



**HAL**  
open science

## **An exploration of the use of structured reflection tasks to surface prospective teachers' awareness of TPACK**

Aibhín Bray, Elizabeth Oldham

### ► **To cite this version:**

Aibhín Bray, Elizabeth Oldham. An exploration of the use of structured reflection tasks to surface prospective teachers' awareness of TPACK. Twelfth Congress of the European Society for Research in Mathematics Education (CERME12), Feb 2022, Bozen-Bolzano, Italy. <hal-03748311>

**HAL Id: hal-03748311**

**<https://hal.science/hal-03748311v1>**

Submitted on 9 Aug 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

# An exploration of the use of structured reflection tasks to surface prospective teachers' awareness of TPACK

Aibhín Bray<sup>1</sup> and Elizabeth Oldham<sup>2</sup>

<sup>1</sup>Trinity College Dublin, the University of Dublin, Dublin, Ireland; [brayai@tcd.ie](mailto:brayai@tcd.ie)

<sup>2</sup>Trinity College Dublin, the University of Dublin, Dublin, Ireland; [eoldham@tcd.ie](mailto:eoldham@tcd.ie)

*Keywords: Reflection, TPACK, prospective teachers.*

## Introduction

This study focuses on undergraduate mathematics students in an Irish university who choose to take a module on mathematics education – as part of their academic course, not in an initial teacher education (ITE) programme; thus, the students can be considered as *prospective teachers*. Among the assessment elements for the module is a small component consisting of tutorial exercises. One exercise sets out some structured, technology-facilitated mathematical tasks, involving use of a spreadsheet (Excel), a function graphing and dynamic geometry package (GeoGebra), and a simple programming language (Scratch); the students do the tasks and then post written reactions and reflections to the module's discussion board. The tasks are framed for the students by the overarching idea that – appropriate – use of technology can support, enhance or change teaching and learning, and also by Taylor's (1980) simple but enduring *tutor, tool, tutee* classification (with the tutorial exercise involving the tool and tutee roles). However, the students have not been introduced to the Technological, Pedagogical and Content Knowledge (TPACK) framework (Herring et al., 2016).

Although the section of the module is short (two or three lectures and one tutorial exercise), it has produced insightful reflections from participants over the years. This prompted the research question: Do the tasks involving structured activities and reflections enable prospective teachers, in particular those who took the module in 2019-2020, to surface tacit awareness of components of TPACK?

## Theoretical framework

The theoretical framework for the study is founded in the various technological components of TPACK (Herring et al., 2016): Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The latter denotes the knowledge required by teachers for the effective integration of technology into their teaching in any content area. Teachers who display TPACK demonstrate a good understanding of the complex interplay between technological, pedagogical and content knowledge, by teaching content using appropriate pedagogical methods and technologies.

## Methodology

Ethical clearance was granted, and signed consent forms were returned by 18 of the 25 students taking the module in 2019-2020. Fourteen of them contributed to the discussion board for this task.

Directed Content Analysis (Hsieh & Shannon, 2005) was used on the texts of the (n=14) posts, using the definitions of the four technological components of TPACK as outlined on [www.tpack.org](http://www.tpack.org). Thus, the analysis aimed to identify instances where the students displayed TK, TCK, TPK, or TPACK.

## Results

In total, 48 sections of text were coded in relation to the TPACK framework. Of the 48 codes, 15 showed evidence of students' TPACK, for example (from student 7):

These graphing programmes certainly have a role to play in the teaching of school mathematics. Such educational tools help students to visualise mathematics in a more relatable manner, hence strengthening the understandings of mathematical concepts. For instance, first-year groups were introduced to Scratch and encouraged to learn about geometric shapes and their properties by using the tool, thus making the learning of abstract concepts more meaningful.

Here the student is clearly considering the role of technology in relation to different representations of content, as well as showing an understanding of how it might change the way the students learn. Regarding TCK, there were 16 instances, such as the following, in which student 12 reveals an understanding of how GeoGebra can be employed to create new representations of content:

...very valuable as a tool in teaching maths, especially in terms of coordinate geometry and the links between algebraic expressions and their geometric realisations. For example, it could [...] be used to explore the relationship between the coefficients of a function and the shape [of] its graph.

A further 12 sections of text were coded as TPK, illustrating both a knowledge of how technology can be used in teaching and an understanding of how its use may change teaching and learning. Student 5 posted:

... the students being able to visualize it easier because of the spreadsheet would help and it might also help students that are not very good at computations in maths gain confidence if they could see that they could understand what's happening even if they couldn't do the calculations by hand.

Only five instances of TK were identified, such as (from student 6): "When creating worksheets, GeoGebra is a very accessible tool which makes diagrams clear and easy to paste into a document." This is indicative of an appreciation of how technology can be used for a simple educational goal.

## Conclusions and implications

This research has identified the potential of using structured tasks, followed by reflection and analysis, to surface prospective teachers' awareness of TPACK concepts. We propose that the process could be effectively integrated into ITE programmes to expose students to the framework in a way that makes it accessible and personal. Having completed the structured tasks and reflections, the students would be introduced to the TPACK framework and asked to analyse their own reflections. We aim to conduct further research using this model with post-graduate students enrolled in ITE.

## References

- Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277–1288. <https://doi.org/10.1177/1049732305276687>
- Herring, M. C., Koehler, M. J., & Mishra, P. (Eds.) (2016). *Handbook of technological pedagogical content knowledge (TPACK) for educators*. Routledge. <https://doi.org/10.4324/9781315771328>
- Taylor, R. (1980). *The computer in the school: Tutor, tool, tutee*. Teachers College Press.