Background

Pedagogical Content Knowledge (PCK) • A theoretical framework for investigating teaching that emphasizes the interplay between different types of knowledge:
  1. Content Knowledge (CK): Traditional knowledge of the subject matter, such as physics
  2. Pedagogical Knowledge (PK): The knowledge of students’ difficulties, of various approaches to teaching specific content, and how this knowledge fits within the larger student learning experiences
  3. Pedagogical Content Knowledge (PCK): The knowledge of traditional subject matter in the context of teaching it: includes ways of helping students construct a deep meaningful understanding, being aware of what makes subject matter easier/more difficult, and how student conceptual difficulties impact their learning

Technology-Enhanced Pedagogies in Teacher Education

PeerWise Online Collaborative Tool

Course Goals
- Implement the PeerWise system into a secondary physics methods course in a teacher education program

Objectives
- Integrate the PeerWise system with other technology-enhanced pedagogies, such as Peer Response Systems and simulations

Research Goals
- Compare the traditional benefits of the PeerWise system with the impacts in a small teacher education course
- Investigate the effect of an online collaborative tool on teacher-candidates questioninging and commenting skills

Explore teacher-candidates’ expressions of PCK:
  a) How do these expressions change over the course of a teacher education methods course?
  b) How do teacher-candidates’ conceptions of the different areas of knowledge interest?

Course Context
- Ten (10) teacher-candidates at a large research-based university in Canada
- Secondary Physics Methods course in a Teacher Education Program
- As a component of the course requirements, each week students:
  a. Submitted five (5) questions (original or modified from other source)
  b. Included an answer justification for each question
  c. Answered ten (10) questions
  d. Commented on peers questions as appropriate

Sample Questions
- Question, answer justification, comments, and ratings included
- Indicative of quality from beginning, middle, and end of term

Frequency Results
- A) Means for questions and comments
- Frequency Results
  - Frequencies of ratings on question and comment scales

Future Directions

1. Course Goals
   a. Revise course requirements and instructions in order to integrate PeerWise efficiently and effectively into the physics methods course, with the goal of developing students Pedagogical Content Knowledge
   b. Develop a process for participating in PeerWise that students will “buy in” to, allowing instructors and students to take advantage of the benefits of PeerWise in an authentic and meaningful way
   c. Develop students skills commenting online in a constructive and thoughtful manner

2. Research Goals
   a. Repeat study in a second cohort, altering course requirements and research questions to reflect our first year experience
   b. Explore the long-term effects of the role of questioning on teacher-candidates practice and PCK
      1. Follow up during long-practicum experience and at the end of the Teacher Education Program through interviews and focus groups

Methods

Questions Ratings
- Course Instructor and Masters Teaching Assistant rated all submitted questions on three scales for Bloom’s Taxonomy level, distractor quality, and answer justification

Comment Ratings
- Course Instructor and two Research Assistants rated all submitted comments on four scales for PK, CK, PCK, and overall quality

Results

• Total number of questions, answers, and comments increased
  • Students met course requirements in W1 and exceeded course requirements in W13 for:
  a. Number of questions submitted
  b. Number of answers submitted (allowing instructors to decrease number of answers)

Questions
- Utilized previous tool to assess students’ development and demonstration of questions with higher cognitive skill
- Ran ANOVAs to measure significant difference between W1 and W13 on all scales

Bloom’s Taxonomy Level
- Statistically significant difference between W1 and W13; F(1, 118) = 24.204, p < .01

Distractor Quality
- No significant difference between W1 and W13

Answer Justification
- No significant difference between W1 and W13

Impact
- Increase in Bloom’s Taxonomy level, demonstrating increased cognitive level of students’ questions, with a resulting maintenance of quality of distractors and answer justifications demonstrates an overall shift in students’ capacity to question effectively
- Maintenance of Pedagogical Content Knowledge levels in comments with increasing frequency of comments shows promising results for students’ increased capacity to critically evaluate questions
- Increased number of questions contributed during a one-week period with maintained distractor quality and answer justifications indicates students’ ability to efficiently select, critique, and write questions is increased

References