

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

Paper and Pencil based Homework (Paper/PPH)	WebWork (online/WW)
Problems are identical for each student	Problems contain unique numbers and therefore, different for each student
Students need to provide detailed solutions	Students need to enter final answer
Students do not get instantaneous feedback	Students get instantaneous feedback although, no hints or detailed solutions are provided
Students get detailed solution after submission deadline	Students get detailed solution after submission deadline but the numbers used in solution may not be same as what they worked on
Students do not need to have computer access with internet	Students need computer and internet access
Students do not know if their solution is incorrect until answers are posted	Students know their solutions are correct or not instantaneously
Grading can be subjective	Grading is objective
Students usually attempt a problem once or twice	Students are allowed to attempt the problems as many time as they want (until they get it right)

- ❖ 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

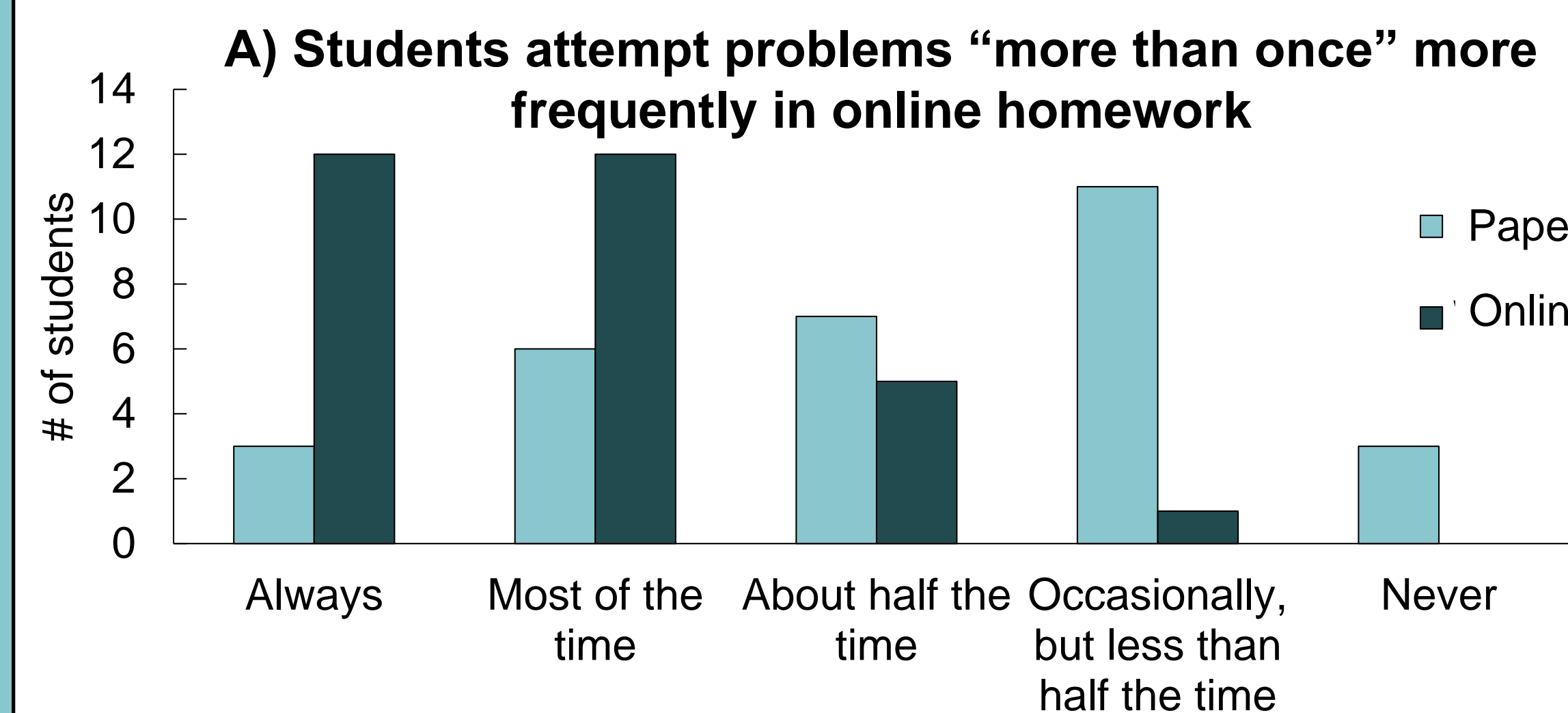
- ❖ How does manually curated WW compare with PPH in improving students' self efficacy (**self confidence**)?
- ❖ Can we use WW data for **formative assessment** and design teaching modules for difficult concepts?

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)



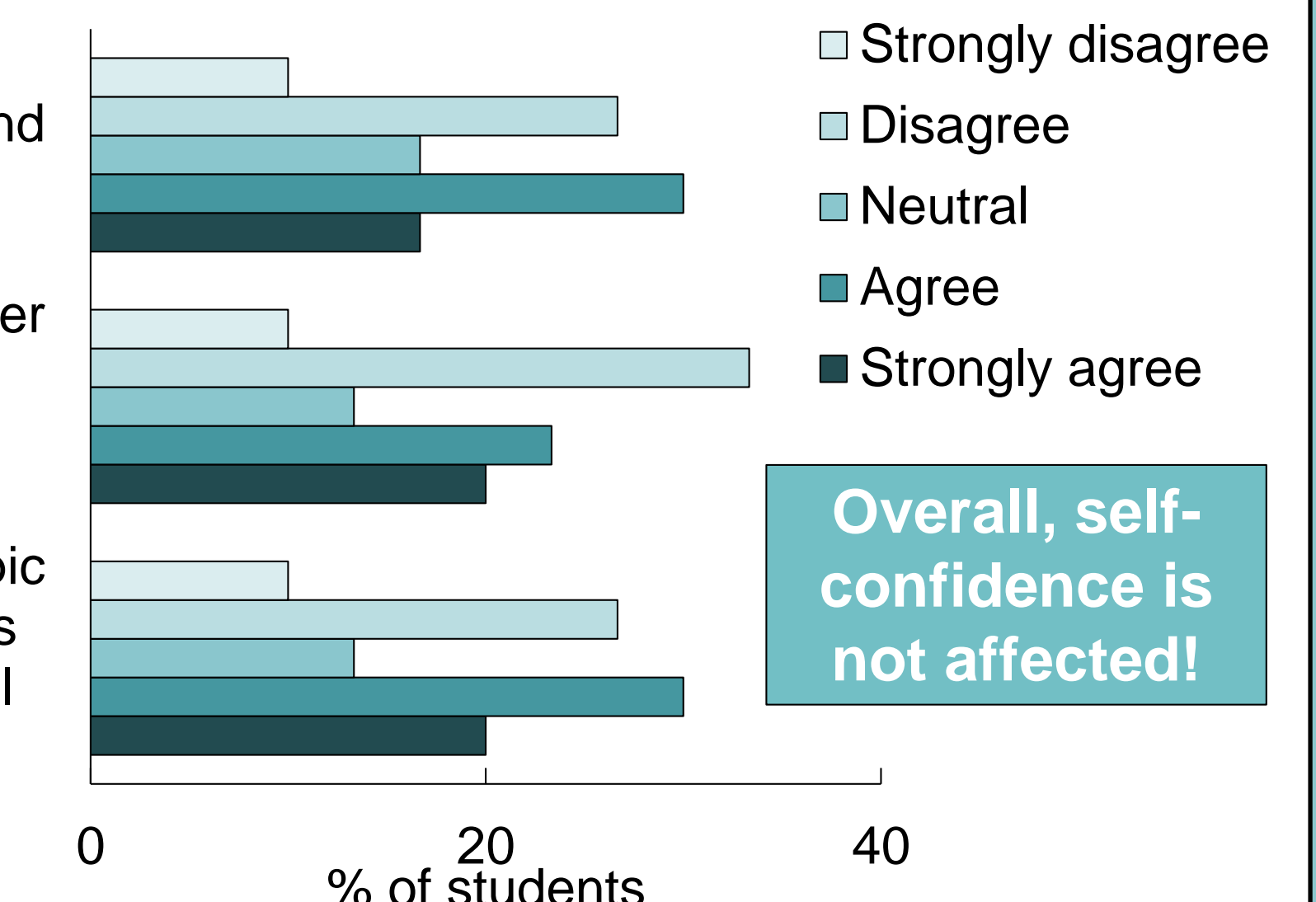
B) Self-reported time spent per problem is reduced in online relative to paper

Online → Paper ↓	1-10 mins	11-20 mins	21-30 mins	31-40 mins
1-10 mins	5	1		1
11-20 mins	5	10		
21-30 mins	1	4	1	1
31-40 mins				1

C) I prefer WebWork over paper and pencil homework

I feel more confident in a topic after WebWork assignment as compared to paper and pencil homework

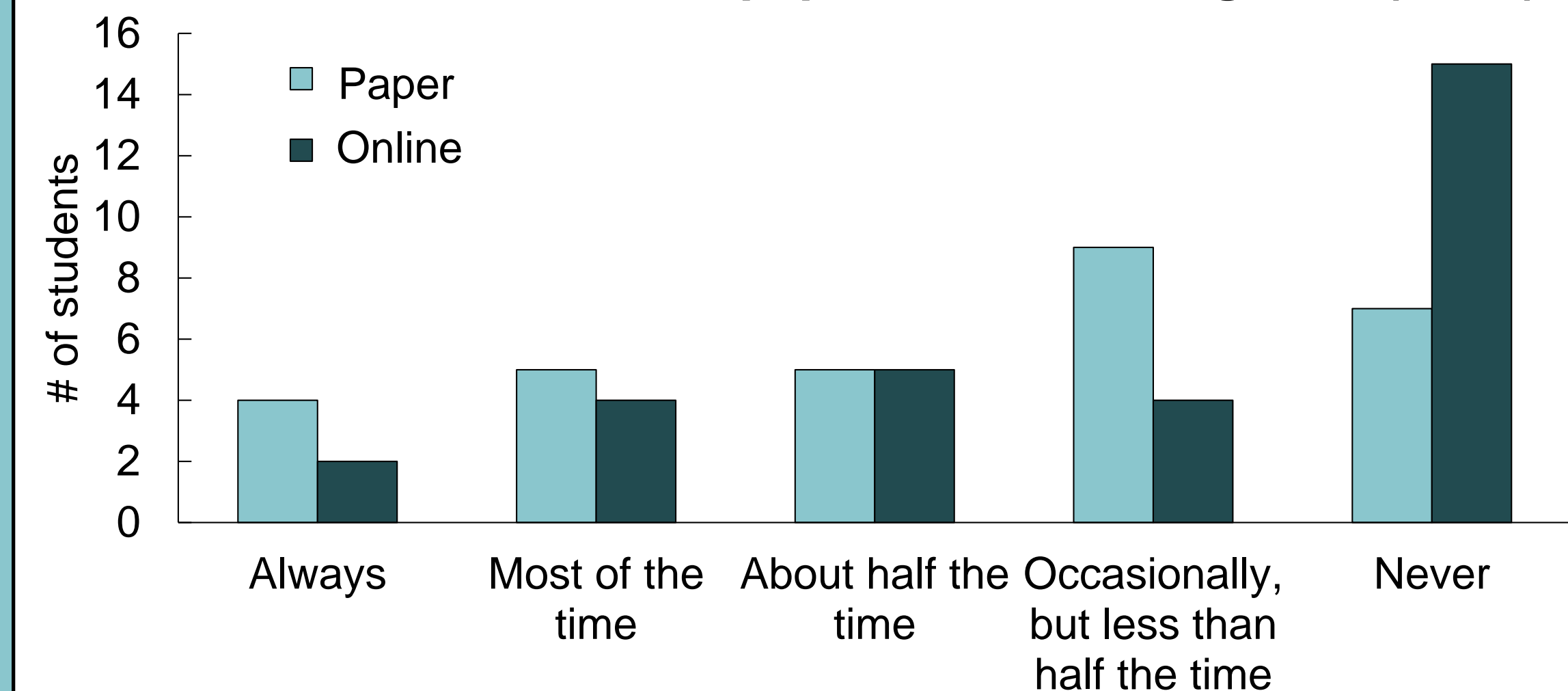
I gain more experience in a topic after WebWork assignment as compared to paper and pencil homework



Overall, self-confidence is not affected!

- ❑ Students answered that they **spend lesser if not equal time doing problems** online relative to paper despite increased attempts, likely due to **increased guesswork** and lesser time per attempt
- ❑ Students do not perceive any changes in self-confidence after using online relative to paper. They also don't show any preference for one over the other

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)

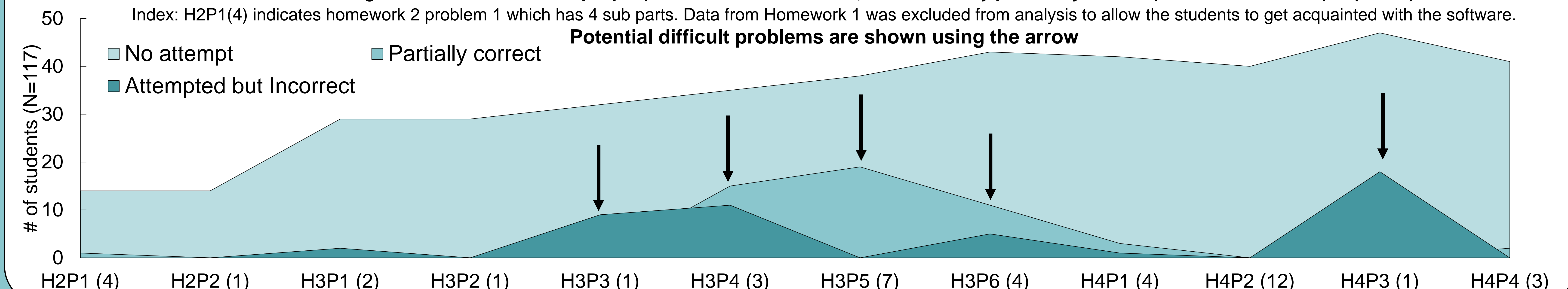
Ability to show their work

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)



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 completely correct despite multiple attempts, we can predict the difficult problems/concepts for them

References

- [1] Bowman CR, Gulacar O, King DB. Predicting Student Success via Online Homework Usage. J Learn Des. 2014;7: 47-61.
- [2] Roth V, Ivanchenko V, Record N. Evaluating student response to WebWork, a web-based homework delivery and grading system. Comput Educ. 2008;50: 1462-1482.
- [3] Megan E and KM. Students' Reactions To the Homework Assessment System Webwork. Math Comput Educ. 2016; 42-52.

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