The Effect of Using Online Homework Exercises on Student Achievement in a Quantitative Methods Course

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Introduction and Purpose

- WeBWorK is an open-source online homework system.
- The goal of this research project was to determine whether the positive outcomes from using WeBWorK observed in other disciplines were generalizable to teaching and learning Quantitative Methods.

Conceptual Framework

- Active learning is an important factor in student success, particularly in the QM course
- Homework is related to motivation, mastery of material, and to achievement (Hauk & Segalla, 2005)
- In several studies, students who did online exercise outperformed their peers who did traditional written exercises (Zerr, 2007)
- Students who did more online exercises scored higher on tests and exams than students who completed fewer of the exercises (Hirsch & Weibel, 2003)

Research Questions

How do WeBWorK exercises affect the student learning process and outcomes in the Quantitative Methods course in the Social Science program?
1. What are students’ perceptions and opinions regarding the WeBWorK and written exercises?
2. Will students who do WeBWorK exercises get significantly higher grades than students who do written exercises?
3. Will students who complete more of the WeBWorK exercises get significantly higher grades than students who complete fewer of the WeBWorK exercises?

Methodology

- Quasi-experiment
- Paradigm: post-positivism
- Crossover design schedule
- Convenience sample of two sections taught by the researcher
- Matched-pairs and independent samples
- A survey to collect data about students’ perceptions and opinions of both the WeBWorK and written exercises
- Only the data of those who had signed a consent form were used

Results and Analysis

1. Students found the written exercises more helpful but preferred the WeBWorK exercises.
2. Independent sample t-tests showed no statistically significant difference in grades between students who did the WeBWorK exercises and students who did the written exercises.

<table>
<thead>
<tr>
<th>Group Correlation Coefficient</th>
<th>Test 1 Written</th>
<th>Test 2 Written</th>
<th>Test 3 Written</th>
<th>Test 4 Total (Tests + Exam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A, Test 1</td>
<td>0.42</td>
<td>0.39</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>Group A, Test 2</td>
<td>0.19</td>
<td>0.32</td>
<td>0.35</td>
<td>0.37</td>
</tr>
<tr>
<td>Group A, Test 3</td>
<td>-0.07</td>
<td>-0.09</td>
<td>-0.12</td>
<td>-0.10</td>
</tr>
<tr>
<td>Group B, Test 3</td>
<td>0.83</td>
<td>0.86</td>
<td>0.89</td>
<td>0.90</td>
</tr>
<tr>
<td>Group A, Tests + Final</td>
<td>0.39</td>
<td>0.41</td>
<td>0.44</td>
<td>0.47</td>
</tr>
<tr>
<td>Group B, Tests + Final</td>
<td>0.44</td>
<td>0.45</td>
<td>0.46</td>
<td>0.47</td>
</tr>
</tbody>
</table>

3. There is a moderate positive correlation between the number of exercises done and grades; this pattern is more consistent for written exercises than for WeBWorK exercises.

Discussion and Conclusions

- The questions on the tests more closely reflected the written exercises than the WeBWorK questions, and this may have influenced the results.
- The context in which WeBWorK is used most likely has some impact on student learning.
- It is likely that the WeBWorK system is a valuable teaching tool that can be used by interested instructors to enhance student learning in Quantitative Methods.
- Further research may investigate how the WeBWorK system can be used more effectively.
- Another topic is to ask students to explain why they found one type of exercise better than the other, and whether WeBWorK is more effective for some kinds of learners.

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