Investigating Learning and Technology Using the MBTI and Kolb's LSI

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Abstract

This presentation will share the findings of a three-year study at the University of Cincinnati on the effects of using technology on student learning in two basic engineering courses. We will compare our results to existing data on engineering students and practicing engineers, as well as discuss whether technology affected performance among various groups. Findings may clarify whether the learning by students of a particular learning style and personality preference is enhanced by specific technologies and may indicate ways in which teaching and learning can be improved.

Although many engineering colleges are beginning to use the Internet and Worldwide Web to enhance routine classroom instruction, very little has been done to match the use of new technologies to the learning styles of students. In this study we want to see if it is possible to match the use of new teaching technologies and student performance with learning styles. We use "learning style" to describe the phenomenon of how students learn.

In this study, three different technologies were used: Streaming Video, Web-based and Interactive Video which was evaluated separately at the originating and receiving sites, resulting in four separate categories. A standard lecture section was used as the control group. Faculty worked together as a team to select common texts, develop common syllabi and block final exams resulting in standardized materials and grading.

To identify learning style, the project team selected two well-known instruments: the Myers-Briggs Type Indicator (MBTI) and the Kolb Learning Style Inventory (LSI). Both inventories were administered to students in all sections of Mechanics I and later in all sections of Basic Strength of Materials at the University of Cincinnati College of Engineering starting in the fall of 1999. In addition, two sections of Mechanics I at Wright State University also participated in the first year of the study.

Results to be reported are based on data from a sample of more than 400 students. Preliminary indications are that the use of streaming video and interactive video may improve student performance among personality preferences and learning styles that are less common among students in most engineering classes.

Introduction

Society has long searched for ways to improve learning and to increase teaching efficiency. What learning style and technology have in common is that both seem to promise these results. The present study investigates whether a connection can be demonstrated among student learning style or personality type, the use of educational technology, and improved student learning. The study was conducted by a team from the University of Cincinnati under a three-year grant from the General Electric Fund. In addition to engineering students enrolled at the University of Cincinnati, engineering students at Wright State University also participated in the first year of the study.

Two widely accepted instruments, the Myers-Briggs Type Indicator (MBTI) and Kolb's Learning Style Inventory (LSI), were selected to provide information on how students learn. The MBTI has been used extensively in studies with engineering students, and we hope to build on that current knowledge base. We plan to use the data gathered to determine implications for teaching and using technology to enhance learning.

Description of Program

All classes received in-person instruction which varied depending on the specific instructional technology used in that class. The traditional class and the interactive video classes were standard lectures. Students in the web-based class and the streaming video class were required to preview the Mechanics I course material prior to the class. The instructor's role changed from the traditional lecturer to that of mentor; he reviewed difficult concepts, answered questions, worked problems and gave practical examples.

A statistical analysis was used to assess student learning based on MBTI types and LSI in the control class and each of the three technology classes. We examined how various personality types and learning styles perform within a specific class, how various personality types and learning styles perform across all four instructional formats; and how student interest in the class or instructional technology affects his/her grades.

The students' learning styles and personality types were measured and compared to student performance in the Mechanics I and Basic Strength of Materials classes taught using four different instructional technologies: interactive video, originating and receiving, a web-based class and a streaming video class. A standard lecture class was used as the control class.

There were approximately 400 students enrolled in the five classes. Data acquired during this spring will provide additional samples that will significantly increase confidence in the results. Significant differences were found between the web-based and streaming video classes as well as the web-based and traditional classes. Analysis revealed that differences in thinking types (ST/NT on the MBTI scale) played an important role in grade performance in classes with different instructional technologies. We were unable to detect the role that LSI learning styles may have on student performance in a specific technology class. LSI results conformed to the national norms for engineering students with the students with convergent learning styles performing slightly better than students with other learning styles. [1]

Brief Descriptions of Psychological Type

The Myers Briggs Type Indicator (MBTI) uses C.G. Jung's theory of psychological type to indicate how an individual's behavior is orderly and consistent based on differences in the way individuals prefer to use their perception and judgment. Perception involves the ways of becoming aware of people, things, events and ideas. Judgment involves the ways of coming to conclusions about what has been perceived. Differences in perceptions and conclusions result in differing reactions, interests, values and motivations and skills.

The MBTI has four separate indices that reflect the four preferences used in perception and judgment. These preferences reflect not only what people attend to in a given situation but also how they draw conclusions about their perceptions. The main objective of the MBTI is to identify four basic preferences. These preferences or indices, EI, SN, TF, and JP are designed to point in one direction or the other. They are not designed to measure traits or behaviors. The intent is to reflect a habitual choice between rival alternatives, analogous to right-handedness or left-handedness. Just as everyone expects to use both hands but generally prefers one to the other, every person tends to use both poles of the preferences but responds first with the preferred functions or attitudes.

It is very important to understand that one preference is not qualitatively better than or inferior to another. They are simply different. By identifying individual differences in basic functions and attitudes, the MBTI can be used in a wide range of human activities. In education the MBTI is useful in:

- Developing different teaching methods to meet the needs of different types
- Understanding type differences in motivation for learning
- Analyzing curricula, methods, media and materials to meet the needs of different types.

Based on a review of literature, we found that students in engineering and practicing engineers have personality types that are similar across programs and businesses. The distribution of personality types among engineers is somewhat different from that of the general population (see Table I).

"Engineering attracts significantly more thinking than feeling types. Thinking types in theory should be motivated to work with concepts and materials that work on logic and cause-effect. . ." according to McCaulley, Macdaid and Walsh. [2] They continue, "Engineering students and practicing engineers have more judging types than perceptive types. We predicted that J students who value system and order might have an easier time in engineering than P students who value a more adaptive or spontaneous approach."

Felder [3] stated that "engineering professors usually orient their courses toward introverts (by presenting lectures and requiring individual assignments rather than emphasizing active class involvement and cooperative learning), intuitors (by focusing on engineering science rather than design and operations), thinkers (by stressing abstract analysis and neglecting interpersonal considerations), and judgers (by concentrating on following the syllabus and meeting assignment deadlines rather than on exploring ideas and solving problems creatively)."

These studies are of particular importance to our study at the University of Cincinnati. While the percentages in feeling and thinking types among UC students were consistent with the findings of the ASEE Consortium and MBTI studies reported in the Atlas of Type Tables[4] and with new studies such as those reported by Thomas, et. al. [5], the reported percentages in judging and perceiving types were not. This could be an important finding for further study concerning retention of more students who are perceptive in type. If the use of technologies enhances learning for perceptive types, it could be an important factor in retaining these students.

Table I. Comparison of Type for Engineers among Samples from Various Studies

	General Population[4]	Myers [6] N=2389	McCaulley [7] '76 N=1060	Sloan&Jens [8] Cl. of '80 N=450	Practicing Engineers [4] '85	UC Sample 1999-2001
Introvert	30%	52%	62%	57%	52%	45%
Extravert	70%	48%	38%	43%	47%	55%
Sensing	70%	33%	52%	45%	53%	53%
Intuition	30%	67%	48%	55%	47%	47%
Thinking	50%	68%	59%	72%	63%	63%
Feeling	50%	32%	41%	28%	36%	37%
Perceiving	50%	36%	40%	46%	40%	63%
Judging	50%	64%	60%	54%	60%	37%

The following are the results for two of the three years of our study, which is currently underway.

Brief Description of Learning Style Inventory (LSI) Patterns.

David Kolb's theory of learning style proposes four groups[1]. The convergent learning style (CNV) relies primarily on the dominant learning abilities of abstract conceptualization and active experimentation. The strength of this learning style is in problem solving, decision-making and practical application of ideas. Ideas are organized for solving problems using deductive reasoning. The divergent learning style (DIV) relies on concrete experience and reflective observation. The greatest strength of this learning style is in being able to organize information from a variety of perspectives. Assimilation learning styles (ASM) are identified by abstract conceptualization and reflective observation. The strength of this style is in inductive reasoning and the ability to create theoretical models. The fourth style, accommodation (ACC), emphasizes concrete experience and adaptive experimentation. The strength of this style is in carrying out plans and tasks, risk taking and action.

Results

For all students in our study, CNV students performed significantly better than DIV students and ASM students ((3.377)= 4.386; p=0.005). Students with convergent learning styles did significantly better in the web-assisted course than in classes using other technologies. Despite the above finding, Univariate ANOVA's indicate that there is no significant overall interaction or LSI main effects between course instructional format and LSI for course grades for the Mechanics I students and Basic Strength of Materials students when results for both groups are combined.

Univariate ANOVA's for MBTI type groups indicate that there is no significant overall interaction between course instructional format and MBTI type for course grade when results for students in both Mechanics I classes and Basic Strength of Materials classes are combined.

On the other hand when we separated the results using MBTI Type Mental Function Subgroups into four subgroups related to career choice (ST, SF, NF, NT), Univariate ANOVA's indicate that there are significant overall interaction effects between course instructional format and MBTI subgroup for course grade for students in both courses. (Mechanics I: F(12) =2.369, p=0.0007) and Basic Strength of Materials F(11) =2.939, p= 0.003). In these cases, students across all of the different Mental Functions did well on final grades in the classes using streaming video, web-based and Interactive video-originating classes. Students with SF and NF types in the Interactive video-receiving classes did less well .

In addition when MBTI Perception and Orientation Subgroups (SJ, SP, NP and NJ) were examined, Univariate ANOVA's indicate that there are significant overall effects between course instruction format and MBTI subgroup for course grade for students in both

Mechanics I classes and Basic Strength of Materials classes. (F (12) =1.990, p=0.026). Looking at final grades for students in each of the classes using different delivery methods, students with Mental Functions of SF, NF and NT did not do as well in the interactive video - receiving classes.

Conclusion

We learned that MBTI results for students who have participated in the program thus far are similar to the national trends of engineering students and practicing engineers. We note that students in the engineering program at the University of Cincinnati have a higher percentage of perceptive types. This may be an area to investigate further to identify ways to retain these students, who have a higher rate of attrition than judging types [2]. It appears that all the various personality types do fairly well in classes using technologies of streaming video, web based courses and interactive video originating. There is some indication that interactive video receiving is not as effective.

Future research is needed to examine the consistency of our findings concerning how personality type, importance of student satisfaction, improvement in technology use; and instructor personality and training affect performance of students in these classes.

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