Exploring Student Perception Towards Online Homework and Comparison with Paper Homework in an Introductory Probability Course

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Introduction
❖ Homework plays an important role in learning for students.

<table>
<thead>
<tr>
<th>Paper and Pencil based Homework (Paper/PPH)</th>
<th>WebWork (online/WW)</th>
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<tbody>
<tr>
<td>Problems are identical for each student</td>
<td>Problems contain unique numbers and different for each student</td>
</tr>
<tr>
<td>Students need to provide detailed solutions</td>
<td>Students need not provide detailed solutions</td>
</tr>
<tr>
<td>Students do not get instantaneous feedback</td>
<td>Students get instantaneous feedback</td>
</tr>
<tr>
<td>Students do not need to have computer access</td>
<td>Students need computer access and internet access</td>
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<tr>
<td>Grading can be subjective</td>
<td>Grading is objective</td>
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Recent study highlighted the potential of using online data on number of attempts and time spent to identify difficult topics [1].

Survey on WW usage indicated that 40% students had difficulty in entering final answers in WW [2].

Manually curated problems have the potential to overcome challenges related to inputting solution [3].

Objectives
❖ How does manually curated WW compare with PPH in improving students' self-efficacy (self-confidence)?
❖ Can we use WW data for formative assessment and design teaching modules for difficult concepts?

Methods
❖ Introduction to Probability and Statistics course is divided into 4 sections with 30 students each.
❖ Assignments were provided using PPH or WW and a questionnaire was provided to gauge differences in self-confidence due to WW.
❖ Data from WW was analyzed to identify difficult concepts.

Results
1. Number of attempts are higher in WW than PPH, yet the self reported time and self-efficacy is not significantly different (N=30)

A) Students attempt problems “more than once” more frequently in online homework

B) Self-reported time spent per problem is reduced in online relative to paper

C) I prefer WebWork over paper and pencil homework

Students answered that they spend less if not equal time doing problems online relative to paper despite increased attempts, likely due to increased guesswork and lesser time per attempt.

2. Students more often do paper homework together (N=30)

3. What students disliked about WW (N=20)

No Hints
Formatting errors
Just final answer counts
Need detailed solutions after solving
Lesser conceptual understanding

4. Students feedback for future implementations (N=20)

Ability to show their work
Hints after incorrect solution
Not confident even after getting it right whether the method is correct
Use online as review modules instead of assignments

5. Using data on number of attempts per problem and success rate, we can identify potentially difficult problems and concepts (N=117)

Potential difficult problems are shown using the arrow

Lessons learned
❖ Despite increased attempts per problem, students didn’t feel more confident after using online homework due to inability to show detailed solutions and get feedback on their methodology.

Group interaction on homework outside the class was reduced due to personalized unique problems for each student and online nature of HW.

Using data from online HW on number of students which failed to get a solution correctly despite multiple attempts, we can predict the difficult problems/concepts for them.

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References