



## Research Analysis on Multi Representation in Physical Materials in The Year of 2014 to 2021

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### ABSTRACT

This research has the goal of analyzing the research of multi representation capabilities in physical matter. This research is a literature study with bibliometric analysis. Secondary data collection of research using Publish or Perish (PoP) in the form of articles of the last six years (2014-2021) on Google Scholar and Scopus. The results of the analysis of 19 research articles were analyzed based on the number of studies each year, VOSviewer visualization, multi representation of measured abilities including problem-solving, understanding concepts, student activities. The highest number of publications in 2021 was 6 articles, in 2015, 2016 there was no VOSviewer Visualization obtained by three dominant clusters. There are seven articles linking multi representation capabilities to problem-solving abilities for a variety of physical materials. The application of multi representation to the understanding of concepts in some materials has been carried out in as many as seven studies. This research is expected to be the next research reference in analyzing the application of appropriate learning models to improve the multi representation ability of learners for various levels of education.

### 13 INTRODUCTION

Physics is a branch of science that studies the symptoms of nature associated with matter and energy. Natural symptoms are compounded by the interaction of various physical magnitudes. Informing natural symptoms one or more physical quantities are interconnected and interact with each other. To facilitate the process of analysis and explanation of natural phenomena, physicists usually use various forms of representation of multi representation abilities can enrich the student context so as to strengthen the understanding of concepts (Abdurrahman et al., 2019; Becker et al., 2020; Purba & Hwang, 2017; TMS & Sirait, 2016), correct diagramming helps students in solving challenging problems (Falkner et al., 2014; Surya et al., 2013; Van Garderen et al., 2013), multi representation is important in physics learning (Mehta & Schwab, 2014; Montavon et al., 2013; Sengupta et al., 2013).

Multi representation is able to help formulate student goals and memory loads during the problem-solving process, multi representation approach can improve students' cognitive abilities (Widianingtiyas, et al., 2015), multi representation is able to improve mental models, and correct visual representation correlates with the student's understanding of physics concepts (Jauhariyah & Wasis, 2018). There is a tendency: the higher the student's multi representation skills, the higher the conception of the student. Representation is a form that can describe something in another form. Multi-representation is to re-represent the same concept in other forms including images, graphics, and mathematics. The three main functions of multi-representation, namely (1) Complimentary; (2) Interpretation limiters; (3) Building understanding (Ainsworth, 1999).

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