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Learning Based On Cognitive Styles**

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ABSTRACT

The purpose of this study was to identify differences in student motivation and attitude in relation to cognitive styles between two types of instruction (virtual and traditional). The study's participants were 40 first-year students enrolled in the Metal Technology Department at Rajamangala University of Technology Phra Nakhon Thailand. All students were doing a virtual reality module within one course and traditional lecture within another. The students completed a cognitive style test (Group Embedded Figures Test) which classified students as either field-dependent (FD) or field-independent (FI). Students also completed a questionnaire designed to measure motivation and attitude. The sample included 20 field-independent and 20 field-dependent students. Results indicated that those FD students were more motivated than were FI students towards the Virtual reality learning environment versus a traditional lecture, they also held more positive attitudes. However, the difference between the two was not significant.

Keywords: Virtual reality environment, motivation, attitude, cognitive styles, Group Embedded Figures Test, field-dependent, field-independent,

INTRODUCTION

The purpose of this study was to identify if there were differences in student motivation and attitude related to virtual versus traditional learning in students with varying cognitive styles. Participants were 40 first-year students enrolled in Metal Technology program at Rajamangala University of Technology Phra Nakhon Thailand. All students were doing a virtual reality module within one course and traditional lecture within another.

Witkin (1981) considers cognitive style as personal approach to collecting and organizing information. Kunlen (1968) defines cognitive style as the general tactic employed by a person to deal with cognitive work or to study the situation. The method often reflects certain personal characteristic. It dictates the way an individual accepts information input from the environment, the way an individual organizes and processes the information and experience, and the performance of the overall cognitive behavior. Among the earliest cognitive styles recognized, field-independent and field-dependent cognitive styles had received more attention of researchers than other styles (Witkin, 1981).

The purpose of field-independence and field-dependence test is to measure the ability of test subjects' to overcome background-irrelevant elements when they attempt to identify relevant components from

the situation. The more they are immune to influence of irrelevant elements, the more they are considered analytical; the more they are dependent on or influenced by irrelevant elements, the more they are considered global. Field-independent and field-dependent people demonstrate significantly different characteristics in their cognitive styles. Significant discrepancies are also observed in terms of their learning, thinking and behaviour. Evangelos (2003), Amory (1999) and Saracho (1991) in their studies identify characteristics of students of field-independent and field-dependent cognitive knowledge of the concept in order to successfully styles as shown in Table 1.

Table 1: Comparison of Characteristics of FI Students and FD Students

Field-Independent Students (FI Students)	Field-Dependent Students (FD Students)
Discrete thinking	Comprehensive thinking
Can better grasp inner motive; can single out components of the facility and their relationship with the organizational background.	Require external assistance. Perception can be easily dominated by the overall organization of the surrounding facility. All components of the facility are deemed integrated.
Approach the environment via analytical method.	Approach the environment via a more global method.
Can better develop self-defined goal and self-empowering.	Require external goal and empowering.
Prefer explanatory meta-instruction unit.	Learn more from explanatory introduction unit.
More independent in development of cognitive reconstruction skill.	More capable and active in development of human relationship skill.
Prefer independent learning.	Prefer group-cooperation learning.

ATTITUDE

The attitude that is often used in conjunction with motivation to achieve is *self-efficacy*, or how capable people judge themselves to be to perform a task successfully (Bandura, 1977). Bandura (1997) provides extensive evidence and documentation for the conclusion that self-efficacy is a key factor in the extent to which people can bring about significant outcomes in their lives. Specifically, there is considerable evidence to support the contention that self-efficacy beliefs contribute to academic achievement by enhancing the motivation to achieve. For example, Schunk (1989) in a number of studies, has shown that children with the same level of intellectual capability differ in their performance as a function of their level of self-efficacy.

MOTIVATION

The motivation is the positive or negative needs, goals, desires and forces that impel an individual toward or away from certain actions, activities, objects or conditions. The inner needs and wants of an individual what affects behaviour. Motivation is an abstract concept that is difficult to measure in any meaningful way (Ball, 1977) It is possible to observe a person's behaviour.

METHODOLOGY

Participants

The initial group of participants were 74 first-year students enrolled in the department of Metal Technology at Rajamangala University of Technology Phra Nakhon Thailand. All participants were enrolled in a beginning welder's course. This course is delivered using a traditional lecture method.

Procedures

Phase 1

Instructors informed their students about the study. They explained that the experiment would take about thirty minutes to administer. Students were tested in groups. First, they read and signed an informed consent form, supplied demographic information and asked any questions they may have had. Each The Group Embedded Figures Test (GEFT) booklet contained a non-identifying participation number to ensure anonymity and confidentiality. The students provided information about their name, major and date of birth in the space provided.

In their name lists they had to put their Grade Point Averages (GPAs). They were assured of the anonymity and the confidentiality of their responses.

The students received both verbal and written instructions for the GEFT. A short practice session preceded the two experimental portions of the test. In each experimental section, the students were given five minutes to locate and identify the simple objects embedded within the complex object. Following the completion of the booklet, students were dismissed.

The Group Embedded Figures Test (GEFT) is a frequently utilized instrument to measure an individual's degree of field-dependency. It was developed by Witkin, Oltman and Raskin (1971) and is designed to measure individuals' levels of field independence by tracing simple forms in larger complex figures. The test includes 18 items. A maximum score of 18 indicates field independence, higher scores indicate higher degrees of field-independence. The test classifies individuals scoring below 13 as field-dependent and those scoring above 13 as field independent.

Participants who take the GEFT are asked to identify a series of simple figures within more complex forms as shown below in Figure 1.

Here is a simple form which we have labeled "X":



This simple form, named "X", is hidden within the more complex figure below:

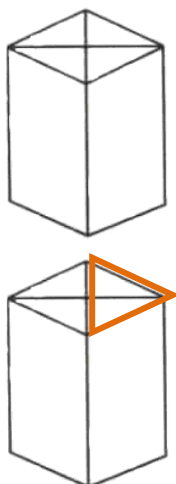


Figure 1 The Group Embedded Figures Test (GEFT)

Phase 2

We calculated the scores for the GEFT for each student and then classified them as either field-dependent or field independent. We then divided students into two groups depending on their cognitive styles (i.e. whether they were field dependent or field independent as well as according to their GPAs.

The results shown in Table 2 indicate that there were a higher percentage of students with Field-Dependent cognitive styles (FD) than Field-Independent cognitive styles (FI). The result from the GPAs showed that most of the students with low GPAs had a Field-Dependent cognitive style (FD). Next, we then eliminated 34 students from the sample. We did this in order to avoid a GPA effect in the study. It was not within the scope of this study to investigate on the basis of gender therefore we grouped males and females. The final sample for the study was 40 students.

Table 2: Description of Field-Dependent (FD) and Field-Independent (FI) Respondents by GPAs and Gender ($n = 74$)

Variable	Description	Total		Cognitive styles			
				FD		FI	
		n	%	n	%	n	%
GPAs	High	29	39%	18	62%	11	38%
	Low	45	61%	33	73%	12	27%
Total		74	100%	51	69%	23	65%

Phase 3

All participants were then invited to play the X-mission game in a computer laboratory all at the same time.

Within this course, we provided participants with the opportunity to use a game-based virtual reality module called The X-mission. The game was created by one of the authors of this paper. The game aims to facilitate learning safety in the welding lab. It also aims to improve the students' self-learning, problem-solving, and information technology skills. In the game, students have an avatar as a young knight (see Figure 2).



Figure 2: The X- mission's young knight

Each player plays the role of a knight who has to save the lives of others in the lab (see Figure 3). The whole game typically requires one hour of play. At the end, the system assesses the students' achievement in relation to their safety skills in the welding lab.



Figure 3: Computer's avatar

Phase 4

In this phase, students completed closed and open questionnaires using a likert scale concerning their experiences, and a discussion followed. The purpose of administering the questionnaire was to determine if students were more motivated by the game than by the traditional classroom lecture. The questionnaire was created by (The author). It includes 20 items. The questionnaire is designed to measure motivation and attitude towards learning. In this case, we wanted to see if field dependence is related to motivation and attitude towards learning i.e. are for example, field independent students more or less motivated by virtual than by traditional learning?

ANALYSES

The GEFT scores were calculated by simply tabulating items. The responses to the questionnaires were analysed using descriptive statistics and T-tests to determine significance.

RESULTS

Tables 3 and 4 illustrate that FD students were more motivated than FI students towards the Virtual reality learning environments versus a traditional lecture. They also held more positive attitudes. However, Tables 3 and 4 illustrate that the difference between the two was not significant.

Table 3: Means, Standard Deviations, and t-test for Respondents' Motivation by Field-Dependent (FD) or Field-Independent (FI) Learning Style ($n = 40$)

Statement	Total		Learning Style				t-value
			FD		FI		
	Mean(SD)		Mean(SD)		Mean(SD)		
	Before VR class	After VR class	Before VR class	After VR class	Before VR class	After VR class	
1. I want to get better grades than other students	4.15(1.01)	4.21(1.01)	4.16(1.00)	4.26(0.96)	4.14(1.02)	4.18(1.04)	
2. I expect to do well in	3.61(0.85)	3.77(0.84)	3.66(0.84)	3.78(1.00)	3.56(0.86)	3.76(0.76)	

Statement	Total		Learning Style				t-value
			FD		FI		
	Mean(SD)		Mean(SD)		Mean(SD)		
	Before VR class	After VR class	Before VR class	After VR class	Before VR class	After VR class	
this class							
3. Studying appropriately, I can learn the material	3.53(0.87)	3.70(0.89)	3.45(0.85)	3.43(0.84)	3.60(0.89)	3.82(0.89)	
4. I prefer course material that arouses my curiosity	3.49(0.75)	3.66(0.80)	3.33(0.67)	3.48(0.67)	3.64(0.83)	3.75(0.84)	
5. I am satisfied with trying to understand content	3.23(0.67)	3.49(0.80)	3.21(0.50)	3.48(0.67)	3.25(0.83)	3.49(0.86)	
6. Course material is useful to learn	3.44(0.79)	3.49(0.83)	3.44(0.82)	3.52(0.85)	3.45(0.76)	3.47(0.83)	
7. I think of the questions I cannot answer ^a	3.29(0.95)	3.30(1.08)	3.27(0.89)	3.30(1.15)	3.30(1.01)	3.29(1.01)	
8. I am interested in the content area of this course	2.9(0.98)	3.14(0.93)	2.87(1.00)	3.00(0.95)	2.93(0.95)	3.20(0.92)	
9. I think of how poorly I am doing ^a	2.65(0.99)	2.81(1.51)	2.64(1.02)	2.83(1.67)	2.66(0.95)	2.78(1.35)	
Total	3.364(0.87)	3.48(0.52)	3.4(0.84)	3.43(0.57)	3.39(0.90)	3.51(0.50)	-0.64

Note: Scale 1=Not at all typical of me, 2=Not very typical of me, 3=Somewhat typical of me, 4=Quite typical of me, and 5=Very much typical of me.

^a Negatively stated items. Means of these statements were reversed in the total mean.

Table 4: Means, Standard Deviations, and t-test for Respondents' Attitude by Field-Dependent (FD) or Field-Independent (FI) Learning Style (n = 40)

Statement	Total	Learning Style		t-value
		FD	FI	
		Mean(SD)	Mean(SD)	
1. Learning through Virtual reality environment instruction is convenient	4.03(1.11)	4.04(0.82)	3.98(0.97)	

Statement	Total	Learning Style		t-value
		FD	FI	
	Mean(SD)	Mean(SD)	Mean(SD)	
2. Virtual reality environment courses allow me to control the pace of my learning	4.00(0.92)	4.13(1.25)	3.98(1.05)	
3. Virtual reality environment courses should be utilized more often to deliver instruction	3.69(0.89)	3.91(0.60)	3.59(0.98)	
4. I will recommend Virtual reality environment courses to my friends	3.62(1.00)	3.78(0.95)	3.55(1.03)	
5. Virtual reality environment courses provide me with learning opportunities that I otherwise would not have had	3.57(1.11)	3.61(1.16)	3.55(1.10)	
6. I enjoy learning from the Virtual reality environment lessons	3.49(1.06)	3.83(0.83)	3.33(1.13)	
7. I will enrol in another Virtual reality environment course	3.27(1.01)	3.30(0.88)	3.25(1.07)	
8. I feel isolated as a student when I take courses via the web ^a	3.01(1.20)	2.91(1.20)	3.06(1.21)	
9. I would not have taken Virtual reality environment courses if I had some other means of acquiring course credits ^a	2.80(0.99)	2.61(0.89)	2.88(1.03)	
10. I prefer Virtual reality environment courses to traditional classroom instruction	2.65(1.05)	2.87(0.87)	2.55(1.12)	
11. Learning through Virtual reality environment courses is boring ^a	2.62(1.02)	2.35(1.07)	2.75(1.00)	
Total	3.49(0.64)	3.60(0.60)	3.37(0.68)	1.38

Note: Scale 1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, and 5=Strongly Agree.

^a Negatively stated items. Means of these statements were reversed in the total mean.

DISCUSSION

Our assumption at the beginning of this study was that FD students would be more motivated by and more attitude toward Virtual based learning. We assumed this because Virtual based learning need student to defuse goals and FI students, they can self structure maybe practically useful in virtual environment, However we also know that FD students best with social context. Our virtual environment did not offer social environment but student work individually. If our virtual environment had included social part for example; student could have interact together socially. They may have been more significant difference. This means that to effect motivation and attitude of FD in virtual environment should provide socially environment such as online chatting.

CONCLUSION, LIMITATIONS AND IMPLICATIONS

The purpose of this study was to identify differences in student motivation and attitude in relation to cognitive styles between two types of instruction (virtual and traditional). The study's participants were 40 first-year students enrolled in Metal Technology program. All students were doing a virtual reality module within one course and traditional lecture within another. The students completed a cognitive style test (Group Embedded Figures Test) which classified students as either field-dependent (FD) or field-independent (FI). Students also completed a questionnaire designed to measure motivation and attitude. The sample included 20 field-independent and 20 field-dependent students. Results indicated that FD students were more motivated than FI students towards the Virtual reality learning environment versus a traditional lecture. They also held more positive attitudes. However, the difference between the two was not significant.

This study was limited to 40 students in a metal technology Department. The results may have been different if the study had been conducted with students in another discipline. Researchers may wish to see if they can confirm or refute our results by conducting studies in other disciplines. We began our study with a group of 74 students but subsequently eliminated 34 of these so that achievement as measured by GPA would not affect our results. If we had worked with the larger group of 74, our results may have been different. It follow-up studies might focus exclusively on students of high GPA or with only low GPA to see if results are significant in that context. Our study was conducted in Thailand. It is possible that results would be different with students of a different cultural group.

Also, as noted in the discussion, the results may have been different if the virtual learning environment had been designed differently, for example, if it had included a social component. This would be our next step, i.e. to conduct the same study but with a game that is online and allows social interaction between students. Furthermore, we did not characterize the activities in the traditional classroom. We know that activities involved primarily lectures but we do not know, for example, if there were social activities in this class. A study with a range of styles of classroom instruction and a range of instructors might yield different results. It would be interesting to conduct a study which compares the virtual learning environment with a different style of traditional classroom.

We began with the assumption that simply because the learning took place in a virtual environment that this would appeal to the FD student. However, we found that this was not the case. We conclude therefore that perhaps virtual learning itself is not necessarily a predictor of motivation and attitude for FD students but that it is the way in which the virtual environment is designed that will determine the motivation and attitude of the FD or FI students. This means that if we want to appeal to, for example, the FD students, we will design the virtual learning to cater to the style of the FD students. This is a hypothesis that could be investigated in future studies.

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