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# The Use of the Social Networking Facebook Platform in a Chemistry E-Learning Course


## Abstract

Because of the rapid development of network communications, the Facebook platform is the most important social networking website for college students. The use of this social networking tool for college students to study chemistry is of benefit to all chemistry teachers. This study uses cooperative learning theory and gaming theory to increase learning effectiveness for students. The study is based on the Providence University General Education "Life Chemistry" course - the cosmetic chemistry section - which has much visual content and is very current, which makes it very suitable for cooperative and game design. The students are randomly divided into two groups: the control group, which uses a general E-learning system, and the experimental group, which uses a Facebook cooperative learning system. The results of the statistical analysis show that the experimental group of students who use the Facebook system performs better than the control group, who use a web learning system. Further analysis shows that female and field dependent students outperform male and field independent students who use the Facebook system.


Keywords: Facebook, cooperative learning, cosmetics, chemistry.

## Research Background

### Facebook—the most common social website

Facebook is a very powerful social tool that allows information to be shared faster with friends. Facebook users can share their photos, send messages, chat, post videos with their own tags, chat on the wall, join groups or create a new group. The group forums allow an exchange, providing a wide range of applications and the ability to play games on Facebook (Mazman, S. G., 2010). Facebook is a very good educational tool because it allows the rapid feedback of information, because there is good social interaction (Mason, 2006). The majority of Facebook users are 18 to 25 year old students. Therefore, it is an organized activity, information sharing system and a cooperative and interactive educational tool (Mazman, S. G., 2010). Teachers can use Facebook as a tool for self-disclosure or for student motivation,


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learning and emotional expression in the classroom atmosphere (Mazer, 2007). Research shows that when teachers use Facebook, students exhibit motivation and emotional expression and there is a more comfortable and harmonious atmosphere in the class.

**Cooperative learning**

Cooperative learning involves students working together towards a common goal in a teaching-learning situation. Cooperative learning is a partnership with others in a systematic and structured teaching environment. By interacting with each other in reciprocal dialogues, students learn to use their knowledge to help each other. Students in a cooperative learning environment each play a part, either by learning or by asking or helping others. Cooperative learning provides situations for students to teach each other. When students explain and teach concepts to each other, the retention of these concepts improves comprehension and helps students to connect their prior knowledge with new information. It is easier to develop collaborative and group autonomy in the learning process than in a normal teaching process. Cooperative learning is a very good learning tool; students learn through positive social interdependence, mutual discussion and by helping and sharing with others to maximize their own learning (Johnson, 2000).

## Research Methods

The main purpose of this study is to verify the Facebook platform as a learning tool, and to verify that it improves learning motivation and learning effectiveness. There is an analysis of the results of using both the "Facebook learning system" and a “Web e-learning system". The statistical data is sued to determine which system is better for different types of students. Using a questionnaire, data is collected about the students and their attitudes to Facebook. In this study, the "Cosmetic Chemistry" unit is the research subject. This specific subject is very practical and has much of video and image material, which is easier to put on the Facebook platform. This unit is a one week course in a University in Taiwan, called “Mathematics and Science and Technology General Course - Life Chemistry" e-learning course. The students come from all colleges. There are a total of 212 valid samples, which are randomly separated into two groups: 106 students in the experimental group and 106 students in the control group.


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1. Group Embedded Figures Test

The group Embedded Figures Test, (GEFT) was designed by Witkin at 1971. This study uses the revised Chinese version of Dr. Wu (1997). This test is intended for students over 10 years old and includes 18 complex and 8 simple graphics, which must be identified by the tester within a period of time. The tests are divided into three parts. The first part is seven simple questions, which are for practice and are not included in the score. Two minutes are allowed. The second and third parts contain nine more difficult topics and are formal tests, each of which takes five minutes. The GEFT test reliability coefficient is 0.82.

2. Pre-test & Post-test

The pre- and post-tests are based on cosmetic chemistry concepts taught in the teaching materials, which are collected from the U.S." ACS Division of Chemical Education Examination test bank". The ACS test bank questions have a reliability coefficient of 9.0 (ID Eubanks, 1991). The online test is a Chinese translation, revised by four chemical education experts, to ensure its validity. All the content of post-test are exactly same as pre-test, but the order and number are randomly rearranged. The post-test scores were collected after the study and used to compare the experimental group and the control group via statistical analysis.

3. Learning Material

In this study, the content is based on cosmetic chemistry and the theory of cooperative and gaming uses the Facebook design. All of the content, was taken from a cosmetic chemistry textbook and website material and carefully reviewed by three chemistry education experts. Both the experimental group and the control group used the same content, but the platform design and presentation methods were different.

General E-learning system

The cosmetics chemistry web content uses streamlined text and animation, coupled with blighting graphics, to attract the interest of learners. Within the content, there are many practical examples to help students to understand the reasoning and principles for cosmetic


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products. All of the learning design uses simple patterns and attractive visual content to increase the attractiveness to the learner. In general, all of the e-learning web pages are produced using Adobe Flash CS5 as the editing tool, with the scrolling function omitted. If there is more than one page of content, it is separated into two pages, which reduces operating problems for learners.

Facebook cooperative learning system

In this study, cosmetics chemistry basic modules, combined with cooperation a learning system designed for Facebook, is designed to stimulate cooperation between students.

Cosmetics chemistry is used as a learning material, which is based on the open environment atmosphere in Taiwan college campus, most of the college students have an in-depth knowledge about cosmetics, especially the females. In the on-line chemistry class, when the teacher puts the information on the board, it induces much discussion on the discussion forum. For that reason, cosmetic chemistry is the best choice for this study, as approved by resident teaching experts.

## Research Background

I. Cooperation theory:

In the Facebook cosmetic chemistry page, the “ News Feeds ”section is used as an innovative way to present the course content; not only for the texts, pictures and videos, but also to induce discussion by the students. Using the “Like” button on the graffiti wall rearranges the order of the learning content and other supplemental materials. Discussion using the unique Facebook "News Feeds" function is a very good platform for students to initiate their own topics and to discuss those with other students. Using Facebook-specific functions, students react to the content published by "liking", which is a simple way to express identity and praise. This encourages more frequent interaction between learners.

The Wall allows learners and instructors to share information and stimulates students' motivation and interest. Research shows that information sharing on the Internet, using the


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Facebook platform, accounts for 56%, followed by e-mail, with 15%, and Twitter, with 8% (Erick, 2011).

II. Gaming Theory:

For the cosmetic chemistry curriculum three simple learning games were designed as applications on the Facebook platform. The game format attracts learners to spend a longer time at the study site and improves their motivation to learn about cosmetic chemistry.

A. Knowledge of skin care products: Most students are not familiar with the difference between skin care products and make up cosmetics. Since the cognitive and the boundaries are very vague, answers are used to learn in the game. The game is controlled by scoring. If the student's game score is less than the set standard, remedial instruction after the end of the game appears in a prompt screen, which allows the learner to read and re-test. If the score is satisfactory, a congratulations screen appears and shows a score list, which tells the students the current top five highest scores. This enables students to compete and to learn cooperatively.

B. Surfactants are everywhere: As surfactants are widely used in the real world, in order to enable students to understand the types of specific surfactant that are used, the game is designed to pick and catch for each sample. Similarly, when the game is complete, remedial teaching materials are provided to help low-scoring students.

C. DIY Laboratory: Students are taught "green soap" virtual production on the screen, using guided experimental interactive steps to lead students to learn with each step. The game gives a detailed explanation of this procedure and the principles, so that students can understand the manufacturing process for cosmetics.

## Results and Discussion

1. The homogeneity of experimental group and control group analysis

In order to understand whether there are any differences in prior knowledge between the experimental (Facebook learning) and the control groups (E-learning), the pre-test scores of


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both group students were subjected to an independent ANOVA, Table 1 shows the results of the ANOVA for the experimental group and the control group. The pre-test scores show no significant differences, so there is no difference in prior knowledge between the experimental group and the control group. The group was randomly separated and the result shows that there is a very good mix.

2. Learning effectiveness analysis for the experimental and control groups

The result of the analysis of learning effectiveness for both groups is shown in table 2. The post-test scores for two groups are analyzed using independent samples. The ANOVA result shows that for a p value of less than .05, there is a significant difference for the experimental group, which shows that Facebook learning is more effective than online learning. The Facebook platform improves learning motivation and increases the learning effectiveness score.

The Facebook group enjoy a cooperative platform. The “News Feeds”function also allows users to share learning through collaborative, constructive discussions. The use of Facebook is also influenced by peers and experience with the website. Golder et al. (2007) found that one of the most frequent activities on Facebook is writing messages. Facebook users can write to each other using private messages, chat, comments and wall posts – messages that publicly appear on a user’s personal page. Research has shown that Facebook is used mostly to keep in touch with people and to get to know them better (Joinson, 2008; Golder et al., 2007; Sheldon, 2008; Wiese and Farrugia, 2009).

All of the embedded functions improve learner's interactive discussion. This, coupled with the social background and some of the material content for the learning games, allow students to understand and absorb knowledge more easily, which then improves their motivation and gives better learning outcomes.

Of the students who use social networking, 60 % talk about education-related issues and more than 50% discuss their learning problems (Karlin, 2007). Klein (2008) reported that in terms of academic achievement for university students, when teachers allow students to use social networking applications in science-related courses, the test scores for those


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students are higher than average, which shows that the use of social networking applications for teaching can improve on learning process.

3. The effect of Personal Variables on Facebook Learning Achievement

An analysis of the relationship between the cognitive pattern and the learning achievement for the experimental group and the control group is shown in Table 3.

For Field dependent students, the experimental group and control group students' learning effectiveness shows a statistically significant difference ($p = 0.014 < 0.05$), which means that the Facebook platform learning system gives a better learning outcome than normal e-learning. Further analysis of the field dependent students in terms of the pre-knowledge score of experimental group and the control group ($p = 0.140 > 0.05$) shows there are no significant differences in the prior knowledge of both groups of students. Previous studies have found that for field-independent students using a social interaction learning model, the learning outcomes are better (Wintkin & Goodenough, 1977). They have a tendency to learn in a group, they prefer to learn with others, in order to achieve their goal, are willing to help others and share positively using the social networking platform (Linda Sen, 2000; Kun original, 1996; Oughton & Reed, 1999; Riding & Rayner, 1999). The experimental group students demonstrate peer interaction and improve their understanding of course content by mutual guidance, to achieve the learning goals, because field-independent learners tend to process information analytically and can better reconstruct cognitive knowledge.

4. An analysis of the relationship between gender and learning achievement for the experimental group and the control group, (Table 5) shows that the learning achievement for female students in the Facebook platform study differs significantly ($p=.008 < .05$). Table 6 shows an analysis of the female students. In terms of the pre-knowledge score for the experimental and control groups ($p = 0.433 > 0.05$) there are no significant differences in the prior knowledge for both groups of students. In terms of gender, this study finds that female students using the Facebook learning platform have better learning performance than those using a regular e-learning system, which suggests that the female students spend more time on the Facebook than the male


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students. Female students are more given to cooperative learning and they are more interested in cosmetic chemistry, so they are more motivated to improve their learning outcome.

## Conclusion

The Facebook platform chemistry learning system is learner-centered and promotes more active participation by all students, using this famous social network. The following results are obtained.

1. The Facebook learning system can improve learning motivation and learning attitude, so the Facebook learning group outperforms the normal e-learning group.

2. After using the Facebook learning environment, students who are field-dependent outperform others.

3. Female students who use the Facebook learning environment achieve better scores than male students who use the same environment.

Learning cosmetic chemistry from other students, rather than from the teacher, can help to demystify the learning process and to reduce anxiety. Cooperative learning using the Facebook platform is an especially effective method of spontaneously activating metacognitive aspects of learning. Cooperative learning also results in more use of higher level thinking, more frequent discovery and the generation of new ideas and solution strategies. These benefits are a result of students internalizing concepts through discussion with peers. Giving explanations to other students requires a deeper understanding than just putting an answer on a worksheet. Students can work cooperatively on significant, interesting and complex tasks. By working with others they improve their ability to communicate about chemistry, to understand it and to think critically about it. The social network site’s ability to allow active involvement in learning makes it more intrinsically motivating to learn. These research results show that cooperative learning increases confidence in students and improves self-esteem and feelings of self-efficacy. This study of a Facebook learning platform presents a conceptual model for a social network learning system. This study also addresses the application of cooperative learning. Designing a


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cooperative system using a different platform for teaching materials will take much time and energy. This work may be difficult, but will definitely be worthwhile. The conclusions of this study cannot be over-generalized, because it limits its focus to only the Facebook learning platform. Subsequent research could determine whether the same results are possible using other social networks. The authors hope to soon see many effective social network learning environments becoming more generally available for students.

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Table 1: ANOVA result for pre-test results for the Experimental group and the control group

| Group | Number | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Experimental group | 106 | 61.14 | 19.38 | 210 | -.852 | .144 |
| Control group | 106 | 58.97 | 17.69 | | | |

p> .05 There is no significant difference


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Table 2: The ANOVA results for the experimental group and control group

| Group | Number | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Experimental group | 106 | 86.57 | 13.00 | 210 | -1.156 | .005* |
| Control group | 106 | 84.11 | 17.59 | | | |

* p<.05 There is a significant difference

Table 3: An analysis of cognitive pattern and learning Achievement

| Cognitive | Group | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Field Independence | Experimental | 86.73 | 11.84 | 105 | -1.021 | .132 |
| | Control | 84.00 | 15.47 | | | |
| Field Dependence | Experimental | 86.42 | 14.15 | 105 | -.653 | .014* |
| | Control | 84.23 | 19.74 | | | |

* p < .05 There is a significant difference

Table 4: Field dependence of prior knowledge table

| Cognitive | Group | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Field Dependence | Experimental | 62.64 | 19.33 | 103 | -0.698 | .140 |
| | Control | 60.190 | 16.51 | | | |

p > .05 There was no significant difference


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Table 5: A comparison between gender and learning achievement

| Gender | Group | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Male | Experimental | 84.55 | 14.60 | 63 | -1.415 | .270 |
| | Control | 78.75 | 18.27 | | | |
| Female | Experimental | 87.50 | 12.19 | 145 | -.451 | .008* |
| | Control | 86.40 | 16.90 | | | |

* p < .05 There is a significant difference

Table 6 : Table showing the prior knowledge of Female students

| Gender | Group | Average | sd | df | t | p |
|---|---|---|---|---|---|---|
| Female | Experimental | 63.06 | 18.89 | 145 | -0.6558 | .433 |
| | Control | 61.07 | 17.90 | | | |

p > .05 There is no significant difference


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