Relationships Among Learner Characteristics, Motivation, and Achievement in Web-Based Instruction

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Abstract

The purpose of this study was to investigate the relationships among student’s characteristics, motivation and achievement in the web-based instruction. Three web-based courses were selected as the examples. A total of 117 undergraduate students were served as the subjects. The research instruments included prior knowledge tests, a motivation questionnaire, and multiple assessments. The results showed that undergraduate students’ gender and prior knowledge affected their motivation for taking the web-based courses, as well as parts of academic achievement. At last, several learner characteristic guidelines for designing the web-based instruction were proposed.

Keywords: web-based instruction, gender, prior knowledge, motivation, academic achievement

Introduction

With the rapid progress of information technology, web-based instruction (or called online learning) has become an important symbol for modern countries. However, research found that 30% to 50% students who took web-based courses would not finish their degrees (Moore & Kearsley, 1996). The reasons for causing this situation may be various, but students’ characteristics, such as gender and prior knowledge, may affect their motivations for choosing the web-based courses, as well as their academic achievement (Kekkonen-Moneta & Moneta, 2002; Kumar, 1999; Moore & Kearsley, 1996; Simonson, Smaldino, Albright & Zvacek, 2003; Sullivan, 2001; Wang & Newlin, 2000).

As for gender, several studies conducted in Taiwan found that male and female college students performed similarly in online learning (Wang, 2001; Lee, 2003). Chmielewski (1998) found that, however, males had significantly more knowledge of the web, and use the web more often than females. On the other hand, Ross and
Powell (1990) found that a greater percentage of women passed distance education courses in the Athabasca University, in Canada, because women felt gaining a university credential was critical and the impact of failing was serious. Furthermore, Rodino (1997) noted that women tended to display social interdependence more often than men during online conferences. Arbaugh’s study (2000) also revealed that men placed more emphasis on the competitive aspects of the web-based course, while women viewed the virtual classroom as a chance for collaboration.

In addition, Sullivan (2001) invited 195 nontraditional college students to comment on their experiences as online learners. The results showed that online courses benefited more female adult learners with children or family responsibility because of their flexibility of schedule and places. However, the research data also showed that female students felt lack of interpersonal interaction in online learning more strongly than males. Male students appeared to be more comfortable working independently in an online classroom than their female counterparts. The similar findings were also verified by a large study conducted by Jackson, Ervin, Gardner, and Schmitt (2001). Results showed that women used email more than men (revealing a communication motive), and that men used the web more than women (indicating the motive to gain information without communication). In all, it is not yet known what impact students’ gender has on their online learning.

With respect to prior knowledge, Chu, Li, Lin and Lee (2002) investigated the effects of students’ prior knowledge on their academic achievement of web courses. The research showed that students with low prior knowledge performed well on multiple assessments of web-based classes, while students with high prior knowledge did equally well. Thus, the researchers stated that the web-based instruction and multiple assessments would help students with low test grades and learning difficulties in traditional classrooms increase their learning performance and confidence. These findings were consistent with the study’s data, conducted by Wang and Newlin (2000). They reported that the weaker cyberstudents tended to do more poorly when they worked alone (e.g. final exam), while their homework scores were improved from the help of the study groups. Thus, the authors suggested the role of learning communities needed further research on understanding how to help distant learners.

Since web-based instruction permits learners freely to choose when and where to learn under their controls, student’s learning motivation becomes an important factor which may affect the learning outcomes of web-based instruction. Biner, Bink,
Huffman, and Dean (1995) investigated the role of personality characteristics in predicting achievement in televised courses. Results indicated that successful telecourse students tended to be self-sufficient, group-oriented, and introverted. In fact, Berge, Collins, and Dougherty (2000) also suggested that web-based courses were more suitable for students who were strong self-directed because there was no one to remind them to sign on in such an open environment. However, do students, who have different gender and prior knowledge, possess various motivations for learning online?

**Research Purposes**

The purpose of this study was to investigate the relationship among student’s characteristics, motivation for choosing web-based courses, and academic achievement in the web-based instruction. Specific purposes related to the problems were as following:

1. To investigate the effects of learners’ gender and prior knowledge on their motivation for choosing web-based courses.
2. To investigate the effects of learners’ gender and prior knowledge on their academic achievement and performance on online discussion.

**Methods**

**Subjects**

A total of 117 undergraduates were served as the subjects. They most were the second or third year of the National Chiayi University (NCYU) in Taiwan. Of them, 57% were female; 43% were male. As for the study areas, 33% of the subjects majored in Science & Engineering, 26.5% in Agriculture, 13.7% in Business Administration, 12.8% in Life Science, and 14% in Humanities Art and Education.

**Experimental Materials**

Three web-based courses, designed by NCYU, were selected as the experimental materials. These courses were used by students to satisfy general education requirements. They were Introduction to Internet, Thanatology Life & Death, and Pet Care. These courses were posted on the web site (http://140.130.41.200) before students accessed them. A textbook and/or a package of reading materials were supplemented in most cases. Students completed most of their course works online (15 weeks) using the NCYU Elearning Network. Other three weeks, including introduction, midterm and final, were carried out in the traditional...
In the motivation questionnaire, the male students’ most agreeable motive is “flexibility of places” (mean = 3.48), while female students’ most agreeable motive is “flexibility of schedule” (mean = 3.42). T test is then run for 17 items to determine if there is significant difference between gender. Summary t test statistics are shown in Table 1. As shown in Table 1, there are significant differences in 6 motives for
subjects with different gender to select the web courses. They are “less learning time”, “making up credits”, “effortlessness”, “curiosity”, “less pressure”, and “learning with computers”. In fact, in the interviews, several male subjects report their motives for taking online courses are, “It is easier to take an online course…” (S08 mi 040518), “I am curious about it, because I have never taken this kind of course before…” (S02 mi 040519). On the whole, effortlessness, curiosity and making up credits are three factors affecting whether undergraduate students with different gender select web-based courses or not. Male students appear to be more possible to choose online course owing to these factors than their counterparts.

Table 1 Summary of T Test by Gender’s Motivation

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Gender</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared to convention web-based courses are taken less learning time</td>
<td>M</td>
<td>3.28</td>
<td>0.69</td>
<td>2.88*</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.88</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>web-based courses can make up the credits I lack</td>
<td>M</td>
<td>2.67</td>
<td>0.86</td>
<td>2.29*</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.32</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is easier to take web-based courses.</td>
<td>M</td>
<td>3.16</td>
<td>0.71</td>
<td>3.04**</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.76</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am curious about the teaching methods of web-based courses</td>
<td>M</td>
<td>3.19</td>
<td>0.70</td>
<td>2.55*</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.86</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is less pressure to take web-based courses</td>
<td>M</td>
<td>3.16</td>
<td>0.71</td>
<td>2.23*</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.86</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like to learn with computers.</td>
<td>M</td>
<td>3.18</td>
<td>0.63</td>
<td>2.46*</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2.90</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05    **p<0.005

Prior Knowledge

There are three prior knowledge groups in this study. In the motivation questionnaire, the most agreeable motivation chosen by high and low prior knowledge groups is “flexibility of places” (mean=3.59, 3.48 respective), while middle prior knowledge group chooses “flexibility of schedule” (mean=3.33) as the most agreeable motivation. ANOVA is then run to determine the differences among three groups. Summary ANOVA statistics are shown in Table 2. One obtained F ratio is significant (F=3.73; p<0.05). The Scheffe method result shows that the high prior knowledge group will be more possible to select online courses than the middle prior knowledge one owing to flexibility of places. That is, students with higher prior knowledge don’t
like to take courses in a far place. One student in the high prior knowledge says that in an interview, “I don’t like to rush to another campus because of a course” (PS 05 i 040517).

Table 2 Summary of ANOVA of Prior Knowledge’s Motivation

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Source</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>Scheffe</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is flexibility of places.</td>
<td>Prior Knowledge</td>
<td>2.48</td>
<td>2</td>
<td>1.24</td>
<td>3.73*</td>
<td>0.027</td>
<td>H&gt;M</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>37.83</td>
<td>114</td>
<td>.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>40.31</td>
<td>116</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

Analysis of Academic Achievement

Gender

The academic achievement mean scores for males and females are 47.86 and 52.86 respectively. Summary t test statistics are shown in Table 3. There is significant difference in academic achievement by gender. Female students’ performance is superior than male students’ performance. This findings is consistent with Russ and Powell’s (1990) views that female students take distance learning seriously.

Table 3 Summary of T Test by Gender’s Academic Achievement

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>67</td>
<td>47.86</td>
<td>10.62</td>
<td>-2.77*</td>
<td>0.006</td>
</tr>
<tr>
<td>Female</td>
<td>50</td>
<td>52.86</td>
<td>8.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

Furthermore, online discussion performance is a part of academic achievement in this study. All three teachers designed several curriculum-related issues for groups to discuss in the online discussion forum. Table 4 reports the mean, standard deviation and t value for the numbers of discussion by gender. As shown in Table 4, the numbers of female students participating in online discussion exceed their male counterparts.

Table 4 Summary of T Test for Numbers of Discussion by Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of</td>
<td>Male</td>
<td>67</td>
<td>12.10</td>
<td>-2.25*</td>
<td>0.028</td>
</tr>
<tr>
<td>Discussion</td>
<td>Female</td>
<td>50</td>
<td>23.02</td>
<td>31.84</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05
In fact, the difference in online discussion performance can be found from the students’ attitudes toward online discussion. As the following interview with a male student illustrates, “I think online discussion is just a routine job…Although the teacher gives us a discussion question, I just post my answer. That is all. I don’t want to discuss it with my classmates” (S01 mi 040512). However, a female student responds positively toward the online discussion in the interview, “I like to join the online discussion because everyone has different points of view. I like to know them. Maybe we can come out of different ideas” (S07 mi 040519). This finding is consistent with Arbaugh’ (2000) findings that women like to share with others in the web-based course.

Furthermore, differences between the discussion content posted by male and female students are also found in this study. A total of 1,962 articles are posted in the discussion forum (male students send 811 articles, females send 1,511 ones). Based on the criteria of subject-related, personal experience, and multi-facet, there are only 144 high-quality articles selected by three teachers who teach the three web-based courses. Of them, 60 pieces are posted by males, and 84 ones are done by females. As an example of the course of Thanatology Life & Death, 26 good articles are posted by male students, while 34 good ones are done by females. In response to the question of “discussion of funeral rites from different perspectives of religions”, a female student posts a superior article (S21 fd 040608). She writes it from viewpoints of four religions, “Funeral rites in Taoism is too superficial today…Hinduism’s cremation and Lamaism’s celestial burial are both natural-oriented…Christianity’s funeral is more peaceful, and flowers are decorated everywhere…” Then she expresses her own experiences in a funeral, “In grandpa’s funeral, everyone cried a lot at first, then they talk in jovially mood. It is so weird…” Finally, she concludes her favorite funeral rites, “According to the four rites, I would like to choose Christianity style, because it is more sincere and solemn.”

However, the articles posted by male students are inferior than females’. For instance, S26 male student only states that, “If I died unfortunately, I hope only my relatives and close friends to my funeral. But if I became a famous person, I will invite all people to have a meal together. Ha!” (S26 fd 040614). Furthermore, S27 male makes an even briefer answer, “I prefer a quiet funeral without trumpet playing and crying people” (S27 fd 040513). Based on the above examples, articles by male students are generally short and narrow viewpoints, while articles by female students are illustrated from multiple perspectives.
Prior Knowledge

The academic achievement mean scores for the three levels of prior knowledge are 49.70 (H), 50.96 (M), and 48.63 (L) respectively. There is no significant difference in F ratios (F=0.561, p=0.572). In other words, students with different levels of prior knowledge perform in similar ways.

On the other hand, their online discussion performance is different. The numbers of articles posted by students with different prior knowledge are in the following order: the low prior knowledge group highest (26.26), the middle group next (13.37), and the high group lowest (13.31). As showed in Table 5, students with different prior knowledge perform differently in the discussion forum. However, results of the Scheffe method are not significant.

Table 5 Summary of ANOVA for Numbers of Discussion by Prior Knowledge

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of Discussion</td>
<td>Prior Knowledge</td>
<td>3797.37</td>
<td>2</td>
<td>1898.683</td>
<td>3.399*</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>63671.40</td>
<td>114</td>
<td>558.521</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>67468.77</td>
<td>116</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

The low prior knowledge group posts a total of 347 articles in the online discussion, 63 in the course of Thanatology Life & Death, 114 in Pet Care, and 170 in Introduction to Internet. In accordance with the criteria of subject-related, personal experience, and multi-facet, there are only 35 high-quality articles posted by the low prior knowledge group. The remainders are mostly short responses or chats unrelated to the subject. As an example of the discussion topic (How to encourage yourself to live happily?) in the sixth week of Thanatology Life & Death, a student with low prior knowledge responds to it briefly, “I will do my best to make me happy, such as imagining staying with good friends” (S30 fd 040422). Another low prior knowledge student reacts with few words, “Ha, Ha, I will let my imagination run wildly when I am sick…” (S32 fd 040326). Furthermore, these students chat about unimportant themes, “Ha! Ha!, You just copy the sentence…You pretend to be an idiot? Is that right?”, “Brother Ming, I was touched by you…” In view of these examples, more articles are posted by low prior knowledge students, but most of them are not good-quality.

Discussion

The results of this study show that undergraduate students’ gender affect their
motivation for choosing the web-based courses, as well as the academic achievement and online discussion performance. However, undergraduate students’ prior knowledge levels only affect their motivation, but not the academic achievement and online discussion performance.

The most important reasons for male undergraduate students choosing web-based courses are curiosity, credits, and effortlessness. The performance of female students on their academic achievement and online discussion is better than male students. These findings are different from several studies carried out in Taiwan, which report that male and female students perform equally well in the web-based instruction (Wang, 2001; Lee, 2003). A possible reason accounting for female’s superior performance in online discussion may as Sullivan (2001) reports that male students are more comfortable working independently, while female students enjoy interacting online. However, is having different motives for taking web-based courses between gender a factor in affecting students’ academic achievement? Several researchers suggest that some measures must be employed to screen out those students who are underprepared to engage successfully in the web-based learning environment (Cheurprakobkit, Hale & Olson, 2002). How to screen out? What criteria should be employed to screen out unsuitable students? It is evident that there is need to further investigate these problems.

With regard to prior knowledge, the high prior knowledge group will be more possible to select online courses than the middle group owing to flexibility of places. In other words, the feature of no bounds to location in web-based instruction appeals to the high prior knowledge students. Furthermore, though the quality of articles posted in the discussion forum by low prior knowledge group should be improved, the low prior knowledge group is more willing to participate in group discussions than their counterparts. These findings are partly consistent with the report by Chu et. al. (2002). That is, students with low scores in traditional instruction have a great chance to perform well due to the multiple assessments of online learning.

**Educational Implications and Recommendations**

There are several important implications and recommendations for educational researchers and instructional designers to consider from the results of this study.

1. The effects of web-based instruction will depend on enrolled students’ characteristics, such as gender and prior knowledge. Thus, instructional designers should consider these attributes in depth when designing the web-based instruction.
2. Asynchronous discussion is a powerful tool for web-based instruction; however, gender differences exist in this area. The assessment of web-based course should be in suitable proportion to the asynchronous discussion.
3. A continued study could be designed to explore the criteria for assessing students who are suitable to enroll in web-based instruction.
4. Future study could design multiple assessments for students with different prior knowledge levels in order to help them succeed in online learning.

References
Cheurprakobkit, S., Hale, D., & Olson, J. (2002). Technicians’ perceptions about web-based courses: The University of Texas system experience. The American Journal of Distance Education, 16(4), 245-258.


