Exploring pre-service physics teachers’ development of physics identity through the use of Multiple Representations (MR)

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Abstract

The design of the study: Nilsen, T., Angell, C., & Johansson Hazari, A., P. B., & Avraamidou, Z., Cass, C., & Beattie, C. (2015). Obscuring Power Structures in the Physics Classroom: Linking Teacher Positioning, Students’ physics identities? How does the use of multiple representations influences the development of pre-service teachers’ content knowledge about thermodynamics? Does the use of multiple representations in physics problems support pre-service teachers’ physics career identity? What is the relation between preservice teachers’ content knowledge and their physics career identity? There is a recommendation to investigate contextual cues (i.e., how the teachers might see themselves as physics persons. Existing literature provides evidence that the use of MR has the potential to promote students’ conceptual understanding which is directly related to both their competence and performance (e.g. Sonnert et al., 2010) – essentially how students might see themselves as physics persons.

Research Questions

1. Does the use of multiple representations in physics problems support pre-service teachers’ content knowledge about thermodynamics?
2. What is the relation between preservice teachers’ content knowledge and their physics career identity?
3. How does the use of multiple representations influence the development of pre-service physics teachers’ physics identities?

Theoretical Framework

Methodology

This study adopts a single case study approach with the case being defined as one of a group of pre-service physics teachers in Indonesia using mixed-method for data collection and analysis.

Introduction

What is the value of ‘physics identity’? It allows us to respond to questions related to social frames for what it means to become a physicist or a physics educator (Johnson, 2014).

What is missing in existing knowledge base?

• What kinds of activities in the classroom practices can influence students’ physics identities? (Nilsen et al., 2016)
• There is a recommendation to investigate contextual cues (i.e., how the teachers found ways to meaningfully incorporate students’ thoughts and context into the lesson), because this cue appears as a less prominent cue comparing with other cues. (Hazari & Beattie 2015)
• What kinds of procedures, processes, contexts, discussions, and interviews supports the enactment of teachers’ identity in science education? (Avraamidou, 2014)

Why do we use multiple representations (MR)?

• Existing literature provides evidence that the use of MR has the potential to enhance students’ conceptual understanding which is directly related to both their competence and performance (e.g. Sonnert et al., 2010); essentially how students might see themselves as physics persons.

Methods

This study adopts a single case study approach with the case being defined as one of a group of pre-service physics teachers in Indonesia using mixed-method for data collection and analysis.

Data collection and analysis

RQ1

The correlation of recognition, performance, competence, and interest components with seeing oneself as a “physics person”

RQ2

• There is a direct correlation between the participants’ content knowledge and how they see themselves as physics persons.
• Of the 4 identity components, recognition has the strongest impact on how the participants see themselves as physics person.

Discussion and Conclusion

• There is a process of conceptual change based on the correct answer differences of students’ content knowledge test. The distinction between knowledge enrichment and conceptual change allows us to view how the different concept learning processes and how each representation plays different roles in that process (Annis and Levine, 2017).
• Recognition by parents and teacher have the strongest correlation with students’ physics career identity. They see themselves as physics persons due to the support from parents and teachers.
• The second strongest component is interest which relates to the use of mathematics. It has been argued that physics involves a lot of formula and mostly correlate with mathematics ability (Niles, Angel & Corina, 2013). It is also in line with the argument that equation plays a deep role in understanding physics (Freeman, 1965).
• The students have a chance to develop their performance, competence, recognition, and interest in physics which we acknowledge as physics identity through the use of MR as a classroom practice.

References


See the supplementary materials for the full list of references.