Technology Use in Post Secondary Agricultural Sciences Classrooms: What does the research say about instructor implementation of educational technologies as applied to the Technological Pedagogical Content Knowledge (TPACK) framework?

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Pedagogical Content Knowledge (PCK)

Technological Pedagogical Content Knowledge (TPACK)

How has this framework been used?

Lack of studies
- STEM
- Undergraduate
- Student Outcomes
- Discipline based work

Methodology

• Search ERIC and Google Scholar and Individual targeted journals 2000-2015

• Search Terms Used: Undergraduate, Agriculture, Technology, agricultur/al/e education, agronomy, Entomology, + specific technologies

• 31 papers + 13 found
For each paper, the following information was recorded:

- The type or types of technology
- The way students were expected to use this technology
- The content or topic that the technology was supposed to be used for
- The extent to which they discussed pedagogy, themes related to pedagogy or evidence-based instructional practices
- Student outcomes including learning, perception or behavior
- The unit of analysis and method of analysis
- Type of institution
- Course-level (underclassmen, upperclassmen or graduate)
- The sample size
<table>
<thead>
<tr>
<th>Journal of Agricultural Education</th>
<th>Rob Strong, Travis L. Hardy, &amp; Larry M. Dooly</th>
<th>Factors Influencing Agricultural Leadership: Students' Perceptions of Behavioral Intentions</th>
<th>2013</th>
<th>Visualization or video resource</th>
<th>How do they expect students to acquire data?</th>
<th>Prototyping models</th>
<th>Internet search</th>
<th>Moodle/Blackboard (content management systems)</th>
<th>Email</th>
<th>Website/Database</th>
<th>Do they discuss pedagogy or something related?</th>
<th>Is the discussion about the pedagogy cited in other sources?</th>
<th>Content</th>
<th>Pedagogy</th>
</tr>
</thead>
</table>
| Journal of Agricultural Education | Donald M. Johnson, Leslie Edgell, & Cassandra K. Courses | Student Perceptions of ICT Use in Undergraduate Agriculture Courses | 2013 | Yes | Yes - Blackboard is mentioned in article as one of the ICTs | Yes - Email is mentioned in article as a type of ICT | No - does not go into detail of how any of the ICTs can be used for agric. content | No - general technology use in assignments as reported by ag faculty | Did not have any detail about how the computer tech. can be used to improve students learning, but suggests | Cites articles that cover how students need skills in computer tech. for the future (Thomson, Whittington, ...)
| Journal of Agricultural Education | Donald M. Johnson | Student Computer Use in Selected Courses | 2000 | Yes - does this task | Yes - discussed tasks students did | Yes - is mentioned in article | No - general technology use in assignments as reported by ag faculty | Did not have any detail about how the computer tech. can be used to improve students learning, but suggests | Cites articles that cover how students need skills in computer tech. for the future (Thomson, Whittington, ...)

Analysis of all Papers

Results Type of Tech

No General Technology Included

Results Type of Tech no General

Types of Content

Student Outcomes

TCK and
Analysis


Technology Used In Lecture

1. Tablet personal computers

Classification

2. Interactive ability to collect data or formulate GIS maps

3. GPS/GIS

Student Outcomes

- GIS applications in a more interactive learning environment
- Providing real world experiences
- Personalized and flexible learning environment

Overall students (n = 46) perceived tablets heightened learning, increased interactivity. There were perception differences between males and females.
Minus Papers Researching Student General Technology Skills

Percent of Studies Using a Technology (n = 20)
Technologies Covered

Percent of Studies Using a Technology (n = 31)
Results

N = 31

Do not mention pedagogy, but have specific technology for content (n = 4)

General use & perception of technologies (n = 10)

Online course design (n = 1)

Mention pedagogy with limited discussion/citation (n=3)

General technology in course development (n = 6)

TPACK (n = 7)
Results

N = 31

Most studies measured perception and behavior, but not learning.

<table>
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<tr>
<th>Outcomes</th>
<th># Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std. Perception</td>
<td>20</td>
</tr>
<tr>
<td>Behavior</td>
<td>11</td>
</tr>
<tr>
<td>Learning</td>
<td>7</td>
</tr>
<tr>
<td>&gt;1</td>
<td>12</td>
</tr>
</tbody>
</table>
Results TPACK Framework

• Studies with topic specific TCK: 39%
• Number of studies with clear TPK: 48%
• Number of studies with no topic specific TCK or TPK: 26%
• Number of studies with both topic specific TCK and TPK: 23%
• Number of studies with full TPACK: 22%
Recommendations

• Continue to conduct student learning (outcomes) and perception research

• Less equivalency studies

• More content specific studies driving how to teach a particular concept

• Better tags/keywords for articles
Recommendations

• More Exp. Design Studies
• Modification of framework
  – Pedagogy is critical to TPACK
  – Student outcomes should be incorporated
  – Differentiation of disciplinary and topic specific content
  – Incorporation into modified PCK framework and revised TPACK framework
Figure 1: Model of Teacher Professional Knowledge and Skill Including PCK and Influences on Classroom Practice and Student Outcomes

Teacher Professional Knowledge Bases

- Assessment Knowledge
- Pedagogical Knowledge
- Content Knowledge
- Knowledge of Students
- Curricular Knowledge
- Technology Knowledge

Topic Specific Professional Knowledge

Knowledge of: Instructional Strategies, content representations, student understandings, science practices and habits of mind

Amplifiers and Filters: Teacher Beliefs, Orientations, Prior Knowledge, & Context

Classroom Practice

Personal PCK/PCK&S Knowledge, Skill, & Enactment

Amplifiers and Filters: Student Beliefs, Prior Knowledge, Behaviors

Student Outcomes

Gess-Newsome et. al. (in press)
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