

## The Power of Perception: Examining Learning Styles

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### Abstract

In educational psychology, the concept of individual learning styles has long been debated for its perceived influence on learning results. This study explored how varying the presentation of instructional methods—auditory, visual, and reading modalities—affected learning outcomes. Specifically, it examined whether learning outcomes differ based on the mode of instruction and whether individuals' preferred learning styles (auditory, visual, or reading) influence these outcomes. Participants were either matched with their preferred learning style or not. Learning outcomes were measured in terms of test scores. The results of this study provided a different perspective for instructors to enhance students' learning, as findings suggest that utilizing different learning styles depending on students' preferences could limit students to their own learning style and potentially constrain their ability to develop a more versatile and adaptable approach to learning.

*Keywords:* learning styles, teaching methods, learning outcomes, memory recall, educational psychology

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## **The Power of Perception: Examining Learning Styles**

The idea that each student has a distinct learning style lacks empirical support. Research shows that personal learning styles have no significant impact on learning outcomes (Carroll, 2022; Pashler et al., 2008; Willingham, 2005a; Willingham et al., 2015). For example, explaining a difficult topic in a specific way, such as using visual images, demonstrates that effective teaching strategies can improve learning regardless of personal learning styles (Willingham et al., 2015). However, much of the existing research has focused on debunking the learning styles myth rather than experimentally exploring which presentation formats are most effective for learning. Few studies have directly compared different teaching modalities—such as visual, auditory, or written formats, while accounting for individuals’ stated learning preferences (Newton et al., 2021; Newton & Miah, 2017). Thus, instead of focusing on the preferred learning style of each individual, this study aimed to answer whether the presentation of teaching materials affects learning outcomes. Our research question was “do learning outcomes depend more on the presentation of teaching materials than on individual learning style preferences?” The study measured participants’ understanding and memory recall of the material presented, analyzing significant differences in learning outcomes across different methods using a one-way ANCOVA test. Our results indicated no significant difference in memory and recall across the three modalities. Recognizing the potential strengths and weaknesses of different methods for presenting learning materials can help educators better support their students’ academic success. This knowledge is essential for optimizing educational practices and enhancing teaching strategies across diverse learning environments (Ridwan et al., 2019).

### **Literature Review**

Understanding the effect of learning methods on learning outcomes is critical, as it challenges the widespread yet unsupported notion that matching teaching styles to individual preferences enhances learning. Theories, such as Kolb Learning Style Inventory, Howard Gardner’s Theory of Multiple Intelligences, and VAK Model suggest that individuals have distinct learning styles (Fallace, 2023; Oweini & Daouk, 2016; Romanelli et al., 2009; Sayi & Yurtseven, 2021). Learning styles are how an individual acquires information or solves problems (Chui et al., 2021), whereas teaching styles are how an educator delivers information to students. Research indicates that learning outcomes are influenced by how teaching materials are presented rather than each

individual's preferred learning style. For instance, if a student is experiencing difficulty learning about atoms, an educator may explain this concept by using a solar system visual analogy to aid their understanding. This does not necessarily mean the student is a visual learner; the analogy may just make the concept more relatable (Willingham, 2008). Contrary to popular belief, there is no credible evidence that each individual has a distinct learning style (Carroll, 2022; Willingham, 2005a; Willingham et al., 2015). Instead, the type of learning material being taught in the classroom can help determine the most suitable teaching modality (Willingham, 2005b).

Despite this criticism, learning styles are still considered valid by educators (Touloumakos et al., 2023). In fact, Touloumakos et al. (2023) note that the Centre for Educational Research and Innovation has identified learning styles as a neuromyth. A neuromyth is a view or opinion that originated from facts but became distorted through communication. The fact is that people have preferred learning styles, and the distortion is that learning with one's preferred learning style will impact the outcome (Daumiller & Wisniewski, 2023; Rogowsky et al., 2015). As for the other criticism, it is regarding the excessive number of models of learning styles, thus leading to miscommunication between educators, and a lack of consistent measurement that demonstrates high reliability and validity. In a study done by Rogowsky et al. (2020) on 5th graders, "68% [of them] do not even have a clear learning style preference. For the ones who do, receiving instruction in their preferred style did not equate with better learning" (para. 30). These findings align with those of Isa et al. (2021), who also found no significant relationship between learning styles and academic performance of final year undergraduate students. Their study showed that the types of learning styles did not contribute directly to students' academic achievement, further emphasizing that students' academic outcomes are not significantly affected by their preferred learning style. For undergraduate and postgraduate students, Srivastava & Shah (2021) found that learning improved when the learning style matched the instructor's pedagogical tool. Furthermore, on an individual basis, they believe that students may benefit from acknowledging their learning style to deepen their understanding of themselves and reach their full academic potential. On the other hand, Kohan et al. (2021), whose study was on virtual nursing students, argue that professors can increase student motivation and attendance by matching their learning style, despite their learning style not significantly impacting their academic performance. However, Rogowsky et al. (2020) caution that students should

learn in their non-preferred style, as solely using one's preferred learning style perpetuates a harmful mindset and discourages them from strengthening their weaknesses. Moreover, tailoring instruction to each student's preferred learning style is only practical in one-on-one settings. In a classroom, it may not be realistic as students have different learning preferences, making it difficult to teach everyone in a way that suits each person at the same time. Therefore, the best approach is to use the teaching method that best aligns with the material being taught.

## Methods

This study was a between-groups experimental design to investigate if learning outcomes are influenced by each individual's preferred learning style. We explored the potential impact of different learning styles (audio, visual, and reading) on memory recall and accuracy.

### Participants

Participants were recruited through convenience sampling, including both KPU students and the friends and family of the researchers. This approach allowed for a practical and accessible method of participant recruitment. A total of 60 participants were recruited from KPU SONA. The study was created using the Qualtrics platform and was shared with friends and family via a link to the survey. This allowed us to recruit 24 more participants, increasing the sample size to a total of 84 respondents. However, only the results from 67 participants were analyzed, as 14 participants did not pass the two attention check questions and 3 participants did not complete the study. The mean age of the participants was 22.7 years ( $SD = 6.71$ ).

**Table 1**

*Participants Demographics: Gender*

	<i>n</i>	<i>%</i>
Male	18	26.9
Female	48	71.6
Preferred not to say	1	1.5
Total	67	100

**Table 2***Participants Demographics: First Language*

	<i>n</i>	%
Cantone se	1	1.5
Chinese	1	1.5
English	45	67.2
Hindi	4	5.9
Nepali	3	4.5
Punjabi	13	19.4
Total	67	100.0

**Procedure**

Participants were given an adapted version of the VARK questionnaire (Vark, 2024) by Neil Fleming to determine their preferred learning style (Fleming, 1995). The original VARK questionnaire had another learning style, kinesthetic, which was not included in our research, as our study was conducted online, where hands-on, physical activity associated with the kinesthetic learning style is difficult to implement effectively in a virtual environment. The purpose of the VARK questionnaire was to identify the participants' preferred learning style and to compare the results with those who matched their preferred learning style and those who did not. While the three learning methods tested were given randomly, participants' preferred learning style generated from the VARK questionnaire was taken into account to keep a record of whether the participants received their preferred condition or not. This allowed us to check if participants with their preferred learning style performed differently than those who did not, which was analyzed using an independent samples t-test. The learning material for this study consisted of a fictional map (see Figure 1), as well as a written and oral description of the information that the map presents. Overall, the type of learning style was the independent variable, with three levels: audio, visual, and reading. The dependent variable was the accuracy of the test scores. The covariate was whether the participants' preferred learning condition matched their assigned condition.

Immediately, we measured participants' learning styles. We introduced them to our experiment, which employed a one-factor, three-level between-subjects design

(learning styles: audio, visual, and reading). We first assigned participants randomly to one of the three learning methods. Each participant was allowed 3 minutes to visually see (visual condition), hear an audio clip (audio condition), or read the instructional material (reading condition) corresponding to their assigned condition. Participants in the audio group were presented with a narration of the information; in the visual group, only the image of the map was presented, narrowing the focus by using illustrations such as arrows and numbers to relay the information to the participant; and the reading group were given a written description of the content. The study took approximately 20 minutes to complete. After completing reviewing the instructional material, all participants were asked the same series of questions to assess their understanding and memory recall of the material presented.

Lastly, a screening questionnaire was presented to gather demographic information such as age, gender, and first language, which were our control variables for the study (Frost, 2024). Finally, the data collected from all the groups was analyzed by conducting a one-way ANCOVA test to determine if there were significant differences in memory recall across the different learning methods used in this study.

## Results

We performed an independent samples t-test to explore the impact of the “condition matched” factor on test scores and compared the mean scores (see Table 3) of participants in the matched learning style condition versus those in the mismatched learning style condition. The results indicated that the participants who were matched with the condition of their preferred learning style ( $M = 6.1$ ,  $SD = 1.8$ ) did not have a significant difference than those who were not matched with their preferred learning style ( $M = 5.7$ ,  $SD = 1.8$ ),  $t(65) = .84$ ,  $p = .40$ . This supports our prediction that there is little or no difference in scores between the participants who were matched with their preferred learning styles and those who were not.

**Table 3**

*Group Statistics*

	<i>n</i>	<i>M</i>	<i>SD</i>
Condition			
Matched?			
Yes	31	6.1	1.8

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No	36	5.7	1.8
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Furthermore, we performed a one-way ANCOVA to compare the effect of three conditions: auditory, visual, or reading learning styles, on test scores while controlling the confounding effect of the learning condition being matched with the preferred learning style. Therefore, whether they were matched with their preferred learning style or not (i.e., condition matched) was used as a covariate to analyze the results. The covariate was non-significant,  $F(1, 63) = .85, p = .36$ , which suggests that the matching of the learning condition to participants' preferred learning style did not have a statistically significant effect on test scores. Levene's test was conducted to assess the equality of variances, and the assumptions were met,  $F(2, 64) = 2.32, p = .11$ . The results suggest that the mode of instructional delivery, whether auditory, visual, or reading, does not significantly impact learning outcomes. The main effect of learning types was non-significant,  $F(2, 63) = .10, p = .91$ . A follow-up post-hoc analysis using Tukey's HSD revealed no significant differences between any of the groups: reading vs. visual ( $p = .87$ ), reading vs. auditory ( $p = .94$ ), visual vs. auditory ( $p = .93$ ). These results suggest that the learning format (visual, auditory, or reading) did not significantly affect the test scores, further supporting our prediction that learning styles do not impact learning outcomes.

**Table 4**

*Dependent Variable: Scores*

	<i>M</i>	<i>SD</i>	<i>n</i>
Learning			
Condition			
Auditory	5.9	1.5	23
Reading	5.9	1.7	22
Visual	5.8	2.8	22
Total	5.9	1.8	67

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## Discussion

### Summary of Findings

Overall, this study aimed to assess the potential effects of different learning methods—written text, visual imagery, and audio narration—on the learning outcomes.

Specifically, we assessed participants' memory recall and understanding of the material, using a between-groups research design. The results showed that there were no significant differences between the test scores of the three learning methods, nor were there any significant differences in scores if the participants were matched with their preferred learning style compared to those who were not. This suggests that focusing on matching teaching styles to individual learning preferences may not be necessary for effective education.

### **Implications and Contributions**

The importance of this research is that it supports the idea that an individual's preferred learning style does not result in better outcomes. Instead, as Willingham (2008) explained, effective learning outcomes are influenced more by the method of presentation rather than matching the method to a student's preferred style. Our findings challenge the idea that matching learning methods to students' learning style preferences enhances learning, which emphasizes that teaching methods should be versatile and adaptable. The implications of this research are significant for educators, as they highlight the importance of using diverse learning strategies that do not rely on catering to perceived learning styles. Instead, an alternative approach that may be beneficial is for educators to incorporate various instructional methods, which could help support all students, regardless of their self-identified learning preferences.

### **Limitations**

This study has several limitations. We examined only three learning styles, excluding other existing ones, such as kinesthetic. Another possible limitation to this study is the small sample size of only 67 participants, further affecting generalizability to the rest of the population, as well as the use of convenience sampling, which could introduce bias since the samples may not be representative of the broader population. Furthermore, the unfamiliar nature of the learning task for participants may have contributed to the lack of significant differences in learning outcome scores. Moreover, using a between-subjects design and conducting the study cross-sectionally may have introduced additional limitations, such as variability in individual experiences that could influence results.

### **Future Directions**

To enhance the ecological validity of this research, future studies can test different subjects other than literature, such as mathematics, science, or hands-on activities, to

better reflect the simulation of real-world educational settings and curricula. As for the statistical validity, it can be enhanced by having larger and more diverse samples and changing the study's method. For example, this could be done by incorporating different learning complexities of the material and change the context in which learning occurs in order to produce more accurate and reliable results. Additionally, conducting this experiment in actual educational environments can provide insights into how the effectiveness of methods may vary in a practical context. Ultimately, future studies will be able to take this research into account in order to produce more comprehensive studies that include more learning styles, expand our knowledge of educational methodologies, and refine our perception of learning.

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### Appendix

#### Adapted VARK Questionnaire

Choose the answer which best explains your learning preference and click the box next to it.

1. I have been advised by the doctor that I have a medical problem and I have some questions about it. I would:
  - a. read an article that explains the problem.
  - b. look at a diagram showing what was wrong.
  - c. have a detailed discussion with my doctor.
  
2. I want to find out more about a tour that I am going on. I would:
  - a. talk with the person who planned the tour or others who are going on the tour.
  - b. use a map and see where the places are.
  - c. read about the tour on the itinerary.
  
3. When finding my way, I:
  - a. rely on paper maps or GPS maps.
  - b. rely on verbal instructions from GPS or from someone traveling with me.
  - c. like to read instructions from GPS or instructions that have been written.
  
4. I want to save more money and to decide between a range of options. I would:
  - a. use graphs showing different options for different time periods.
  - b. read a print brochure that describes the options in detail.
  - c. talk with an expert about the options.
  
5. When I am learning I:
  - a. like to talk things through.
  - b. see patterns in things.
  - c. read books, articles and handouts.
  
6. I want to learn how to take better photos. I would:
  - a. use diagrams showing the camera and what each part does.
  - b. use the written instructions about what to do.

- c. ask questions and talk about the camera and its features.
7. I want to find out about a house or an apartment. Before visiting it I would want: If you are paying attention, select learning styles.
- a. a plan showing the rooms and a map of the area.
  - b. a printed description of the rooms and features.
  - c. learning styles.
8. 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. listening.
  - b. seeing the diagrams.
  - c. reading the words.
9. I want to learn about a new project. I would ask for:
- a. an opportunity to discuss the project.
  - b. a written report describing the main features of the project.
  - c. diagrams to show the project stages with charts of benefits and costs.
10. I have finished a competition or test and I would like some feedback:
- a. from somebody who talks it through with me.
  - b. using a written description of my results.
  - c. using graphs showing how my performance has improved.
11. When learning from the Internet I like:
- a. interesting design and visual features.
  - b. detailed articles.
  - c. podcasts and videos where I can listen to experts.
12. I want to learn to do something new on a computer. I would:
- a. talk with people who know about the program.
  - b. follow the diagrams in a book.

- c. read the written instructions that came with the program.
13. I want to learn how to play a new board game or card game. I would:
- a. listen to somebody explaining it and ask questions.
  - b. use the diagrams that explain the various stages, moves and strategies in the game.
  - c. read the instructions.
14. When choosing a career or area of study, these are important for me:
- a. using words well in written communications.
  - b. communicating with others through discussion.
  - c. working with designs, maps or charts.
15. I am having trouble assembling a wooden table that came in parts (kitset). I would:
- a. study diagrams showing each stage of the assembly.
  - b. read the instructions that came with the table.
  - c. ask for advice from someone who assembles furniture.
16. I prefer a presenter or a teacher who uses:
- a. question and answer, talk, group discussion, or guest speakers.
  - b. handouts, books, or readings.
  - c. diagrams, charts, maps or graphs.

**Disclaimer that will be presented to all the modules:**

Description: In the information presented to you, Jimmy (the thief) is being chased by the police and running all over the town. You (the participant, a police officer) have to follow Jimmy's route. Try to remember the important landmarks such as streets and building names and where they are located. Jimmy will go to the points in chronological order. For example, from point 1 to 2 to 3 and so on.

**Visual Module:**

**Disclaimer:** You will have 3 minutes to view the map and memorize as much information as possible.



<https://www.youtube.com/watch?v=ptaimJqxZug>

**Questions participants will complete after learning modules:**

1. Which road/lane/street/square is the Sports Centre located?
  - a. North Road
  - b. Park Lane
  - c. Charles Street
  - d. Albert Square
  
2. Where did Jimmy go after the Sports Centre?
  - a. Cinema
  - b. Grand Hotel
  - c. Park
  - d. Chinese restaurant
3. Where did Jimmy take a u-turn?
  - a. Hillside Road
  - b. Charles Street
  - c. Station Road
  - d. Park Lane
4. Which direction is the Station (last building Jimmy visited) located in?
  - a. North
  - b. West
  - c. South
  - d. East
5. Where did Jimmy get his next meal from after he leaves the park? If you are paying attention, select the second option.
  - a. Chinese Restaurant
  - b. Grand Hotel
  - c. Pasta House
  - d. Theatre
6. Select which statement is false.
  - a. Jimmy went to the Grand Hotel
  - b. Jimmy went to Hillside School
  - c. Jimmy went to the Theatre
  - d. Jimmy went to the Pasta House
7. Where did Jimmy start his journey?
  - a. Cinema

- b. Cafe
- c. Bank
- d. Sports Centre

8. The Pond is located inside the Park.

- a. True
- b. False

9. What is the second last place Jimmy visits?

- a. Park
- b. Grand Hotel
- c. Hillside School
- d. None of the above

10. Which building is in front of the bank across the North Road?

- a. Cinema
- b. Sports Centre
- c. Hillside School
- d. Station

*\*Underlined options are the answers*

**Post Survey Questions:**

1. What is your age? (Please enter a number below)
2. What is your gender identity?
  - a. Male
  - b. Female
  - c. Other (please specify)
  - d. Prefer not to say
3. What is your first language?
  - a. English
  - b. French
  - c. Other (please specify)