



Creatively engaged online: student-generated content in a non-majors introductory course

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Design and Methodology

We describe the implementation of the PeerWise tool into a large introductory Physics course for non-majors at UBC. PeerWise is an online system that enables student cohorts to author multiple choice questions (MCQs) related to course content and to answer, comment and discuss those contributed by their peers.

Integration of PeerWise into courses to support learning in various contexts has been described previously (see References), with studies investigating student engagement, highlighting the importance of scaffolding for students to be able to write good quality questions, correlations with learning (as measured by end of course exams), question quality and the effects of badging & game elements. We build on these previous studies, implementing PeerWise as part of the summative assessment component in 3 sections of Physics 101 (total enrollment 791), a course taken by over 1700 students annually, very few of whom will take further physics courses. For each of two assessments (each worth 2.5% of course grade), students were required to contribute as a minimum:

Write 1, Answer 5, Rate & Comment 3

Students were introduced to the PeerWise system in their first tutorial session, (weeks 2 & 3 of class) where a series of initial scaffolding exercises were used, with students working in small groups. Following the initial round of tutorials, students were notified of the assessment requirements for the activity, and given several weeks to complete the minimum participation requirements. Subsequent tutorials wove in elements of further practice, exposure to the system or training. These elements included incorporation of student questions as 'warm up' clicker questions at the start of the tutorial, and specific focus on how to improve elements of a question (eg distracters, explanations).

Assessment credit was awarded such that a substantial fraction was given for meeting the minimum participation requirements, with bonus credit based on performance, as measured by a scoring algorithm within the PeerWise tool.

Conclusions

Student participation is generally well beyond the minimum participation requirements for course credit.

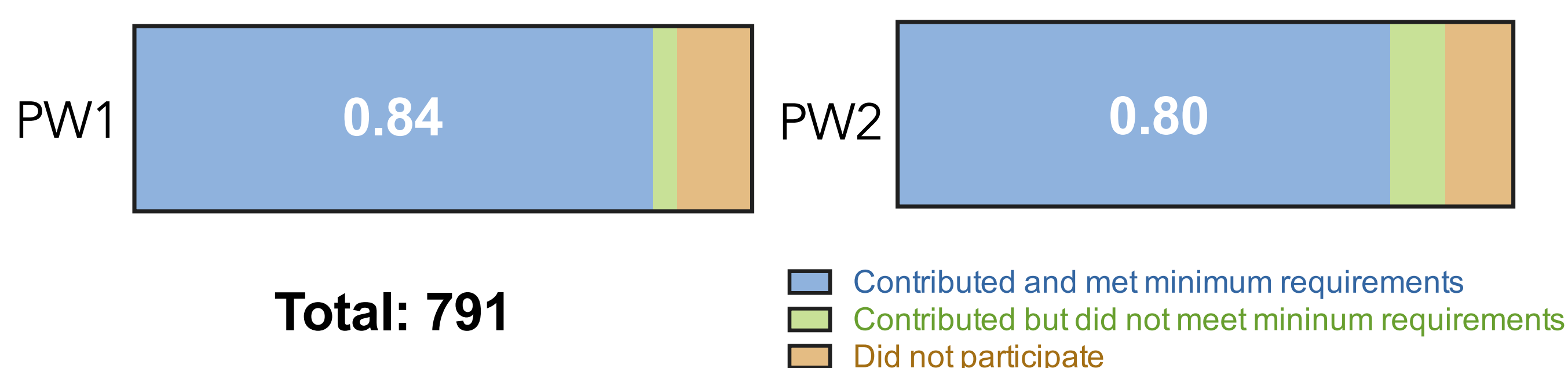
Unlike similar studies with Physics majors, non-majors tend to produce questions of lower overall quality.

There is some evidence to suggest that question quality and detail of explanation improves with practice.

Student engagement with PeerWise

We illustrate student engagement with the PeerWise activities (PW1 and PW2) from three different perspectives: overall cohort engagement; quantity of contributed content and frequency of use.

Cohort engagement. Only 80-84% of the cohort contributed to the content repository, with the vast majority who did meeting the stipulated minimum requirements. There exist a variety of possible reasons for this, some of which we have anecdotal evidence to support, based around assessment crowding.



Quantity of contributed content. Contributors generally exceeded the minimum requirements for questions answers and comments, by multipliers ranging from 1.3 to 19x. In the table below, multipliers are reported as follows: [relative to the active students for that assessment] and (relative to the total cohort size).

	Number	Multiplier	Number	Multiplier
Questions	1105	[1.7] (1.4)	998	[1.6] (1.3)
Answers	11393	[17.2] (14.4)	11807	[18.7] (15.0)
Comments	4901	[7.4] (6.2)	5509	[8.7] (5.0)
	PW 1		PW 2	

Frequency of activity. Defining an activity freq., $A_x = N_x / N$ where N_x is the number of days when new content of a given type ($x =$ question, Q; answers, A; comments, C) was created and N is the total number of course days. Counting from the first day of the semester to the final exam, including weekends, public holidays and a reading week mid-semester, $N=94$, so we find:

$$A_Q = 0.78 \quad A_A = 1.03 \quad A_C = 0.91$$

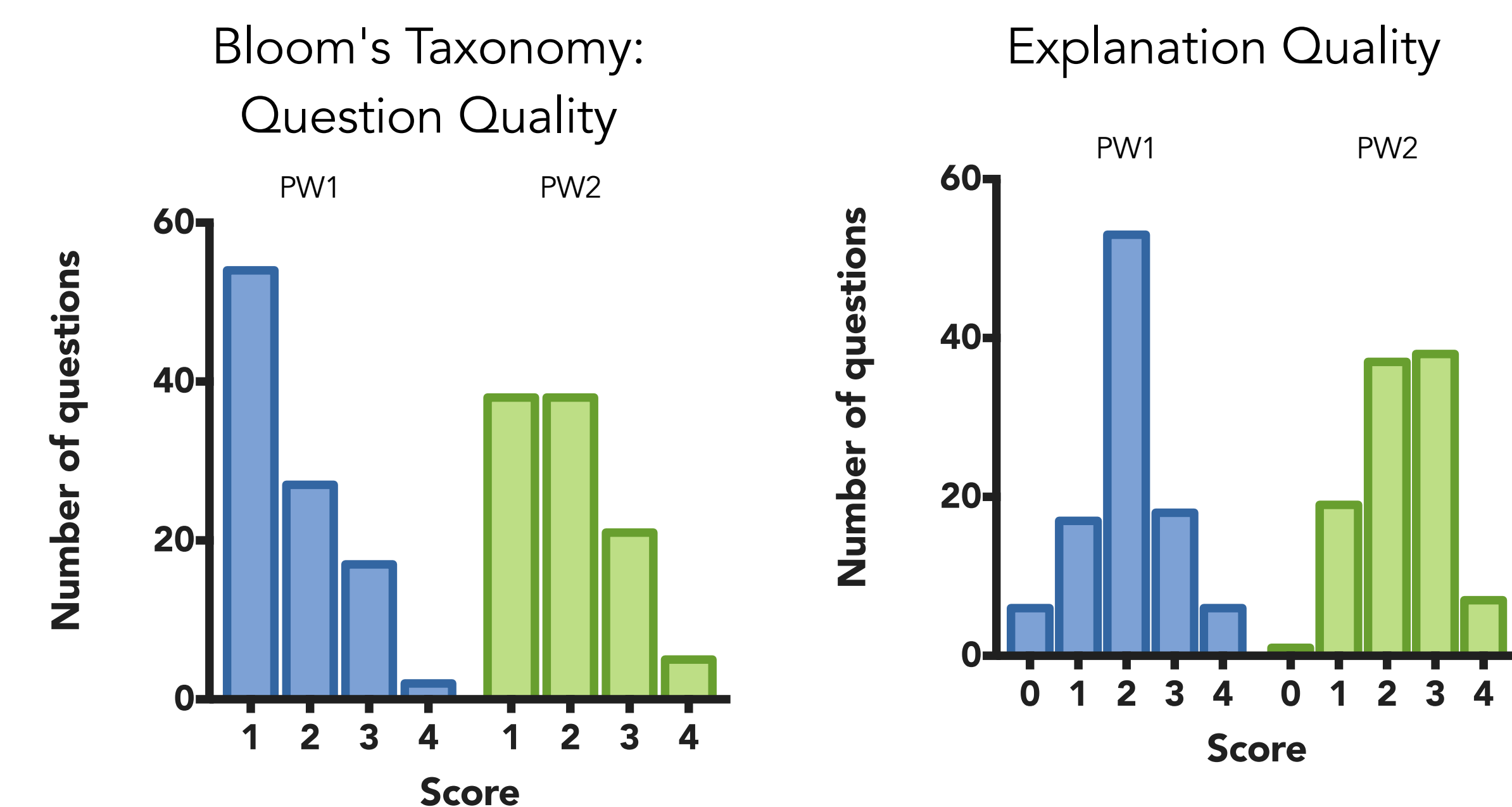
Thus, on more than ¾ of all days, there was new question content being developed, and the fact that A_A exceeds 1 indicates that question answering persists slightly beyond the final exam date. Though not particularly 'broad' (i.e. relatively few students may be engaged on a given day), this activity is a useful counterpart to scheduled face-to-face sessions, which tend to be far less frequent but 'broad' in the sense that most / all of the cohort is involved (e.g. in a whole class lecture).

Question & Explanation Quality

We assessed the quality of a random sample of questions submitted as part of the two assignment tasks (PW1, PW2, respectively), with a sample window from the start of the assessment to three days prior to the deadline. In total, 204 questions were categorized (PW1 $N_1=103$, PW2 $N_2=101$) according to the cognitive level of the question and quality of the solution explanation, using the criteria shown.

Bloom's Taxonomy of levels in the cognitive domain

Score	Level	Description
1	Remember	Factual knowledge, trivial plugging in of numbers
2	Understand	Basic understanding of content
3	Apply	Implement, calculate / determine. Typically one-stage problem
4	Analyze	Typical multi-step problem; requires identification of strategy
	Evaluate	Compare & assess various option possibilities; often conceptual
	Synthesize	Ideas and topics from disparate course sections combined. Significantly challenging problem.



Description of explanation quality scores

Score	Level	Description
0	Missing	No explanation provided or explanation incoherent/irrelevant
1	Inadequate	Wrong reasoning and/or answer; trivial or flippant
2	Minimal	Correct answer but with insufficient explanation/justification/ Some aspects may be unclear/incorrect/confused.
3	Good	Clear and detailed exposition of correct method & answer.
4	Excellent	Thorough description of relevant physics and solution strategy. Plausibility of all answers considered. Beyond normal expectation for a correct solution

In the case of question quality, the change between PW1 and PW2 is not significant ($p=0.23$). For the explanations, the difference is significant ($p=0.002$) with improvement in the second assessment.

References

PeerWise[™]

PeerWise - Community[™]

Student-facing system <http://peerwise.cs.auckland.ac.nz/>

All the research studies referenced and scaffolding materials referred to are accessible through the PeerWise community site <http://www.peerwise-community.org/>