Learning styles and online education

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Abstract

Purpose – The purpose of this paper is to recognize that individual learning styles must be taken into account in the instructional design template used in online education. The paper argues that when students' learning styles are identified, it is possible to define an appropriate context of learning.

Design/methodology/approach – The paper identifies a set of instructional principles for online learning environments that are derived from multiple theories of learning with a consideration of different learning styles. The VARK questionnaire was used to determine learning styles of students who participated in two online courses. The VARK instrument identifies four distinct learning styles: visual (V); aural (A); reading/writing (R) and kinesthetic (K). These four dimensions are used to analyze the appropriateness of online learning structures.

Findings – The paper identifies teaching strategies in online courses while recognizing the four learning styles. The paper concludes that the achievement of online learning can be improved by providing instruction in a manner consistent with each student's learning style. However, it is important to keep in mind that, even if a specific student learns best in a certain way, he or she should be exposed to a variety of learning experiences to become a more versatile online learner.

Originality/value – The new result indicates that students with the auditory learning preference do not select online education as their first choice for learning. The combination of different techniques can make it possible for students with all types of learning styles to be successful in an online course.

Keywords Learning styles, Teaching methods, Computer based learning, Distance learning

Paper type Research paper

Introduction

Distance education is an instructional delivery system that allows students to participate in an educational opportunity without being physically present in the same location as the instructor. The rapid growth in the number of distance education courses and programs has had a profound impact on the ideas and beliefs about teaching and learning. The use of the internet with web-based coursework has become a core method of instruction in distance education, particularly in higher education. The increasing number of students enrolled, the course offerings, and the availability of distance education all speak to the importance of this method of instruction.

The growth in distance education programs in recent years has been fueled by the development of the internet and technologies that support online learning. Online education appears to have the power to change the education landscape. But while technological innovation is necessary to the development of distance education, it is not sufficient to assure that distance education is effective.

Students have different learning styles, and some students may learn best by watching and listening, others by reading, and others by doing and moving or by a hands-on environment. Therefore, it is important to consider students' learning styles while developing a distance-learning course. This paper describes an assessment instrument that can be used to identify students' learning styles. The information generated by the instrument can identify the general cognitive and motivational characteristics of the students. This information in turn can be used in course planning and teaching strategies for online education.

Literature review

Research in learning style has its roots in the late nineteenth century. Initial work documented that there were style differences among learners. Instruments were developed to measure those differences in both adults and children (Dunn *et al.*, 1981). Most of that early research concerned the relationship between memory and oral or visual teaching methods. The findings were conflicting, possibly due to differences in the populations, learning materials, and tests (Keefe, 1987).

Later researchers recognized that different learners had different cognitive styles and habitual information-processing strategies that determine a learner's typical mode of perceiving, remembering, thinking, and problem solving (Messick, 1976). This wave of research has shown how to use diagnostic capability to match instruction to the style of individual students (Galloway, 1984). When students have a strong preference for the manner in which new material is presented, it is difficult or even impossible for them to learn when educators fail to present material in their preferred way (Gregoric, 1985a, b). Other efforts to explain the underlying processes of learning recognize not only cognitive styles but also affective and physiological aspects. Researchers have attempted to identify and isolate specific traits of learners in each of these areas to describe the unique processes of learning (Keefe, 1987; Messick, 1976). This research reinforces the central theme that variations in student learning style have important implications for the instructional process.

Many of the learning style theories have spawned assessment tools that can be used to categorize learners and match students with teachers and approaches that are suited to their learning styles (Keefe, 1987). Research on the learning styles of college students in various disciplines has also been reported in literature. Canfield (1988) reports significant differences among groups of students enrolled in various majors in collegiate settings.

Biberman and Buchanan (1986) examine learning styles within the area of business and find that the styles of majors in accounting and economics/finance vary from majors in marketing and management. Dunn *et al.* (1981, 1989) indicates that the achievement of college students could be improved by providing instruction in a manner consistent with each student's learning style.

It is critical that online education considers the learning styles of students. In order to teach more effectively in online courses, instructors need to know more about differences in learning and how to address the variety of learning styles found in their students. Instructors who know about differences in learning styles are better able to modify their teaching strategies and techniques in online education. This can help ensure that their methods, materials, and resources fit the ways in which their students

learn and create a learning environment that will maximize the learning potential of each student.

Defining learning styles

The concept of learning style has been studied in various ways. Learning style has been defined as:

- a certain specified pattern of behavior according to which the individual approaches learning experience (Campbell *et al.*, 1996);
- a way in which the individual takes in new information and develops new skills (Dunn *et al.*, 1981); and
- the process by which the individual retains new information or new skills (Kolb, 1984). Table I summarizes different learning styles frequently discussed in literature (Sims and Sims, 1995).

For the purposes of this paper, a learning style is defined as the preference or predisposition of an individual to perceive and process information in a particular way or combination of ways.

Identifying learning styles in online education: the VARK

In the traditional classroom setting, there are techniques the instructor can use to identify a student's specific learning style. The first step is to do a preliminary analysis through brief personal interviews with students and formal observation of their specific behaviors in the classroom. Another step for evaluating a student's learning style is an in-depth personal interview with the student. The next step in defining learning styles is to use checklists and the VARK questionnaire (Appendices 1 and 2). In online courses, it is impossible to conduct observation and in-depth personal interviews, however, the VARK questionnaire can be used to determine learning styles of students who participate in online course. It is important to keep in mind that even if a specific student learns best in a certain way, he or she should be exposed to a variety of learning experiences to become a more versatile learner. As students' learning styles are identified, it is possible to define an appropriate context of learning.

The VARK questionnaire presented in the appendices was developed at Lincoln University, Canterbury, New Zealand, in 1995. It focuses on the modal preferences for learners and teachers. According to Neil D. Fleming, the author of the VARK questionnaire, the use of this tool allows teachers to reach more students because of better match that can be made between teaching and learning styles (Canfield, 1988).

Theorist	Characteristics of learners		
Celli/Sarasin	Auditory	Visual	Tactile/kinesthetic
Gregoric/Butler	Abstract/sequential	Random/concrete	Concrete
Harb	Abstract/reflective	Concrete	Active/concrete
McCarthy	Analytic	Imaginative	Dynamic
Sims & Sims	Cognitive	Perceptual	Behavioral affective

Table I.
Characteristics of learners

Fleming identifies the most common mode for information exchange as speech that arrives at the learner's ear and therefore is coded as aural (A) in the questionnaire. Some students reveal preferences for accessing information from printed words. This group of learners is coded as read/writers (R) since reading and writing are their preferred modes for receiving in information.

A third group of students is coded as visual (V) since those students like information to arrive in the form of graphs, charts, and flow diagrams. They prefer to learn by picturing information or enhancing it via colors and layout. The last group of students likes to experience learning by using all their senses, including touch, hearing, taste, smell, and sight. This group is coded as kinesthetic (K). Learners from this group like concrete, multi-sensory experiences in their learning. Learning by doing is strongly preferable, and abstract material must be presented to them via suitable analogies, real life examples, or metaphors.

No student or teacher is restricted to only one of the four modes: V, A, R, or K. Both students and teachers usually exhibit a strong preference for one particular mode, and at the same time they may have a relative weakness or strength in some other modes.

Application and analysis

At the beginning of the summer semester 2004 and the fall semester 2004 academic year, online Principles of Macroeconomics students in the Lewis College of Business at Marshall University answered the VARK questionnaire. Table II summarizes the learning preferences for online students.

Tri-modal learning preferences prevail in both courses. Only two students (one female and one male student) in each class indicated preference for auditory learning, giving these two a multi-modal learning style. This result may indicate that it is possible that students with prevailing auditory learning preferences may not be selecting online education as an option. The total sample for both courses showed no gender difference in learning preferences. The types of learners, teaching strategies, and behaviors for the four learning styles are presented in Table III.

Teaching strategies to be used in online education

Online courses tend to be text-based forms of instruction. This may be preferable to some students, but it must be recognized that students have different learning styles. These differences among students within a learning context can appear in areas of general skills, aptitude, information processing, and application of information to new situations. The following three strategies are recommended for the use in an online course to address individual differences in learning styles:

	Number of students	Unimodal number	Bimodal number	Trimodal number	Multimodal number
Summer online course	10	0	2	6	2
Fall online course	15	0	3	10	2

Table II.
Learning styles of online students

Type of learner	Teaching strategies	Behaviors
Auditory learners: Abstract and concrete, analytic, sequential, reflective, independent, achievement-oriented, memory-oriented, competitive, perceptual, conceptual, skill-oriented	Lecture, oral directions, discussions, independent tasks, oral and objective presentations and practice, programmed instruction, tasks with specific answers, memorization, verbal sorting, sequential presentation, thinking time, verbal questioning, focusing/directive questions, continued verbal sharing, verbal rewording	Need ample process time, interact with information orally, request oral repetitions, rephrase, and expand on topics, request additional information, first must understand the facts and then understand the whole concept
Visual learners: Abstract and concrete random, concrete, active, effective, field-sensitive, field-dependent, concept-oriented holistic, perceptual and imaginative	Visual formats, environmental influences, group learning, graphic organizers, modeling, demonstrations, role-playing, student presentations, filed trips, motivational accounts or stories, computer-aided instruction, activities that allow freedom and emphasize creativity, open-ended questions, teaching to senses	Prefer to learn about a concept before trying to understand its parts, repetition, visual imaging, not paying attention, wait time, outlining, require visual aids (charts, diagrams, drawings and outlines) in order to make sense of something new
Kinesthetic learners: Dependent and independent, concrete sequential, concrete random, creative, behavioral, need for interaction, hands-on, physical by nature, sensory, learns by doing, active, concrete	Supplementing commercial materials with manipulative components, focusing techniques that include interaction with objects, questioning based on physical interactions with objects; Internship, field trips, direct contact, experiential learning, simulation, games demonstrations	Like learning by doing, need for something to understand and master, rely on physical interaction during learning process, like to be active and dynamic participants in order to fully understand and learn, require exploration and experimentation time, interaction with resources and materials, preparation in advance, application of concept, first-hand experience, participation
Read/write learners: Abstract & concrete random, concrete, active effective, field-sensitive field-dependent, concept-oriented	Focusing techniques in writing, focus questions in writing, visual stimuli, diagrams and charts; Visual formats, modeling, demonstrations, role-playing, computer-aided instruction, activities that allow freedom and emphasize creativity, open-ended questions, teaching to senses	Prefer to take information most efficiently from reading headings, lists, definition, lecture-notes and textbook, like to write ideas and principles into other words, write out the words again and again, organize and turn any diagram, chart, and graph, game and simulation into words

Table III.
Types of learners, their
characteristics,
instructional strategies
and behavior

Provide content in multiple formats
This can be accomplished through the use of various communication techniques. Lectures can be audio-streamed and synchronized with the applicable PowerPoint presentation. These lectures can be transcribed and posted in the course WebCT Vista. Content can also be presented through WebCT chat room discussion groups where students are required to share and discuss information with each other. Each course also has links to outside web sites that provide supplemental material on the current topic.

Allow for individual locus *of control*
All courses provide various means of navigation. Content can be accessed through links or a graphical organizer. Students should be able to access course material in several ways. The course can be built and presented in a hierarchical sequence, but students should be able to move through the course topics in random order.

Encourage active and collaborative interaction
Each course should be designed with activities that are both individual and group-based. Within virtual teams, students work together to solve problems, analyze cases, and develop group deliverables. These assignments allow individual ideas, perspectives, and experiences to be heard and collectively considered. The idea of agreeing to disagree is taught through these experiences.

Techniques for online learning
Active and collaborative learning can occur in many forms in an online environment. Discovery learning, project-based learning, and cooperative learning are common techniques for engaging students in activities that involve creativity, decision-making, and problem solving. Each of these instructional approaches emphasizes the importance of learning from goal-driven and activity-based experience. The following examples show how active learning can be applied in an online environment where students demonstrate multi-modal learning styles defined by the VARK method.

Online course projects
Application-rich courses can be designed around major projects and specific activities to be completed in order to create a final product. For example, in an instructional design course where students are expected to create a complete training module, they complete many tasks, such as conducting a needs assessment, developing training plans, and creating instructional media. By adopting a project-based approach, the online instructor can easily incorporate the concept of active learning into a virtual environment instead of providing the typical read-and-write online course.

Online work in groups
Working in groups of two or three students is an active learning technique frequently used in many face-to-face classes, though it can also be successfully used in online courses. This strategy can be used in both synchronous and asynchronous situations.

Small-group discussion during synchronous sessions
Few online programs rely on synchronous sessions, but synchronous sessions can provide powerful opportunities for student interaction. These sessions can be provided weekly in which the instructor performs a live audio broadcast to the students over the web while the students interact with the instructor and the other students in a group chat space. Although this in itself encourages active learning, incorporating small-group interactions into the large-group discussions can further enhance learning. This is accomplishment by having the instructor describe a discussion activity to the class and then asking them to enter their private virtual team chat space to discuss and complete the assignment. A specific time is given when the students are expected to return to the class chat space and discuss their findings with the rest of the class. This technique is commonly used in many face-to-face classes, but it is underused in an online learning environment.

Virtual field trips and videos
An alternative to bringing an online lecturer might be for the class to go on a virtual field trip. It is suggested that students be sent to web sites that take them to places of interest relevant to the course. For example, the Federal Reserve provides an excellent online tour that addresses the various issues related to the central bank and monetary policy in the context of stabilizing the economy. There are web sites that offer many exciting possibilities for these types of virtual visits in online economics education. Textbook publishers provide e-packs that include special short videos or short films. Providing students with virtual trips will allow students to be able to comprehend what they are learning (comprehension level) and apply what they have learned in new ways (application level). Students learn at the speed comfortable to them, and this affords them with more opportunities to feel in control. They take personal responsibility as active learners for the analysis and synthesis of the information with what they have already learned:

- online faculty can also use the following techniques to promote successful online learning process:
- use short-term and long-term, individually written assignments;
- combine individual assignments with group assignments;
- provide step-by-step instructions and directions whenever they are needed;
- provide written comments on homework assignments;
- allow students to work in groups and help each other to discuss, analyze, and solve problems;
- use games, simulations, and/or active learning in combination with lecturing;
- allow students to gain extra credit points from their oral presentations and active participation in class discussion or group learning;
- provide oral assignments; and
- use video and computer assignments in combination with other teaching techniques.

The combination of different techniques can make it possible for students with all type of learning styles to be successful in an online course.

Conclusions

In order to help students succeed in online education, instructors must understand how they learn, how they perceive, and how they process information. Learning styles of online students must be identified so that the instructor can plan appropriate teaching strategies to accommodate individual strengths and needs. It is very important for instructors to share information with students about their learning styles and the preferred teaching strategies to accommodate those styles. By sharing information about learning styles, instructors help their students gain power and control over their personal learning styles and the learning process.

Each online course should accommodate all types of learners. It is necessary to provide a number of different learning options that take into account different learning styles. Combining a mixture of approaches and teaching methods allows online students to choose the instructional style that best fits their individual learning styles. Effective teaching arises when teachers reach those students who are mismatched with their own learning/teaching style. The VARK instrument allows teachers to overcome this problem. Effective use of the VARK instrument and proper online course design can result in a learning experience that can be appropriate to all types of students.

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Appendix 1. Administering the VARK Questionnaire

Developed by Neil D. Fleming, Lincoln University, Canterbury, New Zealand

When you are instructing others to fill the questionnaire, they should be advised to make a selection (V, A, R or K) for each question. If necessary they may omit a question or choose two or three options. Those who are strongly read/write in preference will probably read the instructions. Some academics may fasten onto the word meanings in the questionnaire and contest them because of their orientation towards word meanings. Others with a kinesthetic preference might ask for additional contextual or situational information before they choose their answers, especially to the first two questions. Avoid giving further information as it may prejudice their choices in those questions.

You should indicate the use to which the data will be put and whether it remains confidential to the individual or the group. Posting the results (preferences) for each person in a group usually leads to following outcomes. For example (Table AI).

Analyzing the results

It is not expected that any one perception mode will be dominant or that people are unimodal. What will become apparent in a group is that some individuals may have weak preferences for some modes and strong preferences for others. A major group will have several equally strong preferences that we refer to as bi-modal or multi-modal. In the table above, Steve is multi-modal (V, A and R). Allen has a very strong visual preference (V). Mary is bi-modal (V and R).

A score for a mode that stands out from the others will indicate a strong or very strong preference. The Table below indicates a "rule of thumb" and should not be rigidly applied. Remember that the questionnaire is not intended to "box" the respondent into a mindset that he/she has been "diagnosed" (Table AII)

Scores less than two will indicate a weak preference. Pay particular attention to zero scores on any mode and even more attention to them if the total number of responses is high. Zero scores are unusual and the respondent will often have an interesting story to tell.

	V	A	R	K
Allen	10	0	3	1
Steve	6	7	4	5
Mary	7	1	8	0

Table AI.

Total number of responses	Very strong preference indicated by a score that exceeds any other by	Strong preference indicated by a score that exceeds any other by	Mild preference indicated by a score that exceeds any other by
Up to 16	4 +	3	2
17-22	5 +	4	3
23-30	6 +	5	4
31 +	7 +	6	5

Table AII.

Appendix 2.

This questionnaire aims to find out something about your preferences for the way you work with information. Choose the answer which best explains your preferences and circle the letter next to it. Please circle more than one if a single answer does not match your preferences. Leave blank any question that does not apply.

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. Would you:
   V) draw a map on paper
   A) tell her the directions
   R) write down the directions (without a map)
   K) collect her from the hotel in your car.

2. You are staying in a hotel and have a rental car. You would like to visit a friend whose address/location you do not know. Would you like them to:
   V) draw you a map on paper
   A) tell you the directions
   R) write down the directions (without a map)
   K) collect you from the hotel in their car.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. Would you:
   A) phone her immediately and tell her about it
   R) send her a copy of the printed itinerary
   K) show her on a map of the world

4. You are going to cook a dessert as a special treat for your family. Do you:
   V) thumb through the cookbook looking for ideas from the picture
   A) ask for advice from others
   R) refer to a particular cookbook where there is a good recipe
   K) cook something familiar without the need for instruction

5. A group of tourists have been assigned to you to find out about national parks. Would you:
   V) show them slides and photographs
   A) give them a talk on national parks
   R) give them a book on national parks
   K) drive them to a national park

6. You are about to purchase a new stereo. Other than price, what would influence your decision?
   V) it looks really smart and upmarket
   A) the salesperson telling you what you want to know
   R) reading the details about it
   K) listening to it

7. Recall a time when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill e.g. riding a bike. How did you learn best? By:
   V) visual clues – pictures, diagrams, charts
   A) listening to somebody explaining it
   R) written instructions
   K) doing it or trying it

Figure A1.
The VARK Questionnaire

8. Which of the these games do you prefer:
    V)   Pictionary
    R)   Scrabble
    K)   charades

9. You are about to learn to use a new program on a computer. Would you:
    V)   telephone a friend and ask questions about it
    R)   read the manual which comes with the program
    K)   ask a friend to show you on the computer

10. You are not sure whether a word should be spelled "dependent" or "dependant". Do you:
    V)   see the word in your mind and choose by the way it looks
    A)   sound it out in your mind
    R)   look it up in the dictionary
    K)   write both versions down on paper and choose one

11. Apart from price, what would most influence your decision to buy a particular textbook:
    V)   it looks OK
    A)   a friend talking about it
    R)   skim reading parts of it
    K)   using a friend's copy

12. A new movie has arrived in town. What would most influence your decision to go (or not to go)?
    V)   you saw a preview of it
    A)   you heard a radio review about it
    R)   you read a review about it

13. Do you prefer an instructor or teacher who likes to use:
    V)   flow diagrams, charts, slides
    A)   discussion, guest speakers
    R)   handouts and/or a textbook
    K)   field trips, labs, practical sessions

Count your choices				
Total	V ___	A ___	R ___	K ___

Figure A1.

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