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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2019

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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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, 2014).

What is missing in existing knowledge base? • What kinds of activities in the classroom practices can influence students’ physics identities? (Hearet al., 2019)
• 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. (Hearet Beattie, 2015)
• What kinds of procedures, processes, contexts, discussions, and interviews supports the enactment of teachers’ identity in science education? (Arwastes, 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. Sabans et al., 2017); essentially how students might see themselves as physics person.

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

Theoretical Framework

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?

Methods

Data collection and analysis

Phase 1
1. Quantitative • Physics problems and physics concept test
• Thermodynamics Concept Survey (CS)
• Semi-structured interview related to the physics problems
• Glass observation
• Physics identity (PI) questionnaire
• Semi-structured interview
2. Qualitative • Describing the result of semi-structured interview
• Describing students’ difficulties when they found problems with multiple representations
• Content analysis

Phase 2
1. Quantitative • Physics problems and physics concept test
• Thermodynamics Concept Survey (CS)
• Semi-structured interview related to the physics problems
• Glass observation
• Physics identity (PI) questionnaire
• Semi-structured interview
2. Qualitative • Content analysis

Findings

RO1
• 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

RO2
• 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 (Ansareo and Levoni, 2017).

References


Sabans et al., 2017. Students’ content knowledge and their physics identities (this result is the same with Hazari’s work (Hazari, Sonett, Sadler, & Shanahan, 2010); it means that the important of support and belief of another people can effect students identity (Fuyi et al. 2015).

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 & Corso, 2013). It is also in line with the argument that equation plays a deep role in understanding physics (Feynman, 1965).

The students have a chance to develop their performance, competence, recognition, and interest in physics which in which we acknowledge as physics identity through the use of MR as a classroom practice.