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Editorial: Visual images in science education

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Editorial on the Research Topic
Visual images in science education

Visual Images (V.I.) are integral in knowledge construction, thinking, and communicating in science. Similarly, science teaching and learning are increasingly discussed as multimodal processes, relying on a multitude of V.I. On the one hand, science teaching typically relies on V.I. to introduce, define, and explain scientific concepts and phenomena. On the other, scientific literacy, which involves competency in effectively communicating scientific ideas, requires a variety of representational abilities and is closely related to visual literacy, i.e., the ability to understand, interpret, think through, and create V.I. (Lemke, 1998; Ainsworth, 2008; Jewitt, 2008; Tang, 2023).

Science education has primarily been primarily dependent on verbal communication to investigate, mediate, and evaluate science-related meanings, largely overlooking the importance of images in constructing scientific meanings. Even when the importance of the visual mode in science teaching and learning was acknowledged, it has been misleadingly assumed that V.I. bear unambiguous meanings, that are self-evident to viewers. However, understanding, creating, and using images in the context of science education are challenging processes demanding targeted instruction (Kress, 2003; Glazer, 2011). Failing to recognize these requirements deprives students of critical competencies related to scientific (visual) literacy, particularly essential in an era dominated by visual communication.

Moreover, V.I. are complex constructs, often associated with viewers' emotions toward science (Christidou et al., 2021; Duan and Bombara, 2022). All these observations highlight the necessity for sophisticated and multidimensional instruments to investigate the role of V.I. in science education comprehensively. As a response to the need for science education to support students' scientific visual literacy, there has been a growing research interest in how V.I. can be meaningfully integrated into science teaching, how learners read and interpret V.I., or how they visually express their views about different science topics.

Attempting to address some of the aforementioned issues and contribute to the discussion on Visual Images in Science Education we invited valued and interested researchers to participate in this Research Topic. Twenty-five authors from 5 countries in Europe, North America, and Asia contributed 9 articles that cover a range of themes, which fall within two broad and interrelated clusters signified by different colors in Figure 1.

The first cluster (designated with blue in Figure 1) involves research with a primary focus on students, exploring how V.I. support students' meaning making in science, students' visual representations as evidence of their thinking and learning in science, students' difficulties in reading science images, emotional reactions induced by V.I., and students' images of scientists and science.

The focus of the second thematic cluster (designated with yellow in Figure 1) is on science teaching. Related themes examine the relations between V.I. and scientific literacy, the characteristics of V.I. in science teaching material, the use of multiple V.I. in science teaching and learning, ways of scaffolding students' scientific visual literacy, science teaching and learning as multimodal practices, and teachers' use of V.I. in science.

As Figure 1 illustrates, most articles relate more or less directly (indicated with continuous or dashed lines respectively) to a variety of themes pertaining to both clusters. Thus, Uchinokura and Koba explore primary students' visuospatial thinking skills and their use in domain-specific tasks requiring the interpretation of diagrams about solar cells.

Viewers' positioning regarding different V.I. designs is explored in two articles. Lenski and Großschedl investigate whether including emotional design illustrations in concept maps about the Lake Ecosystem is associated with students' affective state, cognitive load, and learning performance, while Höst et al. explore the effect of realism indicators in interactive science center exhibits on viewers' preferences, perceptions of the depicted biological entities as real, and desire for further exploration.

Adbo and AAkesson Nilsson indicate the potential of student-generated playdough models of atomic nuclei for exploring a range of challenges faced in understanding chemistry content that could be concealed in students' verbal explanations.

Chionas and Emvalotis expand the long research tradition of exploring students' images of scientists and science through drawings, by using an open-ended questionnaire. Their findings indicate some interesting deviations from previous studies based on visual data, namely an emphasis on scientists' personality traits instead of their skills, appearance, or specialty.

Christidou et al. make a case for using student-generated V.I. to explore their views on scientific issues by analyzing children's verbal comments and drawings about SARS-CoV-2 and COVID-19 preventive practices and exploring age- and mode-related differences.

After performing two studies to examine the role of representational competencies in students' learning from video games about astronomy, Herder and Rau suggest that representational competency supports designed for structured learning environments may not be effective for educational video games.

Pantidos et al. discuss how different types of V.I. with varying degrees of naturalism and abstraction can be amalgamated to support the formation of science concepts by connecting everyday and specialized visual codes in the context of multimodal science classroom communication.

Wright et al. propose the use of wildlife photographs in place-based education as a means for developing visual literacy, which they consider a powerful component of environmental literacy.

The diversity of themes, research questions, and methodologies addressed by the articles in this Research Topic indicates that integrating V.I. in science education constitutes a promising and multidimensional field to which this volume aspires to make a valuable contribution.

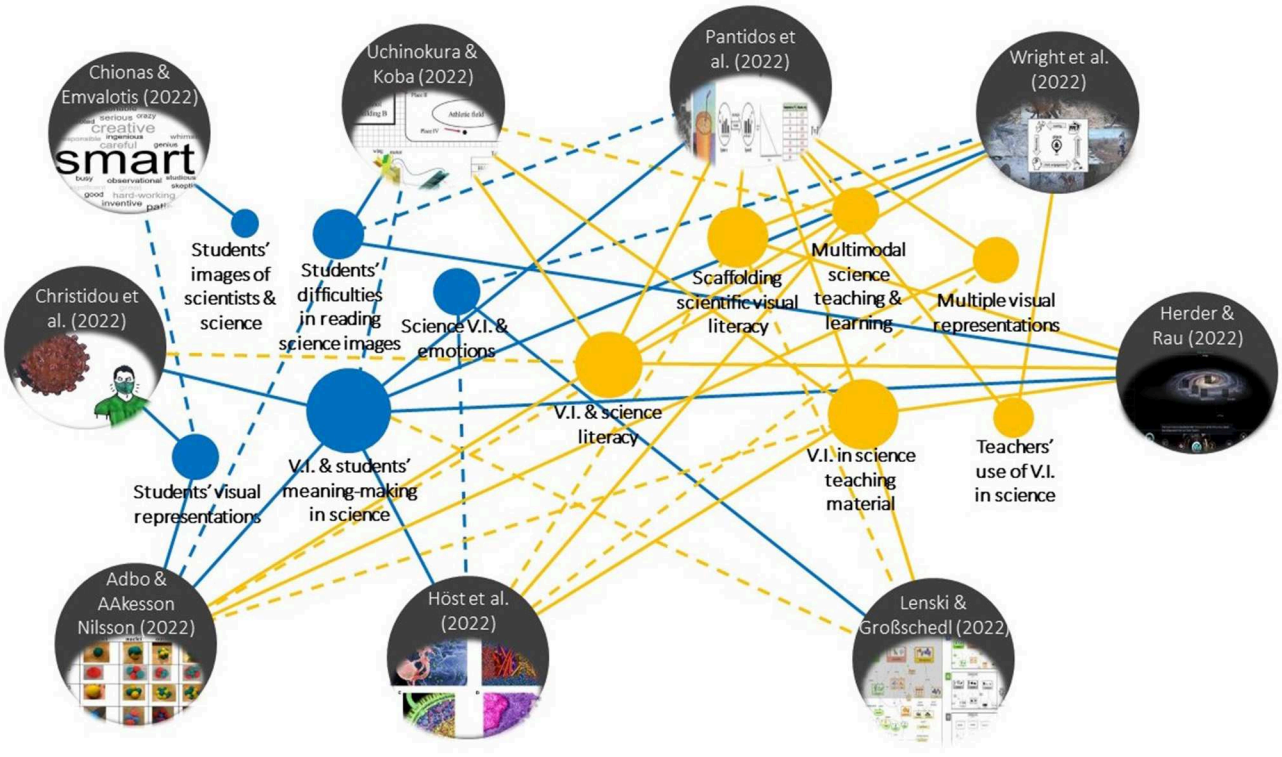

FIGURE 1
Themes covered by the articles in the "Visual images in science education" Research Topic.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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