

# DIFFERENT ACADEMIC BACKGROUND TEACHERS' CONCEPTIONS OF THE ROLES OF MATHEMATICS IN TAIWAN STEM EDUCATION

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## THEME:

Teacher education and professional learning in STEM

## BACKGROUND AND AIMS

To enhance national competitiveness under the trend of globalization, various countries have paid attention to the cultivation of students in STEM (Science, Technology, Engineering, and Mathematics) fields and their integration at K-12 stage (e.g. National Governors Association [NGA], 2007; Project Lead the Way, 2014). In Taiwan, STEM education is also mentioned in the latest syllabus to develop students' 21<sup>st</sup> century skills (Ministry of Education, 2014). Teachers play key roles in designing and implementing STEM tasks, and then their conceptions would influence the effectiveness of STEM education (Vescio et al., 2008). Mathematics, as a minor subject in current STEM education, needs to be highlighted in the future STEM education (Barry, 2014). To better understand the potential roles of mathematics in STEM education, the aim of this study is to investigate different academic background teachers' conceptions of the roles of mathematics in Taiwan STEM education. Comparing secondary school teachers with different academic background in Taiwan contributes to expanding the roles of mathematics in STEM education.

## METHODOLOGY

Interpretative phenomenological analysis is used as a research method in this study, twelve secondary school teachers were the participants in our study. All participants were in-serve teachers with STEM teaching experience, four teachers with the same disciplinary background, respectively, in mathematics, technology and engineering and science. We conducted approximately one hour of online semi-structured with each teacher, and the interview outlines were provided to them in advance. For interpreting the data, we identified codes, clusters as well as emergent themes and conduct a cross-case comparative analysis to describe the differences among teachers from different academic background by using thematic analysis method (Braun & Clarke, 2013; Yin, 2014). Through continuous comparison, we have finally developed six themes to interpret different academic background teachers' conceptions of the roles of mathematics.

## RESULTS AND CONCLUSIONS

Table1 summarizes the main differences between mathematics and other disciplinary teachers in the six themes, including STEM integration, Purpose, Real-world situation, Entry of STEM tasks, Technology usage and Challenges. The meaning of the main differences would be elaborated in the presentation.

**Table 1 Different academic background teachers' conceptions**

	Mathematics teachers	Other disciplinary teachers
STEM integration	<ul style="list-style-type: none"> <li>· Mathematics as core</li> <li>· Focus on mathematical concepts or thinking</li> </ul>	<ul style="list-style-type: none"> <li>· Mathematics as peripheral</li> <li>· Blurred boundary of knowledge</li> </ul>
Purpose	<ul style="list-style-type: none"> <li>· Improving the motivation of learning mathematics</li> <li>· Developing mathematics</li> </ul>	<ul style="list-style-type: none"> <li>· Improving the motivation for overall learning</li> <li>· Applying mathematics</li> </ul>
Real-world situation	<ul style="list-style-type: none"> <li>· Clear situational structure</li> <li>· Situations for learning mathematics</li> </ul>	<ul style="list-style-type: none"> <li>· Open situational structure</li> <li>· Situations as context for exploring</li> </ul>
Entry of STEM tasks	<ul style="list-style-type: none"> <li>· Situational problems with mathematical perspective</li> </ul>	<ul style="list-style-type: none"> <li>· Problems formulated by students from situations</li> </ul>
Technology usage	<ul style="list-style-type: none"> <li>· Importance of technology use for mathematics learning or understanding</li> </ul>	<ul style="list-style-type: none"> <li>· Importance of mathematics for technology use or design</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>· Designing mathematics-based STEM tasks</li> </ul>	<ul style="list-style-type: none"> <li>· Designing STEM tasks and time planning in line with students' cognition</li> </ul>

We will provide implications in terms of the planning of integrated STEM curriculum, the design of STEM tasks and the collaboration of different academic background teachers.