Exploring pre-service physics teachers’ development of physics identity through the use of Multiple Representations (MR)
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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? (Johansson 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 class), because this cue appears as a less prominent cue compared with other cues. (Hazari & Beukes 2015)
• What kinds of procedures, processes, contexts, discourses, and interactions supports the enactment of teachers’ identity in science education? (Avraamidou, 2014)

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 pre-service 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-method for data collection and analysis.

Methods

The design of the study

Data collection and analysis

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<th>Role</th>
<th>Methods</th>
<th>Data Collection and Instruments</th>
<th>Data analysis</th>
<th>Tool</th>
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<td>1. Quantitative</td>
<td>Physics problems and physical concept test</td>
<td>Describing the result of semi-structured interview</td>
<td>Cronbach’s Alpha</td>
<td>Atlas</td>
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<td>2. Qualitative</td>
<td>Thermodynamics Concept Survey (TCS)</td>
<td>Describing students’ difficulties when they found problems with multiple representations</td>
<td>Content analysis</td>
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<td>3. Quantitative</td>
<td>Semi-structured interview</td>
<td>Correlation between TCS score and PI score (after the learning process)</td>
<td>Content analysis</td>
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<tr>
<td>2. Qualitative</td>
<td>Physics identity (PI) questionnaire</td>
<td>Correlation between PI questionnaire and semi-structured interview</td>
<td>Content analysis</td>
<td>SPSS</td>
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Findings

| RQ1 | The comparison between the participants’ scores on the pre- and post-test indicates that their content knowledge was improved |

Discussion and Conclusion

| RQ3 | There is a direct correlation between the participants’ content knowledge and how they see themselves as physics persons. |

References


Shanahan, S., Ball, D., & Martinjak, J. (2010). ‘They refer to his family’ are very supportive, especially my third brother. He confess that this is important 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’.

The correlation of recognition, performance, competence, and identity with seeing oneself as a "physics person"

<table>
<thead>
<tr>
<th>Performance</th>
<th>Recognition (RQ1)</th>
<th>Recognition by parents and teacher</th>
<th>Recognition by parents and teacher</th>
<th>Recognition by parents and teacher</th>
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</thead>
<tbody>
<tr>
<td>PI</td>
<td>0,236**</td>
<td>0,396**</td>
<td>0,266**</td>
<td>0,304**</td>
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<tr>
<td>Teaching others</td>
<td>0,319**</td>
<td>0,266**</td>
<td>0,306**</td>
<td>0,359**</td>
</tr>
<tr>
<td>Co-operating with students</td>
<td>0,158</td>
<td>0,213**</td>
<td>0,141</td>
<td>0,234**</td>
</tr>
<tr>
<td>Understanding physical phenomena</td>
<td>0,345**</td>
<td>0,166</td>
<td>0,318*</td>
<td>0,158</td>
</tr>
<tr>
<td>Understanding physical phenomena</td>
<td>0,406**</td>
<td>0,466**</td>
<td>0,397**</td>
<td>0,397**</td>
</tr>
</tbody>
</table>

** It is significance p<0.05
* It is significance p<0.01

Interest: *In the beginning, I like mathematics. Then I was wondering 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."

Recognitation: "They ("refers to his family") are very supportive, especially my third brother. He confesses that this is important 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".

The correlation of recognition, performance, competence, and identity with seeing oneself as a "physics person"