Understanding Secondary School Teachers’ Knowledge and Technology Implementation in the Mathematics Classroom

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Figure 1. The TPACK Framework.

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Technology Integration in the Mathematics Classroom

• Attitudes and Beliefs
  ◦ Pierce and Ball (2009)
    ▪ more enjoyable for students
    ▪ deeper understanding

• Teacher’s Self-Confidence
  ◦ Hennessy, Ruthven, and Brindley, (2007)
    ▪ As confidence increases, benefits will increase
    ▪ Technology not always best for teaching math
Research Questions

- Is the technological, pedagogical, and content knowledge of teachers reflected by the strategies used to integrate technology in the classroom?

  1. What is the TPACK of the middle and high school math and special education teachers in a rural public school system in the Mid-Atlantic region of the United States?

  2. How are the middle and high school mathematics and special education teachers in a rural public school system in the Mid-Atlantic region of the United States integrating technology in their classrooms?
Methodology

- convergent parallel design of a mixed methods study (Creswell & Clark, 2011)
Context

- small, rural public school system in Mid-Atlantic region

1:1 digital conversion beginning 2015-2016
- high school – laptops
- middle school – Chromebooks
- elementary school – iPads and Chromebooks
Participants

- 31 math and special education teachers
  - 13 middle
  - 18 high
  - 24 with 11+ years of experience
  - 5 with 5-10 years of experience
  - 2 with less than 5 years of experience
  - 14 with elementary education (1-6) certification
  - 15 with middle school math (4-9) certification
  - 15 with secondary math (7-12) certification
  - 7 with special education certification
Data Collection & Analysis

- TPACK survey developed by Zelkowski, Gleason, Cox, & Bismark (2013)
  - 22 Likert-scale questions
- 7 open-ended questions about technology integration
- Qualtrics survey sent through email
- Descriptive Statistics
- Holistic Coding → Pattern Coding
Table 1. Descriptive Results by the TPACK Components

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK</td>
<td>28</td>
<td>3.70</td>
<td>1.02</td>
</tr>
<tr>
<td>CK</td>
<td>28</td>
<td>4.46</td>
<td>0.69</td>
</tr>
<tr>
<td>PK</td>
<td>28</td>
<td>4.49</td>
<td>0.62</td>
</tr>
<tr>
<td>TPACK</td>
<td>28</td>
<td>3.91</td>
<td>0.87</td>
</tr>
<tr>
<td>Theme</td>
<td>Definition</td>
<td>Example</td>
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<td>------------------------------</td>
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<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Conceptual Understanding</td>
<td>An integrated and functional understanding of mathematics</td>
<td>“It has helped students understand concepts better and make connections between different topics.” Participant 8</td>
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<tr>
<td>Teaching Strategies</td>
<td>Methods used to help students learn course content</td>
<td>“With numerous resources, we have multiple ways to teach and enhance lessons.” Participant 25</td>
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<tr>
<td>Time</td>
<td>Time refers to the amount and quality of time spent with students in the classroom and time spent using data to drive learning</td>
<td>“Saves times so you can delve deeper into the problem.” Participant 22</td>
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<tr>
<td>Student Engagement</td>
<td>The attention, interest, and persistence of students in their work</td>
<td>“They take ownership of their learning.” Participant 24</td>
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<td></td>
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<td>“Technology enables me to give tasks about real-life problems.” Participant 6</td>
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<tr>
<td>Theme</td>
<td>Definition</td>
<td>Example</td>
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<tr>
<td>Resources</td>
<td>Resources involves access to and the quality of devices, internet access, digital programs, tech support, and funding</td>
<td>“Sometimes there are so many options it is hard to get proficient with just one.” Participant 7</td>
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<tr>
<td>Time</td>
<td>Time refers to time spent with students in the classroom, teachers’ planning time, and time spent in professional development</td>
<td>“Time to apply in class, time to research during planning.” Participant 18</td>
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<tr>
<td>Teacher</td>
<td>Teachers’ understanding of the purpose and methods for technology use in the classroom</td>
<td>“Not knowing other technologies to use in math that is effective.” Participant 21</td>
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<tr>
<td>Knowledge</td>
<td></td>
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<tr>
<td>Teacher</td>
<td>Teachers’ beliefs and perceptions of technology</td>
<td>“I don’t like technology nor do I want to use it in my room.” Participant 19</td>
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</tr>
<tr>
<td>Attitudes</td>
<td></td>
<td>“We can always do better.” Participant 30</td>
<td></td>
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</tbody>
</table>
Inspiring Professional Development

• **Time to Learn**
  - Boot Camp Model
  - After School Workshops with Teacher Leaders
  - Professional Development Sessions

• **Peer Learning**
  - Pineapple Chart
  - Departmental Meetings
  - Planning Period Sessions
  - Drop-in Schedule with Teacher Leaders