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Auditory, visual, kinesthetic-tactile, and multi-sensory modalities: A quantitative study of how preferred modalities create more effective teaching and learning environments

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This study aims to examine how teaching methods and learning styles of instructors play a role in how students learn, and how technology is selected. There are four type of learning styles: auditory, visual, kinesthetic-tactile and multi-sensory. The survey population was evenly distributed, consistening of 100 faculty members and 100 students with a response rate of 25%. The results of the research indicate there is some evidence that: Instructors will have higher perceived teaching effectiveness when using their preferred teaching method; students will prefer a teaching method that is consistent with their learning style(s); students preferences in teaching method, the course subject, and situational factors (that is, class size) are related to instructors' preference in teaching method and use of technological advancements. Overall, this study produced some interesting findings, indicating some significant relationships between teaching methods and learning styles.

Key words: Teaching method, learning style, auditory, visual, kinesthetic-tactile, multi-sensory, computer-based technologies.

INTRODUCTION

Although the traditional mode of college teaching is the lecture method, this method has been criticized for being authoritarian, boring, and predictable due to its emphasis on memorization and tests of specific information (Breishline and Holmes, 2007). Although this teaching style continues to dominate instruction in higher education, many faculty members have used other more interactive teaching styles to supplement or replace the lecture method. A number of factors may influence the instructor's decision to use certain teaching methods, such as his/her learning style, perception of student preferences, the course subject, and class size or facilities.

College faculty members have a wide range of technologies that can be utilized to better, or in some cases replace, traditional teaching methods. For example, instructors may use lecture-enriching technology, such as PowerPoint presentations or video conferencing,

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to bring guest lectures from distant places into the classroom. Computer-based technologies can also be used to facilitate communication between the instructor and student via electronic mail, web pages, chat rooms, and electronic bulletin boards. Although all of these technology options exist, there is little empirical evidence as to what factors might influence the choice or limit the use of technology in the classroom, such as the instructor's learning style, his/her perception of student technology preferences, the course subject, class size, institutional support, and knowledge of how to use various technologies.

One factor that would likely play a role in an instructor's choice of teaching method is their preference or comfort level with particular methods. Although this may be influenced somewhat by the teaching methods they experienced during their years of education, it is likely that their learning style also plays a role in what they believe are effective teaching methods. A common way of mapping a person's learning style is to determine the modes or senses through which one takes in and processes information. One theory considers three basic modalities: Auditory, Visual, and Kinesthetic-Tactile (KT) (Willis and Hodson, 2000)(Table 4).

Discussions of visual, auditory, and kinesthetic learners are common in educational literature, teacher-preparation programs, and professional development workshops. The theory that students learn more when content is presented in their best modality seems to make sense, seems to be supported by classroom experiences, and offers the hope of maximizing each child's learning by planning different lessons for each type of learner (Hudak & Anderson, 2004). For example, within one kindergarten class, the auditory learner could listen to stories about different holidays around the world, while the visual learner examined pictures of holiday celebrants, and the kinesthetic learner handled costumes and artifacts associated with the holidays (Erikson, 2008). But is the theory correct? And, whether or not the theory is correct, might it not also be true that all of the kindergartners would learn the most about holidays by listening to stories, looking at pictures, and handling costumes?

Before the study tackle the research on using modalities to enhance student learning, let's review a few things that cognitive scientists know about modalities (Williams, 2003). Some memories are stored as visual and auditory representations, but most memories are stored in terms of meaning. Cognitive psychologists have used formal laboratory tasks to investigate the role of modality in memory (Schiedel and Marcia, 2005). An important finding from that research is that memory is usually stored independent of any modality. You typically store memories in terms of meaning — not in terms of whether you saw, heard, or physically interacted with the information. For example, your knowledge that a fire requires oxygen to burn is unlikely to be stored as a visual or an auditory memory (Marcia, 2000). The initial experience by which you learned this fact may have been visual (watching a flame go out under a glass) or auditory (hearing an explanation), but the resulting representation of that knowledge in your mind is neither visual nor auditory (Richardson, and Davis, 2007).

How did cognitive scientists figure this out? An important clue that memories are stored by their meaning is the types of errors people make on memory tests (Pankratz and Morris, 2000). People who listen to a story will later confidently "recognize" sentences that never appeared in the story — so long as these new sentences are consistent with the story's meaning. The same phenomenon is observed with purely visual stimuli. People rapidly lose the memory of the precise images that make up a picture story (for example, whether a character faced left or right), but they retain the meaning or gist of the story.

The mind is capable of storing memories in a number of different formats, and laboratory research indicates that a single experience usually leads to more than one type of representation (Schunck, 2001). When subjects view a picture story, they do have a visual representation of what the pictures look like, in addition to the meaning-based representation (Bandura, 2006). They usually don't remember the visual representation for long, however, largely because when they see the pictures, they are thinking about what they mean in order to understand the story. If, in contrast, they were asked to remember visual details of the pictures and to ignore the story they tell, they would have a better memory for the visual details and the meaning-based representation would be worse.

Smith (2006) focuses that our minds have these different types of representations for a reason: Different representations are more or less effective for storing different types of information. Visual representations, for example, are poor for storing meaning because they are often consistent with more than one interpretation: A static image of a car driving on a snowy hill could just as well depict a car struggling up the hill or slipping backwards down the hill. And some concepts do not lend themselves well to pictures: How would one depict "genius" or "democracy" in a picture? On the other hand, the particular shade of green of a frozen pea would be stored visually because the information is inherently visual (Hudak and Anderson, 2004).

Stout (2007) highlights that these different memory representations store different types of information, you usually cannot use one representation to substitute for another. This point is illustrated in an experiment by Dodson et al. (2000). They asked subjects to listen to two word lists and to judge whether or not each word on the second list (new words) had appeared on the first list (studied words), as shown below. The interesting twist was that each word on both lists was spoken by either a man (depicted by boldface) or a woman (depicted by italics). If a word had appeared on both lists, it might be

spoken in the same voice ("Window") or in different voices ("Doctor"). The question is whether changing the gender of the voice (and, therefore, the auditory experience) influenced memory for the studied words (Table 1).

Wills and Hodson (2000) found that whether the gender of the voice repeated or switched made no difference at all in remembering the word (75% versus 73% accuracy). That is, subjects were just as likely to remember "Doctor" as "Window." But when subjects judged that a word was on the first list, they also had to say whether a man or woman had said it. For this judgment, subjects were more accurate if the same gender voice spoke the word on the first and the second list (57%) than if the voice switched genders (39%). This experiment indicates that subjects do store auditory information, but it only helps them remember the part of the memory that is auditory — the sound of the voice — and not the word itself, which is stored in terms of its meaning (Wills and Hodson, 2000).

Modality theory may also seem correct because, as the study has discussed, children probably do differ in their abilities with different types of memories. the researcher remember their daughter commenting (out of the blue, as 4-year-olds will) that her preschool teacher said "white" in a way that made the "h" faintly, but distinctly, audible. the researcher was impressed that she had noticed this difference, remembered it, and could reproduce it. So their daughter may have a good auditory memory, and that might help her in certain tasks, such as remembering regional accents, should she decide to be an actress (Hudak and Anderson, 2004). It does not mean that the researcher want her teachers to ensure that she receives primarily auditory input in her coursework, because her superior auditory memory will not help her when she needs to remember meaning. But it is easy to see how one might (mistakenly) believe that complex material would be easier for her to master if presented auditorily (Pankratz and Morris, 2000; Marcia, 2000; Schiedel and Marcia, 2005). Further, as the article The Content's Best Modality Is Key indicates, there are various ways in which modality does strengthen instruction (for all kids) — and it's easy to imagine that the effect has to do with a student's modal preference when in fact the effect is due to the content's best modality.

Visual learning defined

A visual learner learns best when information is presented visually. This means that the more the learner is able to see the information, the easier it may be for that learner to learn the information. Some of the things a visual learner might need to use may be: textbooks, worksheets, written notes, maps, flash cards, diagrams, written directions, notes on index cards, notes on the blackboard, information on posters, bulletin boards, written outlines, graphic organizers (a kind of written diagram used for outlining or seeing relationships between concepts), drawings, and pictures (Williams, 2003).

A visual learner may prefer to study using the materials just listed. The learner may prefer to use a highlighter (a light colored marker) on a page in a book, to highlight important information. If this is not allowed as the learner does not own the book, make photocopies of the pages so that the learner may do this. Another study method is to use flash cards for review. Keep the flashcards neatly organized, by topic, in an index card box (Erikson, 2008).

If the visual learner is presented with an activity that is not highly visual in nature, change the activity to accommodate the learner's needs. For example, let's say the visual learner must remember the information presented at a lecture. A lecture is primarily an auditory presentation (using hearing rather than sight). An example of changing this activity to a visual presentation might be to get permission to tape the lecture (Williams, 2003). Later, the learner would listen to the tape and transcribe the notes into written form. The learner would then be able to study the written notes, which is now a visual presentation (Marcia, 2007). The learning method in this example, has changed from a purely auditory presentation, to an activity requiring visual input. Some other ideas might include seeing if the learner is able to read about the activity before actually listening to the lecture (Marcia, 2000). Explain to the lecturer that you are a visual learner. See if you can get a copy of the notes from the lecturer. Now that you know a little more about your learning style, see if you can match or adapt activities to increase your learning success.

Auditory learning defined

An auditory learner learns best when information is presented auditorally. This means that the more the learner is able to hear the information, the easier it may be for that learner to learn the information (Richardson and Davis, 2007). Some of the things an auditory learner might need to use may be: discussion groups, lectures, tape recorder, cooperative learning (that is, where information is discussed within a group), directions discussed by the teacher before an activity is attempted, listening to books read to the group, books on tape, information put to songs, silly sayings that help you remember information (that is, mnemonic devices), and recited poems of information (Frost and Fukami, 2007).
An auditory learner may prefer to study using the materials just listed. The learner may prefer to listen to study material on tape. He/she may also wish to set information to music. After singing the song that was created, see how much faster an auditory learner is able to retain the information (Management Education, 2002).

If the auditory learner is presented with an activity that is not highly auditory in nature, change the activity to accommodate the learner's needs. For example, let's say the auditory learner must remember the information

presented in a textbook. A textbook is a visual presentation (using sight rather than hearing). An example of changing this activity to an auditory presentation might be, to get someone to make an audio cassette tape of the chapter to be studied (Csikszentmihalyi, 2003). The learner would listen to the tape a number of times. The learner would then be able to study the textbook chapter, which is now an auditory presentation. The learning method in this example, has changed from a purely visual presentation, to an activity requiring auditory input.

Label the tape and keep it in an indexed box (Duncum, 2007). This way, the tape may be easily located for future review. Some other ideas might include teaching the learner to subvocalize. This means to whisper quietly under your breath. If a learner must glean information from written material while working in a quiet group, the learner may whisper under his/her breath, thus adding auditory input to a visual activity (Marcia, 2007). When working alone, the learner may wish to read out loud. Teaching the learner to put information to music, poems, or sayings is another auditory method. Sing or repeat study information out loud (Erikson, 2000). Notice how an auditory learner can remember every word to a song, but may have trouble quietly studying a few spelling words from index cards. If the learner sings those spelling words, you will see a difference in the learner's ability to retain the spelling information, with less effort. Now that you know a little more about your learning style, see if you can match or adapt activities to increase your learning success.

Kinesthetic-tactile learning defined

A kinesthetic-tactile learners learn best when information is presented using touch and movement. This means that the more the learner is able to touch, manipulate the materials used to present the information, or use his/her body movements, the easier it may be for that learner to learn the information (Richardson and Davis, 2007). Some of the things a kinesthetic-tactile learner might need to use may be: a typewriter, computer keyboard, sand in a sand tray, blackboard, letter or word magnets, concept models that may be taken apart, stamp pad letters and numerals, gross motor materials (materials requiring large muscle movement), dioramas, and manipulatives (Carter and Wilson, 2003).

A kinesthetic-tactile learners may prefer to study using the materials just listed. The learner may prefer to study by re-writing his/her notes, typing them on a typewriter, or writing them on a computer. In fact, a kinesthetic-tactile learner may need to write, and re-write his/her school notes, over and over and over again, in order to study. He/she may like to use sign language, physically using hand and finger movements, to help remember concepts. Pretending to write words in the air, or on one's leg is another method (Neal, 2008).

A kinesthetic-tactile learner needs to move, build, investigate, and physically create concepts. Unconvential study methods involving movement may be employed. Bouncing a ball, doing jumping jacks, or jumping rope, while saying ones study information (cadence), are examples of study activities requiring movement (Management Education, 2002). Drumming, tapping one's feet, or marching, while reciting information, are other examples. Kinesthetic-tactile learners will focus on the physical movement to the rhythm to support their learning. Having the learner write the information in large letters on a blackboard, requires large muscle movements. Writing information with your finger, in a tray lightly covered in sand, is another tactile presentation. The idea is to add movement and touch to any learning activity.

If the kinesthetic-tactile learner is presented with an activity that is not highly kinesthetic-tactile in nature, change the activity to accommodate the learner's needs. For example, let's say the kinesthetic-tactile learner must remember the information presented at a lecture (Campbell, 2006). A lecture is primarily an auditory presentation (using hearing rather than touch and movement). An example of changing this activity to a kinesthetic-tactile presentation might be to get permission to tape the lecture (Schunck, 2001). Later, the learner would listen to the tape at home and physically act out the information. The learner needs to be able to add touch and movement to the presentation. Let's say the learner wants to remember specific social studies facts. The learner might play a game of social studies charades, where classroom peers in a study group would have to guess the concept that was being acted out. If the learner is in school, try to find teachers that use hands-on activities during their presentations.

Multi-sensory learning defined

A multi-sensory learner learns best when visual, auditory, and kinesthetic-tactile presentation methods are all employed to learn a particular concept. This means that the more the learner is able to see, hear, touch, manipulate the materials used to present the information, and use his/her body movements, the easier it may be for that learner to learn the information (Bourdieu, 2004).

To determine the types of materials, a multi-sensory learner might use, look at the suggestions for visual learners, auditory learners, and kinesthetic-tactile learners above. Basically, you are combining these three presentation methods, when you employ a multi-sensory method. Look at your visual, auditory, and kinesthetic-tactile scores from the previous page. You will find that you scored almost the same in either two, or three of these learning style categories (Smith, 2006). You don't have one particular learning style preference, but rather a combination of two or three styles. The discussion below

Table 1. Word List Recognition - Dodson and Shimamura (2000) asked subjects if the first list of words also appeared in the second list of words.

LIST 1	LIST 2
Shell	Doctor
Radio	Fleet
Doctor	Midnight
Table	Thread
Window	Reason
-	Window

will focus on a multi-sensory learner that needs all three learning style areas (Stout, 2007). If your scores suggest you only need two learning style areas, adjust your presentations accordingly.

In regards to studying, a multi-sensory learner will need to combine study methods from the visual, auditory, and kinesthetic-tactile areas outlined above. For example, you might look at a learning fact on an index card, while reading the fact out loud, followed by re-writing the fact in large letters on a chalkboard, and tracing your finger through the chalk letters while repeating the words.

If the multi-sensory learner is presented with an activity that is not highly multi-sensory in nature, change the activity to accommodate the learner's needs. For example, let's say the multi-sensory learner must remember the information presented at a lecture. A lecture is primarily an auditory presentation (using hearing). An example of changing this activity to a multi-sensory presentation might be to get permission to tape the lecture (Smith, 2006). Later, the learner would listen to the tape at home, write down notes in a notebook, use a graphic organizer (a kind of written diagram used for outlining or seeing relationships between concepts), and physically act out the information (Richardson and Davis, 2007) . Given the above discussion, the following three hypotheses become necessary:

H1: Students will prefer a teaching method that is consistent with their learning style.
H2: Students preferences in teaching method, the course subject, and situational factors (i.e. class size) are related to instructors' preference in teaching method and use of technological advancements
H3: Instructors will have higher perceived teaching effectiveness when using their preferred teaching method.

MATERIALS AND METHODS

Learning style inventory

The population frame for this study comprised of 100 full-time faculty members and 100 students. Using the Directory of Management Faculty (Hasselback, 2001), a stratified sample (by rank) was drawn from randomly selected institutions. Of the 200 questionnaires mailed, 50 were returned, producing a response rate of 25.0%.

The questionnaire developed for the study contained the Learning Style Inventory following by characteristics of each learning style. The LSI was composed of 24 questions to assess how the participant prefers to learn and process information, using a modified version of Barsch and Haynie's (Wills and Hodson, 2009) learning style inventory.

Items 1 through 24 of the survey measured instructor preferred learning style: Auditory, Kinesthetic-Tactile, and Visual. In order to ascertain whether the measures still retained construct validity, a factor analysis was conducted using a varimax rotation and an orthogonal solution (Tables 2 and 3). Cumulative variance explained by the three factors was 52%. Additionally, internal reliability tests showed Cronbach alphas ranging from 0.51 through 0.61 (Table 5). This factor analysis method was used in order to produce variables representative of each learning style that could then be used in subsequent analysis. Surrogate variables were selected since the scales we used are exploratory with little evidence of reliability or validity (Hair et al., 2002).

RESULTS

This section provides preliminary results of the findings of this study and, at this time, is limited to correlations between the variables in the study. Results show that those instructors who are visual learners tended to prefer "mainly lecture with voluntary student participation" (0.250, $p<0.005$) and "mainly lecture with some student discussion groups" (0.257, $p<0.004$).

Results for the other two learning styles did not prove to be significant. Of the other factors examined (perception of student preferences, course subject, or class size and facilities), only class size and facilities was found to significantly impact the use of particular learning methods. Specifically, those instructors who prefer to use "mainly lecture with voluntary student participation" indicated that classroom environmental factors (class size, layout of classroom, etc.) limited their effective use of this method (0.187. $p<.037$). Finally, in assessing instructor's perception as to the impact of their preferred method on teaching effectiveness, instructors who utilized "lecture only with no student participation" believe that this preferred teaching method greatly enhances their teaching effectiveness (0.187. $p<.038$).

With regard to teaching technologies, results show that those instructors who are auditory learners show a preference for using videos (0.181. $p<.044$) and those who are KT learners show a preference for PowerPoint presentations (0.241. $p<.007$). Results for visual learners were not significant. Auditory learner instructors showed a preference for technology that was consistent with their learning style. While KT learner instructors showed a technology preference, their preference was not as consistent with their learning style needs.

Although an instructor's assessment of student preferences for various technologies was not found to be significantly related to his/her technology preference, there was some support for H5 with regard to other factors. Instructors who prefer the use of simulations

Table 2. Learning Styles Inventory- This is a 24 question survey designed to determine the best learning style.

S/N	Variable	Often	Sometimes	Seldom
1	I can remember best about a subject by listening to a lecture that includes information, explanations and discussions	-	-	-
2	I prefer to see information written on a chalkboard and supplemented by visual aids and assigned readings	-	-	-
3	I like to write things down or to take notes for visual review	-	-	-
4	I prefer to use posters, models, or actual practice and other activities in class	-	-	-
5	I require explanations of diagrams, graphs, or visual directions	-	-	-
6	I enjoy working with their hands or making things	-	-	-
7	I am skillful with and enjoy developing and making graphs and charts	-	-	-
8	I can tell if sounds match when presented with pairs of sounds	-	-	-
9	I can remember best by writing things down	-	-	-
10	I can easily understand and follow directions on a map	-	-	-
11	I do best in academic subjects by listening to lectures and tapes	-	-	-
12	I play with coins or keys in their pocket	-	-	-
13	I learn to spell better by repeating words out loud than by writing the words on paper	-	-	-
14	I can understand a news article better by reading about it in a newspaper than by listening to a report about it on the radio	-	-	-
15	I chew gum, smoke or snack while studying.	-	-	-
16	I think the best way to remember something is to picture it in your head	-	-	-
17	I learn the spelling of words by “finger spelling” them	-	-	-
18	I would rather listen to a good lecture or speech than read about the same material in a textbook	-	-	-
19	I am good at working and solving jigsaw puzzles and mazes	-	-	-
20	I grip objects in their hands during learning periods	-	-	-
21	I prefer listening to the news on the radio rather than reading the paper	-	-	-
22	I prefer obtaining information about an interesting subject by reading about it	-	-	-
23	I feel very comfortable touching others, hugging, handshaking, etc.	-	-	-
24	I follow oral directions better than written ones	-	-	-

Table 3. Learning styles inventory scoring procedures- Follow the directions above to attribute the correct score.

Visual		Auditory		Tactile	
No.	**PTS.**	**No.**	**PTS.**	**No.**	**PTS.**
2	-	1	-	4	-
3	-	5	-	6	-
7	-	8	-	9	-
10	-	11	-	12	-
14	-	13	-	15	-
16	-	18	-	17	-
19	-	21	-	20	-
22	-	24	-	23	-
VPS =	-	APS =	-	TPS =	-
VPS = Visual preference		APS = Audio preference		TPS = Tactile preference	

Learning style inventory (Directions: Place the point value on the line next to the corresponding item below. Add the points in each column to obtain the preference score under each heading; OFTEN = 5 points; SOMETIMES = 3 points; SELDOM = 1 points).

were less likely to see course subject as limiting their use of technology (-0.196. p<.029). Those who prefer the use of experiential exercises believe that classroom environmental factors (class size, layout of classroom,

Table 4. Characteristics of a visual, auditory, and kinesthetic-tactile learning-This is analyzed after completing the learning styles inventory (LSI).

Visual learning characteristics
Mind sometimes strays during verbal activities
Observe rather than acts or talks
Likes to read
Usually a good speller
Memorizes by seeing graphics or pictures
Not too distractible
Finds verbal instruction difficult
Has good handwriting
Remembers faces
Uses advanced planning
Doodles
Quiet by nature
Meticulous, neat in appearance
Notices details
Characteristics of auditory learning
Talks to self aloud
Enjoys talking
Easily distracted
Has difficulty with written directions
Likes to be read to
Memorizes sequentially
Enjoys music
Whispers to self while reading
Distracted by noise
Hums or sings
Outgoing by nature
Enjoys listening activities
Characteristics of kinesthetic-tactile learning
Likes physical rewards
In motion most of the time
Likes to touch people when talking
Taps pencil or foot when studying
Enjoys doing activities
Reading not a priority
Poor speller
Likes to solve problems by physically working through them
Will try new things
Outgoing by nature; expresses emotions by physical means
Uses hands while talking
Dresses for comfort

availability of technologies) limit their use of this technology (0.195. $p<0.03$). Those instructors who feel pressured by their institution to use certain technologies were those who preferred computer simulations (0.185. $p<.04$) or email and web pages (0.277, $p<0.002$). Finally, in assessing instructor's perception as to the impact of their preferred technology on teaching effectiveness, no significant results were found, providing no support for H6. It is interesting to note, however, that those who perceived their preferred teaching method as enhancing

Table 5. Factor analysis of learning styles- Scored were assessed in the areas of auditory learning, visual learning, and kinesthetic-tactile learning. With regard to teaching technologies, results show that those instructors who are auditory learners show a preference for using videos (0.181, p<.044) and those who are KT learners show a preference for PowerPoint presentations (0.241, p<.007). Results for visual learners were not significant.

Variable	Factor 1 kinesthetic-tactile (KT)	Factor 2 auditory	Factor 3 visual
The researcher enjoys working with his or her hands or making things	0.79	-	-
The researcher is good at working and solving jigsaw puzzles and mazes	0.64	-	-
The researcher is skillful and enjoys developing and making graphs and charts	0.58	-	-
The researcher prefers to use posters, models, or actual practice and other activities to help me learn.	0.57	-	-
The researcher grips objects in their hands during learning periods	0.41	-	-
The researcher feels very comfortable touching others, hugging, handshaking, etc	0.37	-	-
The researcher would rather listen to a good lecture or speech than read about the same material in a book or journal	-	0.80	-
The researcher retains academically related material best by listening to presentations and tapes	-	0.66	-
The researcher prefers listening to the news on the radio rather than reading about it in the newspaper	-	0.63	-
The researcher follows oral directions better than written ones	-	0.51	-
The researcher remembers best by writing things down several times	-	-	0.72
The researcher requires explanations of diagrams, graphs, or visual directions	-	-	0.62
The researcher likes to write things down or to take notes for visual review	-	-	0.59
The researcher prefers to see information on a chalkboard and supplemented by visual aids and assigned readings	-	-	0.46

their teaching effectiveness also believed that their preferred technology enhanced their teaching effectiveness (0.415. p<.000).

DISCUSSION AND CONCLUSION

The results of this study indicate that selected factors are related to an instructor's preferred teaching method and preferred use of technology for instructional support. Although it was expected that instructors' learning style would be consistent with preferences in teaching methods, this was not the case. Significant results for instructors who are visual learners yielded findings more consistent with what one expect for auditory learners (for example, lectures with student participation or discussion groups). It is possible that instructors, recognizing their own learning style, choose to utilize teaching methods that they believe will cater to other types of learners. These findings require further investigation. Not surprising, classroom environmental factors (class size, class layout) do appear to limit those who wish to use "lecture with voluntary student participation." Large classes, which are becoming increasingly common on many university campuses, do not allow for such participation on the part of students. It also appears that a number of faculty members believe that using a "lecture only with no student participation" greatly enhances their teaching effectiveness, supporting the idea that some faculty members continue to feel very comfortable with the traditional lecture method of teaching. Learning style was also found to be related to one's preferred choice in

technology use. For example, instructors who are auditory learners showed a preference for using videos that is consistent with the needs of that particular learning style. Instructors with the KT learning style indicated a preference for PowerPoint presentations, which is less consistent with their learning needs. This finding requires further investigation. It was interesting to note that, with the use of simulations becoming more popular, the course subject did not appear to be limiting factor for those instructors who prefer to use such technology. This may also be influenced by the fact that there are now more computer simulations available for different courses (for example, International Business, Strategic Management, Human Resource Management), as opposed to being limited to one or two course subjects.

Classroom environmental factors also were found to restrict the type of technology used in courses, particularly the use of experiential exercises. Of the environmental factors listed, it is likely that class size would play the biggest role in using this technology. Institutional pressure also influenced the use of technology. Those who indicated that they experienced institutional pressure to use technology were those who preferred computer simulations or email and web pages. It is difficult to determine if the pressure experienced to use technology was for specific types of technology that may or may not be consistent with one's preferences. For example, an instructor may experience institutional pressure to use on-line technology but their preference is to use simulations.

Overall, this study produced some interesting findings, indicating some significant relationships between teaching methods, learning styles, use of technology, and factors that might influence either of these.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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