Situated Learning Incorporated into a Web-Assisted Instruction in Nutritional Chemistry Taken by Learners with Learning-Style Differences

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Abstract

In this study, the effect of situated learning theory incorporated into nutritional chemistry online education environment on learning achievements and learning satisfactions of college students was investigated, and under such a teaching method, its effect on learning achievements by learners with different learning styles was analyzed in depth. The study results showed : 1. The learning achievement of the learners receiving online situated education, the experimental group, was better than that of the learners receiving online non-situated education, the control group, and it reached a significant level statistically. 2. Within the experimental group, the learning achievements of the two learning styles did not reach a significant level of difference, which suggested that the way of learning in online situated courses weakened the effect of a learning style on learning achievement, and thus it might be adaptable to the differences among individual learners. 3. In terms of the satisfaction analysis on the learners in the experimental group under this online nutritional chemistry situated education, they responded that this mode of learning had been lively and activating, and thought that it had been easy to associate the educational material which consisted storyline with daily life experiences.

Intentional Learning Theory

Intentional Learning Theory was invented by Margaret Martinez who combined neurological scholars - Daniel Goleman and Joseph Ledoux's theory that "human emotion plays an influential role in human recognition" from their works of "Emotional Intelligence" (1995) and "Emotional Brain" (1996), respectively, and Child development scholar Amanda Woodward's assertion (1998) that human's learning and thinking is affected by his/her emotion (1998 and 1997). Additionally, to support his Intentional Learning Theory, Learning orientation Model, LOM, (1999) and Learning Orientation Questionnaire, LOQ, (1999) were introduced. Intentional Learning Theory includes all factors that may impact on learning, and the theory itself concentrates on the emotional factor as the most influential ingredient for learning activity. Simultaneously, conventional perspective of recognition study such as those concerns personal emotion, attitude, trust, and intention were addressed as the psychological factors (including social factors that may affect a person's intention) influencing and assisting learning activities by Learning Orientation Construct, LOC.

Learning Orientation Construct, LOC, is based on three major factors that are greatly influential on learning: emotion, self-exertion and self-discipline.

Learning Orientation Questionnaire, LOQ, is a well-constructed survey for learning aptitude, coupled with Learning Orientation Model to study the surveyee. Typically, the surveyee has to fill 25 questions with numerals from 1 to 7, and the result is analyzed by LOQ Center.

Learning Orientation Model, LOM, can be grouped into four categories determined by individual's learning difference:

A. Transforming Learner

Transforming learners are stronger then others in terms of learning self-discipline, as they prefer to seek their own means of learning, and dislike interferences from others people. Therefore, they can actively learn by their own inspiration. Their learning outcomes are best when they set their own path and study methods.

Typically, these learners do not like to adhere to rules or standards, so readily higher study goals can be set for them. Their aptitude for learning is so more lively and active, meaning that they like to discover new knowledge or new challenges to be solved and learned. Therefore, they are willing to learn when they are empowered to set their own study path irrespective of course length. In terms of curriculum design, they can accept curricula that are highly challenging; moreover, an interpersonally touch can be considered to include in their study as the role of learning consultancy among others.

B. Performing Learner

In comparison to Transforming Learner, Performing Learners are not willing to take risks, and are more cautious in their learning attitude. Therefore, the length of curriculum course for them should be shortened, with fewer challenges. Nevertheless, within the thresholds of their interests, they are still willing to achieve their learning goals, provided that they are have enough inspirations; thus the 'coaching' style of teaching is well-suited to their learning. Hence, they should be encouraged continuously, while lengthy course should be avoided. They should be guided to avoid "discovery", else they may be intimidated by such difficulties, resulting in inefficient learning.

Performing Learners chooses their learning methods, hence, educational methods should be adapted according to their interest inspiration.

C. Conforming Learner

Conforming learners do not like to make decisions on the learning methods by themselves, and they are not willing to take risks, or effort to discover or solve the problems. Hence, they are passive with little self-discipline at learning. Typically, they dislike challenging or problem-solving curriculum, therefore the teaching curriculum should have a simple, linear design.

D. Resistant Learner

Resistant learners never believe that the goals set by others are ever attainable, and do not believe that the obedience demanded by school instruction is in their own interests. Furthermore, they doubt that the school curriculum that will benefit them. They frequently feel frustrated from school education, and from the conflict of divergent value systems. They are misunderstood by others, and have experienced failure in learning. Hence, they are pessimistic about learning, and will never accept that educations are ever useful to them and their lives.

Resistant Learners are generally negative, yet such a distinctive characteristic can pave a result in motivation to learn. Unexpectedly, once their interest is aroused they can perform with outstanding exertion and willpower. Defense or wary they may be, but they are not completely beyond redemption.

Research Design and Methods

This study focuses on the Polymer Chemical web course from Providence University's daily-chemical Internet curriculum. Most of the research subjects ranged from sophomore to senior years in the college. Typically, most students would had studied Introduction to Computer Science in their freshmen year, and thus acquired the ability to use the Internet.

This research was performed on the Internet. To understand and distinguish students' knowledge in Polymer Chemistry, and study aptitude, students took a pre-study examination before taking the course. The examination not only tested students' previous knowledge in Polymer Chemistry, but also included the Learning Orientation Questionnaire (LOQ) after the internet learning session. The LOQ correlated Leaning outcomes and students' psychological factors, and determined the appropriateness of personalized Internet learning for Chemistry study.

This study divided students into three groups, first to determine whether students' adaptability to the learning environment the influences students' learning outcome, and second, to determine whether adaptive students in different environment are sharing common learning outcomes.
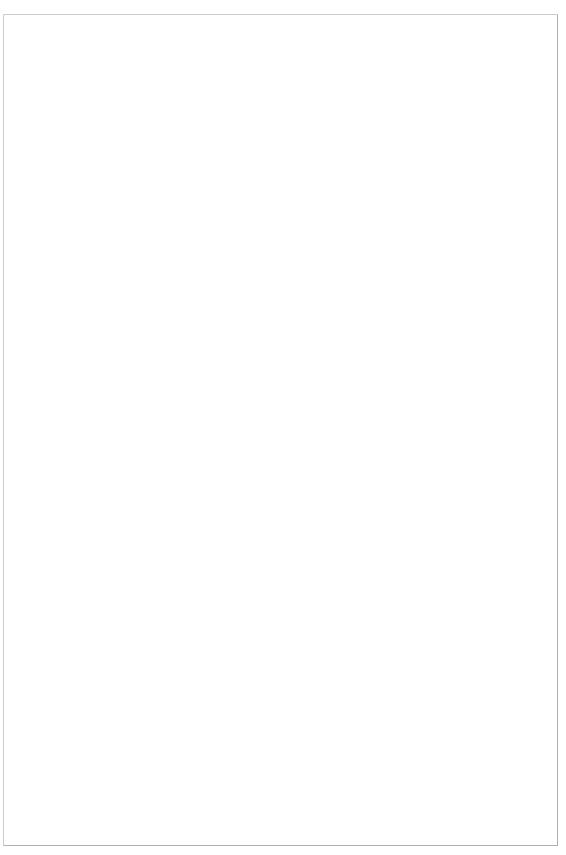
Fig1. Reaserch Design

Result and Discussion

1. LOQ Analysis

A total of 428 students participated in this two-year long research. The analytical results from the authorized LOQ Center are presented below:

Learning Orientation Model	Number of people
Transforming	62
Performing	247
Conforming	119

Table 1. LOQ Analytical Result

2. Pre-test and Grouping

The students were randomly divided into three groups. Students in each group conducted learning activities a different Learning environment. Transforming, Performing, and Conforming. The analytical results of pre-learning test are as follows:

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	661.508	2	330.754	0.621	0.539
Inside Group	69798.194	131	532.811		
Total	70459.701	133			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing	-5.9524	5.6316	0.537
	Conforming	-6.4696	6.6140	0.621
Performing	Transforming	5.9524	5.6316	0.573
	Conforming	-0.5172	4.9715	0.995

Conforming	Transforming	6.4696	6.6140	0.621
	Performing	0.5172	4.9715	0.995

Table 2. Pre-test ANOVA Analysis of Transforming Learning Environment

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	1866.716	2	933.358	2.323	0.102
Inside Group	48208.081	120	401.734		
Total	50074.797	122			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing	11.1111	5.2819	0.114
	Conforming	10.8081	5.8730	0.188
Performing	Transforming	-11.1111	5.2819	0.114
	Conforming	-0.3030	4.2135	0.997
Conforming	Transforming	-10.8081	5.8730	0.188
	Performing	0.3030	4.2135	0.997

Table 3. Pre-test ANOVA Analysis of Performing Learning Environment

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	1032.695	2	516.347	0.956	0.387
Inside Group	67539.180	125	540.313		
Total	68571.875	127			
Learning Orientation		Average	Standard Deviation	Significance

		Deviation		
Transforming	Performing Conforming	6.0071 9.0980	6.3222 6.6174	0.638 0.391
Performing	Transforming Conforming	-6.0071 3.0909	6.3222 4.4937	0.638 0.790
Conforming	Transforming Performing	-9.0980 -3.0909	6.6174 4.4937	0.391 0.790

Table 4. Pre-test ANOVA Analysis of Conforming Learning Environment

In the pre-test analytical results, the students entered into the same learning environment have no obvious clear deviation in the Pre-test ($p > 0.05$). Hence, at the point of entering the learning environment all students are at the same level.

3. Study Outcome

After studying in the pre-set learning environment, adaptive students with the same learning aptitude as the environment performed better then the less adaptive students. The result is validated by obvious difference ($p < 0.05$)

Square Total	Degree of Freedom	Average Square Total	F Test	P	Square Total
Within Group	2770.041	2	1385.021	4.021	0.020*
Inside Group	45122.496	131	344.447		
Total	47892.537	133			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing Conforming	11.9048* 13.6617*	4.5280 5.3179	0.034* 0.040*
Performing	Transforming	-11.9048*	4.5280	0.034*

	Conforming	1.7570	3.9973	0.908

		Average Deviation	Standard Deviation	Significance
Conforming	Transforming	-13.6617*	5.3179	0.040*
	Performing	-1.7570	3.9973	0.908

Table 5. Post-test ANOVA Analysis of Transforming Learning Environment

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	5225.856	2	2612.928	5.137	0.007*
Inside Group	61057.701	120	508.809		
Total	66282.927	122			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing	-15.2278*	5.9442	0.040*
	Conforming	-3.4343	6.6095	0.874
Performing	Transforming	15.2778*	5.9442	0.040*
	Conforming	11.8434*	4.7419	0.048*
Conforming	Transforming	3.4343	6.6095	0.874
	Performing	-11.8434*	4.7419	0.048*

Table 6. Post-test ANOVA Analysis of Performing Learning Environment

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	5472.891	2	2736.446	4.582	0.012*
Inside Group	74648.984	125	597.192		
Total	80121.875	127			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing Conforming	-6.2032 -17.9608*	6.6466 6.9570	0.648 0.039*
Performing	Transforming Conforming	6.2032 -11.7576*	6.6466 4.7243	0.648 0.049*
Conforming	Transforming Performing	17.9608* 11.7576*	6.9570 4.7243	0.039* 0.049*

Table 7. Post-test ANOVA Analysis of Conforming Learning Environment

Subsequently, the three groups of students who entered a suitable environment for their learning orientation to them took ANOVA analysis post test, and had a similar learning outcome. ($p > 0.05$).

	Square Total	Degree of Freedom	Average Square Total	F Test	P
Within Group	754.955	2	377.478	1.383	0.254
Inside Group	36836.349	135	272.862		
Total	37591.304	137			

Learning Orientation		Average Deviation	Standard Deviation	Significance
Transforming	Performing Conforming	3.1349 6.8571	4.0967 4.3654	0.747 0.294
Performing	Transforming Conforming	-3.1349 3.7222	4.0967 3.1390	0.747 0.497
Conforming	Transforming Performing	-6.8571 -3.7222	4.3654 3.1390	0.294 0.497

Table 8. Post-test ANOVA Analysis of Conforming Learning Environment

4.   Gender Difference

Students entered the personalized learning environment, whose learning outcome is T-tested as an independent sample . Male subjects' learning outcomes were found to be better.

Gender	Average	Standard Deviation	t	F Test	Significance
Male	93.33	10.8404	5.214	7.648	0.006*
Female	79.74	17.7993	5.539		

Table 9. Gender difference's independent sample T test.

During the study of Organic stereochemistry's accomplishment factors, Taiwanese scholar Liao, Koun Shi (1999) observed that that irrespective of common chemistry or professional chemistry, male subjects performs better. Wu, Min Long(1998) has asserted that male students are interested in and inspired by the computerized content of studies. Similarly, Zheng, Mei Ying (2003) has claimed that male students are typically more active when using computers. Kam-Cheung Wong from HK University also reported in her 2002 research that within a mixed-gender school, male students perform better than females in particular scientific subjects. Providence University is a mixed-gender college.

5.   Background Difference

    The learning outcomes of students who entered personalized learning environment were T-tested on their study outcome. Students have scientific backgrounds performed better than others.

	Average	Standard Deviation	t	F Test	Significance
scientific backgrounds	90.30	12.2750	3.267	9.491	0.002
Non-scientific backgrounds	81.39	18.7876	3.325		

Table 10 Result of Education Background Difference's independent sample T-test

Taiwanese scholar Zheng, Mei Ying (2003) observed that people with scientific backgrounds are not only more knowledgeable in computer courses than students in other subjects, but are also more enthusiastic in using of computers than others. Within this study, the course was arranged according to personal characteristics with multimedia tuition, and offered an in-depth view of the Polymer Chemical for those who were already familiar with the concept of chemical molecule. Thus their learning outcome was substantially improved in personalized learning.

Conclusion

Careful analysis of statistic data indicates the personalized learning web can improve a student's learning outcome.

All the students who were involved in their most suitable learning environment obtained very significant learning outcomes.

In the personalized web environment, male and Science major students obtained a better learning effectiveness than opposite student. The analytical results indicate that personalized web design is a better model in the e-learning environments.