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

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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, 2016).

What is missing in existing knowledge base?

• What kinds of activities in the classroom practices can influence students’ physics identities? (Rao et al., 2010)
• There is a recommendation to investigate contextual cues (i.e., how the teachers found ways to meaningfully incorporate students’ thoughts and content into the lessons), because this cue appears as a less prominent cue compared with other cues. (Hazari & Beattie, 2015)
• What kinds of procedures, processes, contexts, discourses, and interactions supports the enactment of teachers’ identity in science education? (Ankens et al., 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., Sorenson et al., 2017) – 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 identities?
3. How does the use of multiple representations influences the development of pre-service physics teachers’ physics identities?

Theoretical Framework

This study adopts a single case study approach with the case being defined by a group of 61 pre-service physics teachers in Indonesia and uses mixed-methods for data collection and analysis.

Methods

The design of the study

Data collection and analysis

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Findings

RQ1

• The comparison between the participants’ scores on the pre- and post-test indicates that their content knowledge improved
• Pictorial representations supported the participants to conceptualize the change of macroscopic properties of ideal gases
• Participants faced difficulties in understanding the first law of thermodynamics

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

RQ3

• There is a process of conceptual change based on the correct answer differences of students’ content knowledge test. The distinction between knowledge enrolment and conceptual change allows us to view how the different concept learning processes and how each representation plays different roles in that process (Ankens et Levins, 2017)

Discussion and Conclusion

- Interest: *It is the beginning. I like mathematics. Then I wandered that mathematics is limited in calculation; it’s not about inventing something. If there is an invention, it will be back to the calculation. This is what I want (refers to what he is doing now). It is not only calculating something but also understanding the nature, how is its characteristics, and how we formulate it*. 
- Recognition: *They (refers to his family) are very supportive, especially my third brother. He confess that I am representative in this field. Since we always have discussion about phenomena which is related to physics in daily life.*
- Performance: *I take the initiative to explain the phenomena related to fluid flow, although my friends and my teacher contradict with my argument in the end. I feel that it is fine; now I know how it works.*
- Competence: *I prefer to use mathematical representation, because I am used to it since I was in school. Learning with other representations should be better and can help me, but I still have difficulties when I find the problem presented in other representations*. 

References


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