 (±0.36), respectively. There was also a statistically significant association between age of students' and first year cumulative grade after categorizing the academic grade into three groups (CGPA <3, 3-3.49 and >3.5) (P value= 0.029). However, there was no

statistically significant association between age of students' and second year cumulative grade (P value=0.556) (see figure 4). In the second academic year, there was no statistical significance mean difference in the cumulative grade achievement by demographic variables (see table 6)

Table 6: comparison of average academic achievement by demographic characteristics

Variables	Sample	Year I CGPA		P value	Year II CGPA		P value
		Mean \pm SD	95%CI		Mean \pm SD	95%CI	
Gender							
Male	80	3.16 \pm 0.40	3.07, 3.25	0.591	3.16 \pm 0.38	3.07, 3.24	0.861
Female	12	3.09 \pm 0.46	2.80, 3.38		3.13 \pm 0.47	2.84, 3.43	
Age in year							
25-30	73	3.20 \pm 0.41	3.10, 3.29	0.022	3.19 \pm 0.40	3.10, 3.28	0.063
31-36	19	2.96 \pm 0.36	2.79, 3.13		3.01 \pm 0.34	2.84, 3.17	
Academic year							
Second	19	3.23 \pm 0.39	3.04, 3.42	0.600	3.04 \pm 0.32	2.89, 3.19	0.648
Third	25	3.19 \pm 0.41	3.02, 3.36		3.16 \pm 0.43	2.99, 3.34	
Fourth	23	3.08 \pm 0.43	2.89, 3.26		3.17 \pm 0.38	3.01, 3.33	
Fifth	16	3.17 \pm 0.46	2.92, 3.41		3.25 \pm 0.48	2.99, 3.50	
Sixth	9	3.01 \pm 0.41	3.02, 3.36		3.15 \pm 0.43	2.99, 3.34	
Total	92	3.14 \pm 0.40	3.06, 3.23		3.15 \pm 0.38	3.07, 3.23	

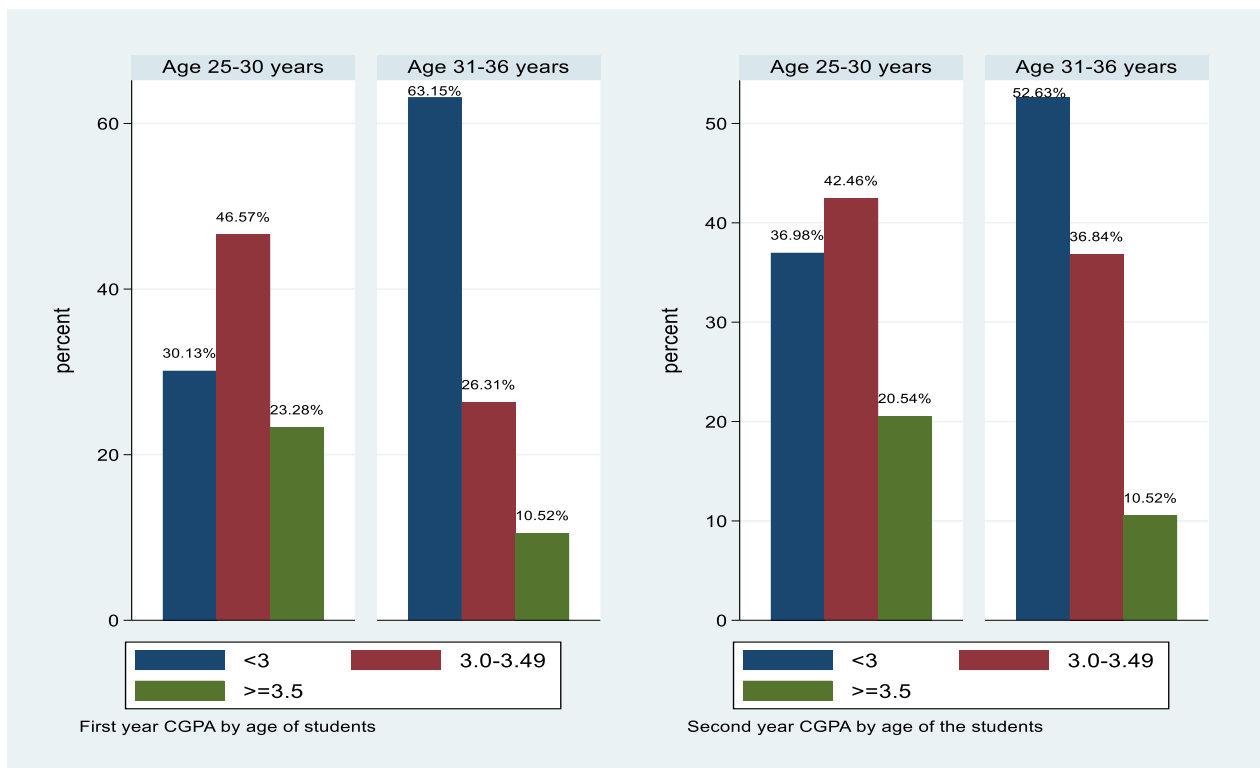


Figure 4: First- and second-year cumulative grade by age of students

Comparison of academic achievement by learning style

Medical students with Kinesthetics learning style had a statistically non-significant higher median of first year (median=3.21) and second year (median=3.24) cumulative grade achievement compared to read-write, visual, aural, and multimodal. The one-way analysis Kruskal-Wallis ANOVA showed that there was no statistically significant difference in the median cumulative grade achievement between the five groups of learning styles in both the first and second academic years (P value=0.6077 & 0.3731) (see table 7). The percentile distribution of the cumulative grade by learning styles for both first and second academic year displayed in Figure 5. However, there was a statistically significant positive correlation between the kinesthetic score and second year cumulative grade achievement of medical students ($r=0.22$, P-value=0.033) (see annex 1 table S5)

Table 7: Comparison of median academic achievement by five groups of learning styles

Learning styles	Sample	Year I CGPA		Year II CGPA	
		Median (IQR)	P value	Median (IQR)	P value
V	10	2.99 (0.33)	0.6077	2.90 (0.42)	0.3731
A	7	3.11 (0.56)		3.05 (0.32)	
R	4	3 (0.64)		2.86 (0.46)	
K	33	3.21 (0.52)		3.24 (0.53)	
Multimodal	38	3.16 (0.56)		3.17 (0.66)	

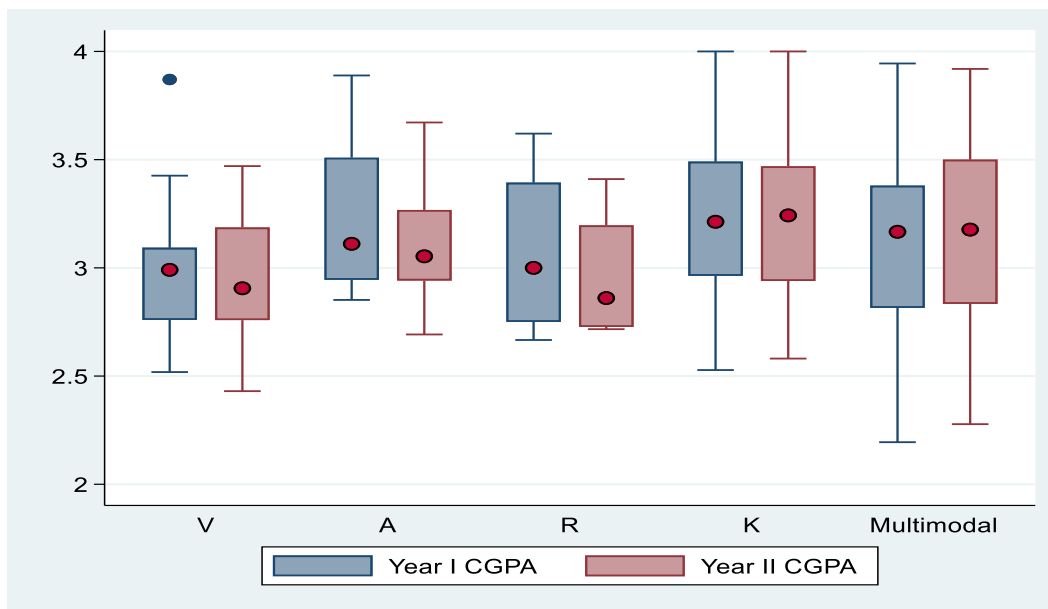


Figure 5: The percentile distribution of academic achievement by five group of learning styles

There was no also statistical significance difference in the mean cumulative grade achievement in both first and second academic year of medical students after grouping the learning styles into unimodal and multimodal learning styles. There was a similar mean cumulative grade achievement between these two groups in both academic years (see table 8 and figure 6).

Table 8: Comparison of mean academic achievement by two groups of learning styles

Academic achievement	Statistics	Learning style				P value
		Unimodal (n=54)	95%CI	multimodal (n=38)	95%CI	
Year I CGPA	Mean ±SD	3.17 ±0.38	3.07, 3.28	3.10 ±0.43	2.96, 3.25	0.4182
Year II CGPA	Mean ±SD	3.13 ±0.35	3.04, 3.23	3.17 ±0.44	3.02, 3.31	0.6762

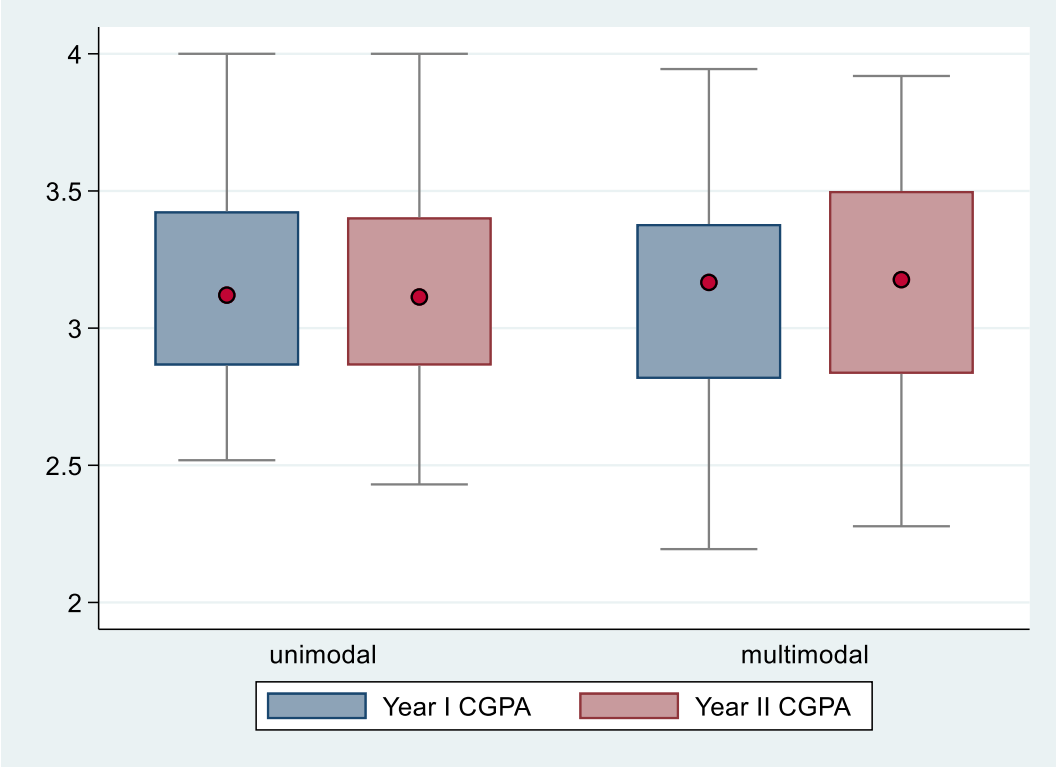


Figure 6: The percentile distribution of academic achievement by two groups of learning styles

Chapter-6: Discussion

Beyond the use of various type of learning theories, understanding the various learning styles and match with the teaching, and learning strategy are important. Indeed, this study evaluate the learning style preferences of 92 medical students enrolled in a new initiative medical education program and compared their academic achievement with learning style.

The participants for this study have completed first degree and most have health professional background. Indeed, the study participants different from the generic medical students in terms of learning experience and curriculum. The most common learning styles among medical students were unimodal (58.7%). The predominate learning style of medical student might be affected various factors including have an experience of previous degree and socio-cultural background. The current study is in line with previous research conducted in Ethiopia at Mekelle University among various undergraduate health science students, as well as studies conducted in Egypt and Malaysia among medical students, in which unimodal learning styles were found to be the most common (15, 36, 37, 41). However, this study contradicts multiple other studies, such as those conducted in Saudi Arabia, Iran, India, and Nigeria, which revealed that multimodal learning style was the most common (13, 27, 31, 33).

Unimodal learning styles preferences were dominated by kinesthetic learning styles (61%), followed by visual, aural, and read-write learning style preferences. The kinesthetic preference learners are better learn if the medical educator use practical exercise and case scenarios such as Problem based learning (PBL), case study, simulation laboratory, review of past exams and other methods related to real life experience (56). The constructivism learning theory and the teaching strategy derived from it could be used for the kinesthetic learning preference (21). However, it is critical to include other teaching strategies to accommodate the visual, aural and read-write learning preferences. As learning style is not a static (56), medical educators needs to help students to shift to the kinesthetic and multimodal learning style preference step by step because medical education by its nature is a practical learning.

The literature review showed that the predominate unimodal learning style was vary by setting and study participants. Our study is contradicting with research conducted in Ethiopia and Egypt, which found that visual learners were the most common among health science students (15, 40, 41). Our study also contradict with Nigeria and Ethiopia (Wollega University) studies among

medical students they found read-write was the predominate from unimodal learning style (16, 40). However, this study is consistent with an India and Turkey studies in which kinesthetic learning style was predominated from unimodal learning style (7, 34). Differences in socio-cultural backgrounds, experience and learning environment may influence students' preferred learning styles. Students may also adopt a new learning style because of the curriculum (the course requirements), assessment method, and learning materials available in the library (4, 56).

Of the 38 medical students (41.3%) who preferred multimodal learning style, 94.7% preferred quad-modal and 5.3% preferred bi-modal. This study did not find the tri-modal type of multimodal learning style. One of the explanations for the absence of trimodal and small proportion of bimodal learning style in this study could be due to the small sample size. However, the fact that most multimodal students were quad-modal (VARK) is a good opportunity for learning because student can match with different teaching strategies. This is contradicted with research conducted in Ethiopia at Mekelle University they found that the majority of multimodal learners (73.3%) were preferred bimodal, followed by trimodal (15). Variation on the study participants in terms of experience, and enrollment program (different curriculum) could be the reason for the inconsistency.

In this study, we found no statistical significance difference on the four groups of learning styles score (VARK) by gender, age, or year of study. The two groups of learning styles (unimodal and multimodal) were not also associated with gender, age, and study year of medical students. The proportion of female participants in this study was small (13%), thus the test statistics of significant difference of learning style score by gender needs further investigation. According to the literature review, there is inconsistency in the relationship between learning style and gender. Learning style preference difference by gender was found in studies conducted in Saudi Arabia and Iran among medical students, as well as in a study conducted in the United States among physiology students (27, 28, 31, 32, 44). However, a lot of studies conducted in Ethiopia, Nigeria, India, and other countries found that gender was not associated with learning style (15, 33, 40). This research also supports Malaysian study that found learning style was unrelated to medical students' gender and age (37). Although it is expected that student may shift their learning style through their study period related with the nature of the course requirement (56), in this study there was no statistical significance difference of learning style score over the study year. One possible reason for this

might be the students have previous undergraduate degree and most of them have health professional background.

Medical students with kinesthetic learning styles had a higher median cumulative grade point in both first year and second year compared to other learners, but this was not statistically significant. Because the sample size is not too large it might not well show the distribution of the predominate learning style among the five groups. However, there was a statistically significant positive correlation between the kinesthetic score and the second-year cumulative grade achievement. The strength of correlation was small ($r=0.22$). The sample size become large enough to show the effect of correlation of VARK score with academic achievement when all participants' VARK score was used in the correlation analysis.

The statistical test difference of academic achievement by learning style preferences of medical students did not change after the learning styles grouped into two; unimodal and multimodal. Even though having a multimodal learning style preference is beneficial to align with multiple teaching strategies, no statistically significant academic achievement difference was found between unimodal and multimodal. There was also no association between the two group of learning style preferences and academic achievement after categorizing the cumulative grade into three groups (CGPA <3 , $3-3.49$ and ≥ 3.5) (see annex 1). This could be due to multiple factors including the employment of numerous teaching strategies to suit students' learning styles and/or the students' learning strategy might fit with their learning styles. Although the implemented teaching methods were not assessed in this study, the curriculum indicated that lecture, skill lab and problem-based learning (PBL) are the primary teaching strategies for the first two years in the system module (57). Thus, there are an indication that the implemented teaching strategies were more than two which might be the reason for not found association between learning style and academic achievement. One of the other reasons for the inability to distinguish between unimodal and multimodal learners on the academic achievement could also be due to the evaluation approach. The evaluation approach might not be well designed in terms of difficulty level or might not be employed various assessment methods which could not be able to differentiate multimodal learners with unimodal on the academic achievement. Saying this in another way, the evaluation methods might fit with various learning preferences. Lastly, the course nature might affect the relationship between learning style and academic achievement. The first two-year students were taking the

basic and public health courses which is more theoretical which might not be able to make difference on the academic achievement across different learning style preferences or the courses content might fit with the various learning styles. The above-mentioned factors might be the reasons to be similar academic achievement across learning styles.

There is conflicting evidence in numerous research about the relationship between learning styles and academic achievement. The relationship between learning style and academic achievement was already observed in studies done in Saudi Arabia, Malaysia, and Nigeria (5, 29, 37, 40). According to these research, multimodal learners outperformed unimodal learners in terms of academic achievement. However, several studies among medical students such as in Egypt, India, Thailand, and Turkey found no relationship between learning style and academic achievement (7, 13, 34, 35, 41). According to the recent review of the literature, four out of six studies were not found the association between learning styles (VARK) and academic achievement among health sciences students (14).

Generally, learning style was associated with cumulative grade point of previous degree but not with current study. Multimodal had a higher cumulative grade point of previous degree compared unimodal learners (see annex 1). Most of the participants (95%) have health professional background in various disciplines for their first-degree study. Thus, multiple factors might interplay in the relationship between learning style and academic achievement these including the teaching strategy, the different assessment methods, the different curriculum, and the experience. It is also difficult to know whether the current students' learning style preferences are the same as they were study their previous degree.

Strengths and limitations

Strengths

This study used a standard learning style inventory to assess the students learning style preferences. The sample size is adequate for two groups of learning style; unimodal and multimodal and to assess the association with academic achievement of the students. The study indicated the pedagogical implications and related learning theory based on the predominate learning styles of the students.

Limitations

This study was conducted among 92 medical students enrolled in the new initiative medical education curriculum, so the sample size might be insufficient to adequately represent the five groups or more learning styles. As a result, the findings are limited to the participants included in this study. This study did not collect information on the teaching strategy, the learning strategy, the time spent on study, or the assessment methods, all of which could have an impact on the academic achievement.

Chapter-7: Conclusions and recommendations

Conclusions

The majority of medical students enrolled in the new initiative medical education curriculum program had unimodal learning styles, with kinesthetic learning styles taking the lead, followed by visual, aural, and read-write learning styles. The most multimodal learners preferred a quad-modal learning (VARK). Medical students' learning style preferences were not statistically different by gender, age, or year of study. In the first and second year, kinesthetic learners had greater median cumulative grades but not statistically significant. But the kinesthetic score was positively correlated with the second-year cumulative grade which was statistically significant.

Recommendations

Multiple teaching strategies but focus more on the kinesthetic teaching strategies such as case study, practical exercise, PBL, demonstration and experience sharing can balance students' learning preferences. However, it is critical to conduct ongoing assessments of learning styles and match the teaching strategy with the students' learning styles. Students may also plan better their learning strategy if they aware their learning style. To fully comprehend the relationship between learning styles and academic achievement, more research with a large sample size is necessary.

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Annex

Annex 1: supplementary information

Comparison of academic achievement of previous degree by learning styles

The analysis of Kruskal–Wallis one-way ANOVA also showed that there was no statistically significant difference in the median cumulative grade achievement of previous degree between five categories of learning styles (P value=0.0871). Medical students with read-write and multimodal learning styles had a non-statistically significant a higher median cumulative grade achievement of previous degree compared to aural, Kinesthetics and visual learning styles (see table s1 and figure S1)

Table S1: Comparison of median cumulative grade of previous degree by five group of learning styles

Learning style category	Sample	Previous degree CGPA	
		Median (IQR)	P value
V	10	3.42 (0.32)	0.0871
A	7	3.4 (0.43)	
R	4	3.62 (0.34)	
K	33	3.33 (0.38)	
Multimodal	38	3.57 (0.35)	

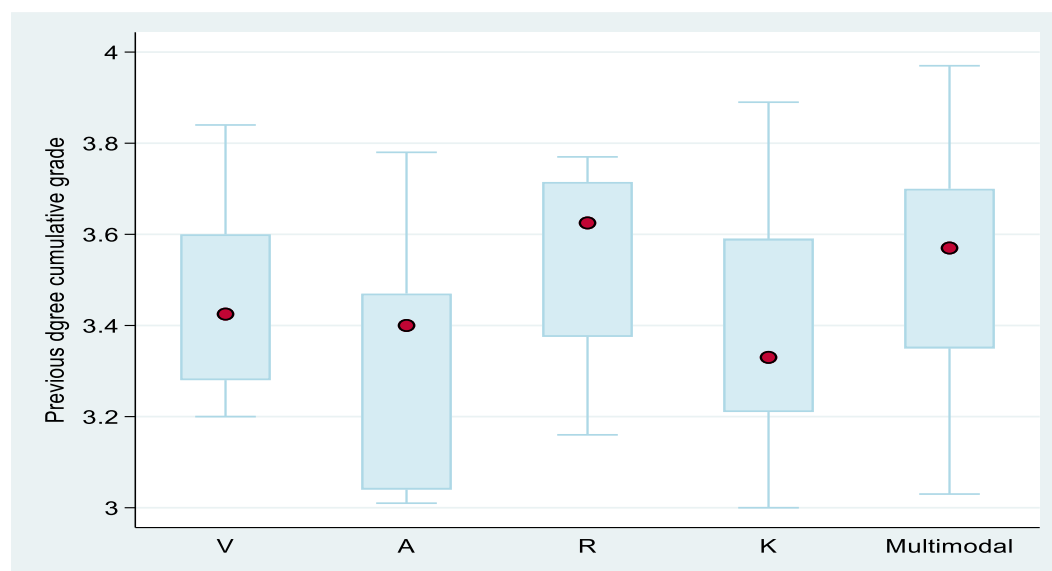


Figure S1: The percentile distribution of previous degree academic achievement by five groups of learning styles

The previous cumulative grade point achievement (CGPA) was statistically significant different between two groups of learning styles: unimodal and multimodal. The mean of previous degree cumulative grade achievement for multimodal learning style of medical students was 3.55(± 0.24), while the mean of previous cumulative grade achievement for unimodal learning style was 3.40(± 0.23), with the mean difference of 0.14 statistically significant (P value=0.0071) (see table S2). For medical students with multimodal learning styles, the predictive mean of prior cumulative grade was 3.55 (95% CI: 3.47, 3.62), while the predictive mean of previous cumulative grade for unimodal learning was 3.40 (95% CI: 3.34, 3.47) (see figure S2).

Table S2: comparison of mean cumulative grade point of previous degree by two groups of learning styles

Learning style	Cumulative grade point achievement		P value
	Mean \pm SD	95%CI	
Unimodal (n=54)	3.40 \pm 0.23	3.34 3.47	0.0071
Multimodal (n=38)	3.55 \pm 0.24	3.41 3.51	

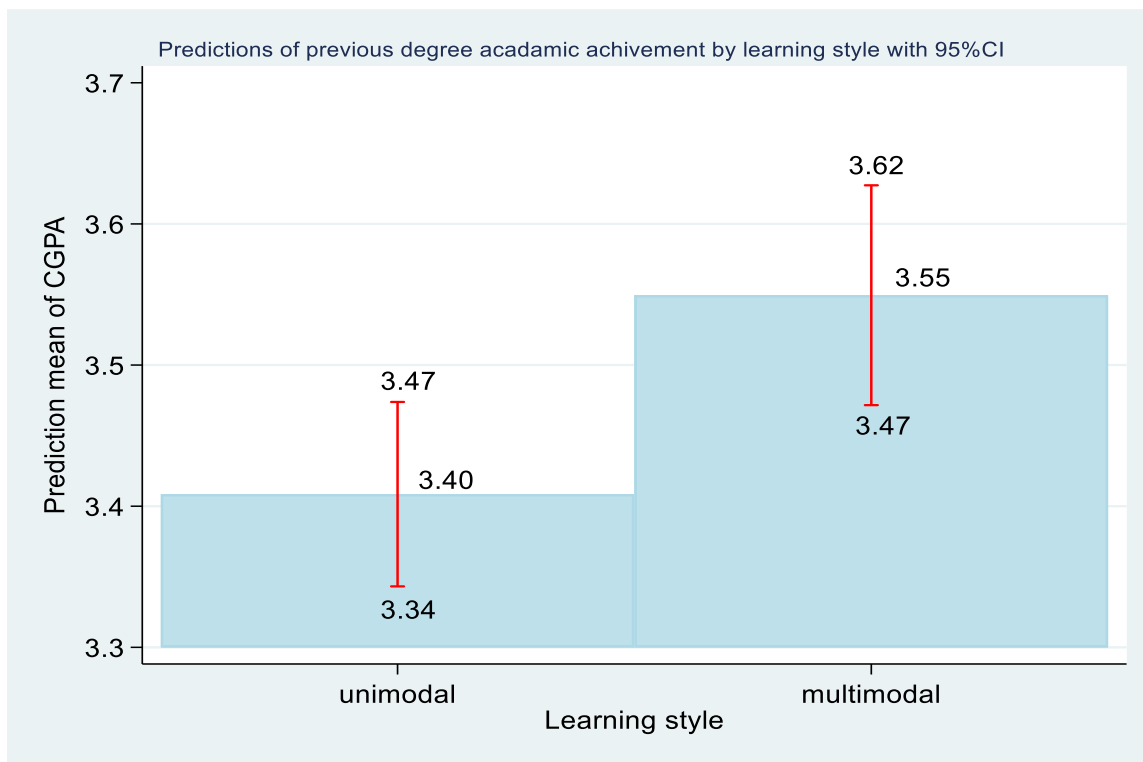


Figure S2: The predictive mean cumulative grade of previous degree by two groups of learning styles

Table S3: Learning style association with first year cumulative grade

Year I CGPA	Learning styles		Chi2 (P value)
	Unimodal	Multimodal	
<3	20 (37.04%)	14 (36.84%)	0.24 [0.887]
3.0-3.49	22 (40.74%)	17 (44.74%)	
>=3.5	12 (22.22%)	7 (18.42%)	
Total	54 (100%)	38 (100%)	

Table S4: Learning style association with second year cumulative grade

Year II CGPA	Learning styles		Chi2 [P value]
	Unimodal	Multimodal	
<3	22 (40.74%)	15 (39.47%)	1.27 [0.530]
3.0-3.49	24 (44.44%)	14 (36.84%)	
>=3.5	8 (14.81%)	9 (23.68%)	
Total	54 (100%)	38 (100%)	

Table S5: The correlation between the VARK score and academic achievement

		Year I CGPA	Year II CGPA
V	Pearson correlation (r)	.004	.114
	P value	.969	.278
A	Pearson correlation (r)	.003	.075
	P value	.974	.476
R	Pearson correlation (r)	.005	.067
	P value	.962	.528
K	Pearson correlation (r)	.133	.222
	P value	.205	.033

Annex 2: Written Informed consent

Dear student

I am doing research entitled “Learning styles preferences and its association with academic achievement among medical students enrolled with New Initiative Medical Education curriculum at Ambo University” for partial fulfillment of the requirements for the Master of Science of Health Professional Education (MHPE) at Jimma University. The study aimed to compare learning style with academic achievement. The research information is expected to improve the teaching-learning practices of the New Initiative medical education program. There are no harms associated with this study. Your honest information is highly valuable for the successful completion of the study and helps to improve medical education. The questionnaire has three parts socio-demographic, learning style, and academic achievement assessment; you will fill the first two sections of the questionnaire. The third section of the questionnaire will be assessed through a record review of your academic achievement by the research team only if you agree to participate in this study. If you agree to participate in this study, you fill a questionnaire that approximately takes 30 minutes, and your academic score will be reviewed from the registrar's office record. The information you provide is kept confidential and used only for a research purpose. Any personal information will not be included in the result of the research. But we will ask your student id to match your learning style result with academic achievement. All information collected from you and your record review will be kept confidential with the principal investigator and all identifiable information will be recorded as unidentifiable code once students' learning style is matched with academic achievement.

A copy of the thesis finding will be communicated to Ambo University to improve the teaching strategy of medical education. Therefore, if you wish to participate in this study, please sign your consent with full knowledge of the study's purpose and procedures.

I thank you, in advance, for your valuable cooperation.

Name: _____

Sign

Date

Annex 3: Questionnaire

Section 1: Demographic and educational background characteristics. Please answer the following questions

1. Student ID (please write it as registrar recorded):
2. Age (Years)
3. Sex: 1=Male 2=Female
4. The academic year of study: 1= second year, 2= Third year, 3= Fourth year, 4=Fifth year
5=Six year
5. Current academic Semester: 1= First 2= Second
6. First-degree profession:
7. First degree cumulative Grade point (out of 4):

Section two: The VARK Questionnaire (Version 8.01)

How Do I Learn Best?

Choose the answer which best explains your preference and circle the letter(s) next to it. Please **circle more than one** if a single answer does not match your perception. Leave blank any question that does not apply.

1. I need to find the way to a shop that a friend has recommended. I would:
 - a. find out where the shop is in relation to somewhere I know.
 - b. ask my friend to tell me the directions.
 - c. write down the street directions I need to remember.
 - d. use a map.
2. A website has a video showing how to make a special graph or chart. There is a person speaking, some lists and words describing what to do and some diagrams. I would learn most from:
 - a. seeing the diagrams.
 - b. listening.
 - c. reading the words.
 - d. watching the actions.
3. I want to find out more about a tour that I am going on. I would:
 - a. look at details about the highlights and activities on the tour.
 - b. use a map and see where the places are.
 - c. read about the tour on the itinerary.
 - d. talk with the person who planned the tour or others who are going on the tour.

4. When choosing a career or area of study, these are important for me:
 - a. Applying my knowledge in real situations.
 - b. Communicating with others through discussion.
 - c. Working with designs, maps or charts.
 - d. Using words well in written communications.
5. When I am learning I:
 - a. like to talk things through.
 - b. see patterns in things.
 - c. use examples and applications.
 - d. read books, articles and handouts.
6. I want to save more money and to decide between a range of options. I would:
 - a. consider examples of each option using my financial information.
 - b. read a print brochure that describes the options in detail.
 - c. use graphs showing different options for different time periods.
 - d. talk with an expert about the options.
7. I want to learn how to play a new board game or card game. I would:
 - a. watch others play the game before joining in.
 - b. listen to somebody explaining it and ask questions.
 - c. use the diagrams that explain the various stages, moves and strategies in the game.
 - d. read the instructions.
8. I have a problem with my heart. I would prefer that the doctor:
 - a. gave me something to read to explain what was wrong.
 - b. used a plastic model to show me what was wrong.
 - c. described what was wrong.
 - d. showed me a diagram of what was wrong.
9. I want to learn to do something new on a computer. I would:
 - a. read the written instructions that came with the program.
 - b. talk with people who know about the program.
 - c. start using it and learn by trial and error.
 - d. follow the diagrams in a book.
10. When learning from the Internet I like:
 - a. videos showing how to do or make things.
 - b. interesting design and visual features.
 - c. interesting written descriptions, lists and explanations.
 - d. audio channels where I can listen to podcasts or interviews.
11. I want to learn about a new project. I would ask for:
 - a. diagrams to show the project stages with charts of benefits and costs.
 - b. a written report describing the main features of the project.
 - c. an opportunity to discuss the project.
 - d. examples where the project has been used successfully.
12. I want to learn how to take better photos. I would:

- a. ask questions and talk about the camera and its features.
 - b. use the written instructions about what to do.
 - c. use diagrams showing the camera and what each part does.
 - d. use examples of good and poor photos showing how to improve them.
13. I prefer a presenter or a teacher who uses:
- a. demonstrations, models or practical sessions.
 - b. question and answer, talk, group discussion, or guest speakers.
 - c. handouts, books, or readings.
 - d. diagrams, charts, maps or graphs.
14. I have finished a competition or test and I would like some feedback. I would like to have feedback:
- a. using examples from what I have done.
 - b. using a written description of my results.
 - c. from somebody who talks it through with me.
 - d. using graphs showing what I achieved.
15. I want to find out about a house or an apartment. Before visiting it, I would want:
- a. to view a video of the property.
 - b. a discussion with the owner.
 - c. a printed description of the rooms and features.
 - d. a plan showing the rooms and a map of the area.
16. I want to assemble a wooden table that came in parts (kitset). I would learn best from:
- a. diagrams showing each stage of the assembly.
 - b. advice from someone who has done it before.
 - c. written instructions that came with the parts for the table.
 - d. watching a video of a person assembling a similar table.

Section 3: Academic achievement record review

Student ID:

Courses	Course grade	Academic year	Academic Semester