

# The study of "Free-rider" in Problem-based Learning Situation

- takes the college interior design course as example

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**Abstract** - Problem-based learning (PBL) is built on the theoretical basis of "cooperative learning", "situated learning" and "constructivism" and the role of the teacher is changed from knowledge authority to a "tutor". The learning mode of student is changed from independent thinking to brain storming. In the PBL learning situation, the learning atmosphere becomes free and diversified. Therefore, PBL becomes an effective teaching method of cultivating student's diversified thinking capability. However, it has been pointed out in the related studies of all kinds of fields that PBL could easily create free-riding learning phenomenon; therefore, in this study, we try to study how to find out the "free-rider" in PBL and what is the cause of free-riding behavior.

In this study, a questionnaire survey and observational method are used. First, in "Involvement and performance evaluation table for PBL in the interior design course learning", personal performance is classified through cross-compared analysis in terms of three aspects: self-evaluation, cross evaluation performance and the observation record from tutors in order to find out free-riding learner. Moreover, in terms of "Classroom climate questionnaire in PBL", we found difference between free-rider and general learner in internal influence factor: "learning style" and external influence factors: "learning situation" and "tutor's leadership style". The purpose of this study is to provide an appropriate PBL teaching method which minimizes the quantity of free-riders.

## INTRODUCTION

Design education focuses on inspiring thoughts and acknowledge and developing creativity. In the process of design education, we pay attention to inspire students' concept and integrate their creations. It is an educational model that makes students abstractly and generally think and expresses design ideas (J.Y. Wu, 1999).

For application design science, such as Interior Design, it is quite worth of adoption. The final goal of teaching of

Interior Design courses is to enable students to integratedly and creatively use the related knowledge they have learned to truly solve the related issues of Interior Design cases in the real world (S.T. Jhuang, 2002). "Cooperative learning" enables learners to achieve better learning outcomes, improve creativity and learning responsibility, and learn social skills and communication ability (Johnson & Johnson 1989). In PBL learning process, students will be arranged into several groups. Therefore, when students resolve problems together, they can recognize the importance of group's cooperation and then learn from each other. Besides, in the interactive process of group learning, students have more knowledge blend and construction, and furthermore, they integrate information into effective action program (J.H. Wang, C.W. Lin, Y.L. Siao, H.W. Siao, 2002). To sum up, the cooperative learning model of PBL group not only contribute to creative thinking of knowledge level, but also promote students' learning of socialization by cooperative model.

In the process of students' socialization, especially group activities, there is a passive attitude, as we often call the "free-rider". But in PBL related experimental studies (D.B. Fong, S.C. Yang, S.T. Jhun, 2005) mentioned: under the PBL cooperative learning model, the quality of individual practical operation is obviously worse and creativity of group's thinking stimulation still need to be strengthened. Because of some students' low participation, they have a "free-rider phenomenon." Running operation is based on a group, so more members, less proportion of personnel who can participate in the core of decision-making. Personal contribution will be ignored. If lack of good teamwork skills, lazy people can fish in troubled waters and rely on others' efforts. Here, the purpose of the study is:

1. How to do efficient and fair assessment when carry out PBL pedagogy in Interior Design courses.
2. To analyze whether individual learning style or different feelings towards teachers and environment in learning environment impacts free rider's learning attitude.
3. And then in PBL pedagogy, beside of curriculum design, to explore the factors which affect learning and to discuss

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how to avoid the free rider phenomenon in order to enhance the effectiveness of PBL.

### RESEARCH DESIGN

Problems oriented pedagogy in Interior Design teaching can help students develop independent thinking and expand the range of their learning. Figure 1, the flowchart of Interior Design study in PBL, which is in the entire progress of design teaching, blend into the PBL teaching model: excavate problems, define problems, state problems, and collect and analyze data. Students can learn to think systematically and soundly by problem-oriented mode of thinking and clearly define problems for innovative and effective thinking skills. After the end of the course, students will be given PBL design teaching checklist to estimate.

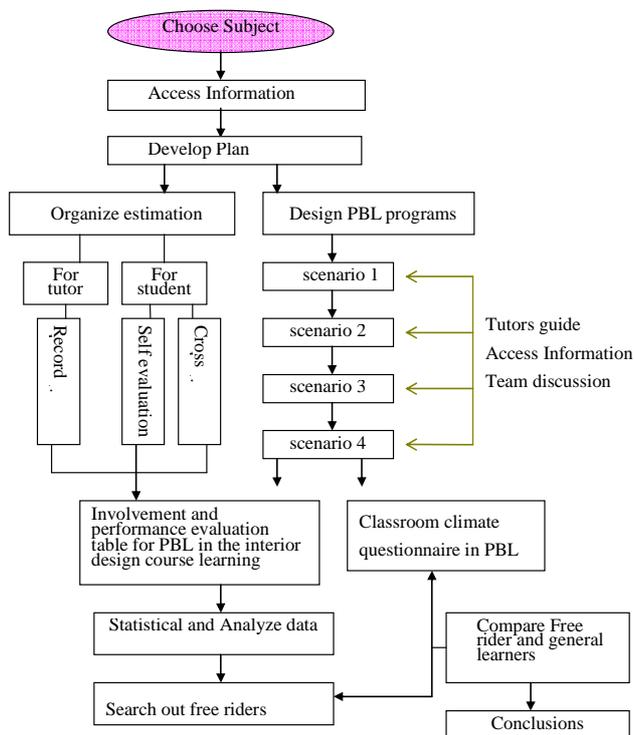


FIGURE1

THE FLOWCHART OF INTERIOR DESIGN STUDY IN PBL

In this study, questionnaire survey and observation method are used (as Figure 1). First, in "Involvement and performance evaluation table for PBL in the interior design course learning", personal performance is classified through cross-compared analysis in terms of three aspects: self-evaluation, cross evaluation performance and the observation record from tutors in order to find out free-riding learner. Moreover, in terms of "Classroom climate questionnaire in PBL", we found difference between free-rider and general learner in internal influence factor: "learning style" and external influence factors: "learning situation" and "tutor's leadership style".

### BACKGROUND

#### 1. Problem-oriented pedagogy

PBL builds on the basis of "cooperative learning", "situated Learning" and "constructivism" these three learning theoretical. Followings are the brief descriptions of the nuclear concepts of these three learning theory:

(1) "Cooperative Learning": The main focus is to use cooperative learning of the group to make students achieve better learning outcomes, enhance creativity, learning responsibility, social skills, and communication skills (Johnson & Johnson, 1989; Lebow, 1993). Faidely and others (2000) emphasized that coordination and cooperation mechanism is an important characteristic of the problem-based learning. Learning in groups enhances more achievements of learners than personal learning, and members can share knowledge with each other. Because in the process of solving problems in groups, learners are able to experience a learning approach which integrate pre-existing cognitive with the thought content of problems right now; additionally, learners develop skills of mutual coordination with team members in the process of learning (S.H. Lin, 2003).

(2) "Situated Learning" is the process of initiative acquisition. It emphasizes to provide learners "a real learning environment" (authentic learning contexts). In the process of situation learning, it emphasizes high-level thinking, so the arrangements of learning contents press close to the daily life, and learners have to work together to solve problems. Students learn how to find a problem and then try to solve it. Teachers need not to decide the knowledge learners need in advance, but through appropriate construction of environment to guide students themselves to control learning orders, speed and contents, and to interpret the contents of teach (J.R. Sie, 2002).

(3) "Constructivism" learners actively construct meanings, and they are lead to bring their prior knowledge to adapt to the new situation (Y.M. Wu, 2002). Constructivism theory emphasizes that approaching knowledge is only actively constructed by individual. It is not passively and unconditionally forced to inculcate the fixed principles by the external environment, but a selective learning. The knowledge that the individual constructs is related to the previous experiences that the one had. And the school of social constructivism even claims that it happens by the interaction of the learners and the surrounding learning environment (R.Z. Chen, 2001).

Brought together the views of many scholars, PBL has the following several key features: 1) Use structural fuzzy (bad and unknown structure) problems (ill-structured problems) as the center of course organizations and learning situations. 2) Learners play the role of a stakeholder. 3) Teaching people serve as the coach of cognition and post-cognition. 4) Encourage cooperative learning group. And 5) adopt a variety of evaluation methods.

#### 2. Problem-based Learning Evaluation Methods

The common problem-based learning assessments which Swanson (1991) proposed are "Process-oriented Evaluation" and "Results-oriented Evaluation." Process-oriented Evaluation records learning activities by writing diaries or notes or taking oral exams. Its purpose focuses on evaluating learners' learning activities. And the other Results-oriented Assessment examines learners' learning results by writing,

computer simulation assessment, short-answer tests, essay exams, and multiple-choice exams. The assessment methods are listed in Table 1:

Evaluation Stage	Assessment Method Cited
Process-oriented Assessment	<ul style="list-style-type: none"> <li>● peer assessment scale self-examination scale</li> <li>● oral exams observation of interview and tests</li> <li>● issues mimic cases review</li> <li>● real assessment practical assessment</li> </ul>
Results-oriented Assessment	<ul style="list-style-type: none"> <li>● cases review students' judgment assessment</li> <li>● multiple-choice exams short-answer tests</li> <li>● essay exams file assessment</li> </ul>

TABLE 1  
PBL LEARNING EVALUATION METHODS  
MODIFIED FROM: S.J.U GAO, 2002.

Maskell (1997) insisted that PBL must adopt the evaluation methods of student-based. The aim is to help learners have responsibility and recognition towards self-learning, and then make them actively and enthusiastically learn by themselves through learners' self-evaluation and peer cooperation assessment. The assessment range covers self-directed learning, problem-based learning, and team learning skills and processes (Savery, & Duffy, 1998). To sum up, the evaluation contents of this study are: students' learning portfolios, learning attitude, self-mutual evaluation checklist, final homework, and final announce.

### 3. Free rider effect

Free rider usually indicated a follower who avoids the cost and expense of finding the best course of action simply by mimicking the behavior of a leader who made these investments. In learning situation, Free rider effect is A Learning Attitude of Negative Inefficiency.

Learning attitude means a reaction which children, according to their ability, experiences, and background, have mutual action with teachers, curriculum, learning environment in a classroom situation. This reaction shows the positive or negative attitude of their learning. It also shows whether their interaction with the teacher is harmonic or not (H. Huang, 1980).S.R. Jheng (1982) thought that school education can create children's positive learning attitude through proper counseling measures. A positive attitude is good for learning, but a negative one will hamper learning. In PBL learning strategies, students with Free rider learning attitude, learning situations and interactions with teachers are observed to provide guidance and help students learn.

The cognitive factor of learning attitude is the prerequisite of resulting emotional and intentional factors. Without cognition, there is no emotion and so-called intention (C.R. Lee, 2005). Discussions on learning attitude and significance are conducted based on student perceptive and cognition.

However, in PBL, if we can improve Free rider learning attitudes, it will help raise the effectiveness of teaching. "Questionnaire of Classroom climate questionnaire in PBL" developed in this research explores students' perception from 3 aspects, internal influence factor: "learning style", external influence factors: "learnig situation", and "tutor's leadership style", and probes into its relationship with free rider learning attitude. Under PBL situations, besides of courses to

discuss the learning effects towards learning results and to further enhance the effectiveness of PBL.

## RESEARCH TOOLS

### 1. Involvement and performance evaluation table for PBL in the interior design course learning

1) Self-mutual evaluation checklist: This study refers to the concept of the problem-based learning evaluation methods brought up by Swanson (1991) and Maskell (1997). It develops the learning evaluation checklist which this research needs. It is divided into student and teachers (guiders) evaluations. In student evaluations, it is subdivided into students' mutual assessment and self-assessment approach to evaluate after the course.

2) Tutors' observing checklist: In the learning process, group guiders, as moderators, lead members to discuss for reaching a consensus. In the process of discussion, they aim at students' participation to make observing records. It refers to the evaluating items, developing "guiders' participatory observing items", of participatory dimensions of "PBL personal performance evaluation" brought up by Z.J. Hong and J.L. Lin (2006), as shown in Table 2.

TABLE 2  
GUIDERS' PARTICIPATORY OBSERVING ITEMS

Appraisals	A	B	C	D
1. speaking	renewable speaking	often speak	sometimes speak	do not speak
2. tone	approve and encourage others	approve others	coldly	argue to win
3. attitude	humble and decisive	time control and efficiency first	critical	arrogant
4. announcement	make constructive statements	speaking with words logic	unclear consciosne ss	irrelevant

### 2. Classroom climate questionnaire in PBL

This questionnaire is divided into three main parts: a. student learning style, b. teacher leadership style perception, and c. learning situation assessment. Discussions are based on student perception and cognition. A 5-scale chart is setup based on "agreement" level.

**A. Learning Styles :** Kraus et al. (2001) pointed, so-called learning styles in general are : individual's preferred method for receiving information in a learning environment."

Kolb (1985) divided the two distinctions, "Concrete Experience / Abstract Conceptualization" and "Active Experimentation / Reflective Observation" in his experience learning theory, into four quadrants. In other words, he divided learning styles into four groups: Diverger, Accommodator, Converger, and Assimilator, as shown in Figure 2:

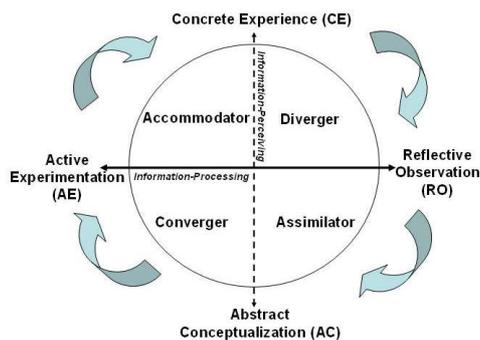


FIGURE 2

KOLB'S LSI TWO-DISTINCTION QUADRANTS AND LEARNING CIRCULAR FIGURE

Free rider students and the general students will have a learning style which they think is the most effective to learn. These learning styles won't be influenced by changing of learning environment in a short time, but according to different learning styles (Smit Kolb, 1985). These learners are respectively "Diverger", "Accommodator", "Converger", and "Assimilator". This study uses the above arguments to classify the learning styles when learners take the PBL courses, and explore different types of learning styles and the relationship between learners and free rider students.

TABLE 3  
LEARNING STYLE DISTINCTIONS

Distinctions	Learning Styles	Part A
Diverger	(1) Actors who prefer feeling with listening and seeing observe more but act less.	1, 5, 6, 12, 18
Accommodator	(2) Actors who prefer feeling with doing by themselves are adventurers, and they believe intuition.	9, 10, 11, 13, 21
Converger	(3) Actors who prefer thinking with doing by themselves believe a single answer and need to experiment by themselves to gain knowledge.	2, 8, 14, 15, 20, 22
Assimilator	(4) Actors who prefer thinking with listening and seeing are good at summarizing knowledge and create conceptual model	3, 7, 16, 19

### B. Teachers' leadership style - Students' perception towards teachers' teaching

a. Transactional Leadership (C.H.Chen, 2001) : According to concept of transactional leadership, leaders let members have confidence and expectations towards work results which they are assigned to accomplish. To integrate views of every scholar, transactional leadership is mainly divided into two main parts: contingency awards and intervening management, which can be divided into passive and active types.

b. Transformational Leadership : The content of transformational leadership is expansion and extension of transactional leadership (C.J. Liou, C.Y. Shen, 1991). According to Burns' (1978) transformative views as a basis, Bass (1985) addressed that transformational leadership theory is the basic viewpoints of measuring transformational leadership which leaders impact members. And he thought under transformational leadership, members feel trustful, respectful and faithful towards leaders. Through leaders'

encouragement, members often do more things than original expectation.

Based on the above-mentioned discussion, this research synthesizes views of every scholar to divide teachers' transformational leadership into 5 main levels of leader behavior---inspiration, shared vision, charisma, stimulating wisdom, and individualized care.

TABLE 4  
TEACHERS' LEADERSHIP STYLE DIMENSIONS

dimensions	definition	Part B
.Transactional Leadership		
reciprocal awards	Teachers and students make agreements with each other for learning results, and better performance wins more rewards. Agreements can be made before or after events.	11
positive intervening management	Before students make mistakes, they give immediate correction anytime.	12, 13
passive intervening management	Teachers passively wait for students' making errors and then intervene in to correct or punish them.	14, 15
Transformational Leadership		
visions	Teachers are aware of environmental and social changes, have forward-looking vision and ideals towards the development of class culture.	1, 2
charisma	Students respect, admire, and trust teachers, and then are provoked agreement and follow class activities that teachers lead.	3, 4
inspiring	Teachers feel proud and expect of students. Through respect, appropriate delegation of authority, meaningful encouraging to students to build their self-confidence, and encourage students to complete class tasks and goals.	5, 6
stimulating wisdom	Teachers encourage students to think in a new perspective when facing problems.	7, 8
individualized care	Teachers maintain close interaction with students, and concern and meet the unique developmental needs of every student.	9, 10

Bass (1985) thought that transformational leadership is not a substitute for a transactional leadership, but rather expanded results of transactional leadership. Therefore, the same leader could both have these two features of a leader. If there are any differences, it is just different degrees of application.

H.S. Huang (1999) a study of class leadership style of elementary teachers and relationship of achievement motivation of students

In practical ways of class leading, class teachers of high achievement motivation tend to balanced application of reciprocating and transforming leadership; class teachers of low achievement motivation tend to use transactional leadership.

Silins (1992), Silins (1993) explored the importance and relationships of transformational leadership and transactional leadership in improving schools: 1) Transformational leadership can successfully improve student's achievement and transform school's culture. 2) Transformational leadership strongly and positively influences schools, teachers, and teaching effectiveness. and3) Transformational and transactional leadership positively correlated.

### C. Environmental Assessment

Mehrabian and Russell (1974) advocates that all reactions on the environment are regarded as approaching or escaped behavior. It can be considered in four aspects: (1) Physical body--- one has thoughts or behavior that he/she wants to stay (approaching) or leave (escaped) the

environment. (2) One has thoughts or behavior that he/she wants to visit (approaching) the environment or tend to be lifeless (escaped) in the environment. (3) One has thoughts or behavior that he/she wants to communicate with others (approaching) or avoid them (escaped) in the environment. (4) One has thoughts or behavior that he/she enhances (approaching) or hinders (escaped) degrees of achievement and satisfaction of work performance (Chen, 2001).

The study slightly transforms some levels Mehrabian and Russell (1974) brought out, and addresses four dimensions, like approach and escape of situation perception, etc., under group discussions and class reports. The definition and numbers of the subject are in the following table:

TABLE 5  
ENVIRONMENTAL ASSESSMENT DIMENSIONS

dimensions	description	Part C
situation of group discussion		
discuss approach	Under the situation of group discussion, they feel happy and have psychological feelings of thinking of staying, visiting the environment, interacting with others, and willing to perform actively.	1, 2 、 5
discuss escape	Under the situation of group discussion, they feel happy and have psychological feelings of thinking of leaving, feeling lifeless, escaping from interacting with others, and unwilling to perform anything.	3, 4
situation of class report		
report approach	Under the situation of class report, they feel happy and have psychological feelings of thinking of staying, visiting the environment, interacting with others, and willing to perform actively.	6, 7 、 10
report escape	Under the situation of class report, they feel happy and have psychological feelings of thinking of leaving, feeling lifeless, escaping from interacting with others, and unwilling to perform anything.	8, 9

The excitation function catalyzes approaching behavior under a pleasant environment; under an unpleasant environment, it expands escaped behavior. Mehrabian (1976) brought out the concept of environmental load, which means using the message rate it conveys to the personal to describe; no matter the sense of sight, hearing, taste, smell or touch, any environment will arouse sensory stimulus and make the nervous system stay in the emotional state of excitation. This means the message rate that the individual receives is related to the feelings of falling on excitation dimensions. The level of environmental load refers to amounts of the message rate of environmental transmission. When the environmental load is high, people are easier to have excited mood, which means the individual will have higher vitality in the environment.

## DATA ANALYSIS AND DISCUSS

There are two steps of data analysis : first, finding the free rider and normal learner ; second, compare with free rider and normal learner in terms of active management, and inspirational, as fig.3 :

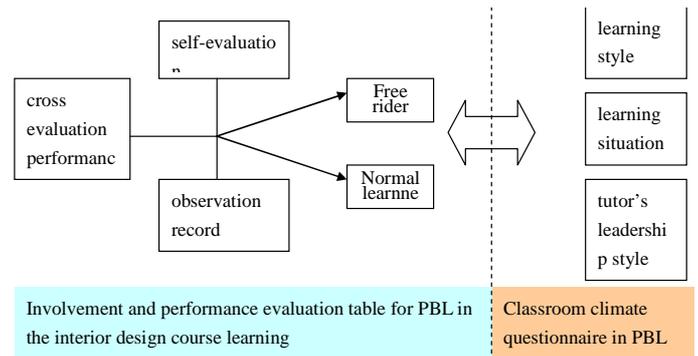


FIGURE 3  
RESEARCH DATA ANALYSIS CONSTRUCTION

### 1. Find the free rider

With learning input items in the peer assessment chart , their contribution to the group, personal responsibility mean values as the main axis, mean values less than one standard deviation are picked. (I.e. students with assessment scores less than 6.909) They are cross examined with self-assessment input scores and tem observation records. Students with Free rider learning inclinations are selected as : B3、B4、F1。

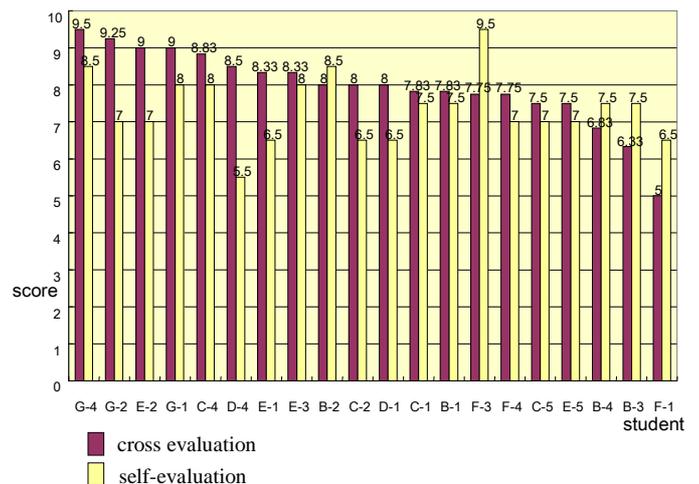


FIGURE 4  
CROSS EVALUATION AND SELF-EVALUATION SCORE

The difference between peer assessment and self-assessment expressed in bar chart (as fig4): students with higher scores in the peer assessment had higher scores than their self-assessment scores. It shows that students that performed better in the group had higher expectations for self. Students with lower scores in the peer assessment had higher scores in the self-assessment. It shows that they had lower expectations for self.

### 2. Difference between free-rider and general learner A. learning style particularly

1. Free rider learners and general learners differ in learning style particularly, the “assimilator” learning style which reached “0.1 significant standards.” It signifies that general learners are more inclined toward assimilator type of learning style as compared to free rider learners.

## B. Teachers' leadership style particularly

1. Free rider learners and general learners differ in Teachers' leadership style particularly, the "Transactional Leadership" learning style which reached "0.05 significant standards." It signifies that general learners are more inclined toward transactional leadership learning type of teachers' leadership style as compared to free rider learners.
2. Free rider learners and general learners differ in teachers' leadership style particularly, the "positive intervening management" learning style which reached "0.05 significant standards." It signifies that general learners are more inclined toward positive intervening management type of teachers' leadership style as compared to free rider learners.
3. Free rider learners and general learners differ in teachers' leadership style particularly, the "inspiring" learning style which reached "0.1 significant standard." It signifies that general learners are more inclined toward inspiring type of teachers' leadership style as compared to free rider learners.

## C. Environmental Assessment particularly

1. Free rider learners and general learners differ in Environmental Assessment particularly, the "discuss approach" and "report approach" learning style which reached "0.05 significant standard." It signifies that general learners are more interested in discussion and report of learning environment as compared to free rider learners.
2. Free rider learners and general learners differ in Environmental Assessment particularly, the "report escape" learning style which reached "0.1 significant standards." It signifies that general learners are less interested in discussion of learning environment as compared to free rider learners.

## CONCLUSION

1. On learning style aspect, the results suggested that general students on average ( $M=3.6179$ ,  $SD=0.3077$ ) more tended to assimilator than free rider students ( $M=3.2500$ ,  $SD=0.2500$ ). It shows that general learners are more inclined toward "assimilator" type of learning style as compared to free rider learners. As the specification of "assimilator", free rider learners are weaker than general learners in terms of thinking, knowledge induction, and conceptual model creation based learning style. Hence by the forward abilities, we can find free riders at an early date and upgrade the tutoring performance.
2. On teacher leadership style aspect, the results suggested that general students on average ( $M=3.3824$ ,  $SD=0.5163$ ) more than free rider students ( $M=2.6667$ ,  $SD=0.2887$ ). General learners have stronger sense of active management, and inspirational and encouraging teacher leadership style perception. Furthermore, when a teacher teaches, his or her willingness to urge students to perform, encourage and inspire student learning in meaningful ways that it will increase the learning willingness of free rider learners.

3. On environmental assessment aspect, general users have higher satisfaction level for discussion and report situations than free rider learners. Thus, if we pay attention to the climate of discussion and report situations it will increase the learning willingness of free rider learners.
4. Since time and course allotment are limited in this study. The experimental samples are taken from a class of fewer than 30 people. It is recommended that follow-up studies increase the number of samples to support the study data and conduct more effective inferences.

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