

# SIG9 Phenomenography and Variation Theory

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**Book of Abstracts**



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## Conference Theme

The theme for the conference is “*Phenomenography and variation theory – the core, the diversity and the potential*”. Phenomenography and variation theory have developed over the decades and are now theories used in several different fields and contexts, focusing on many different phenomena and subjects. As a field and a theory develops, it is worthwhile to every now and then pause and reflect on where one came from, where one is and where one is heading.

The SIG 9 conference 2024 therefore offers the opportunity to focus on the *core*, the *diversity* and the *potential* of our field. This includes clarifying and strengthening core concepts and ideas, discussing possibilities as well as challenges with diversity in use and application of the theories, conceptions and methodologies, and exploring the potential that lies ahead in years to come – both in terms of theory/conceptions, methodology and cooperation with other research fields.



# Keynote Speakers

**Keynote 1:** Gerlese Åkerlind

**Title:** *The Mutually Enhancing Relationship between Phenomenography and Variation Theory*



Variation Theory developed out of phenomenographic research and shares the same epistemological assumptions and definition of learning as phenomenography. In this sense, the two traditions will always be foundationally related. But variation theory has gone on to develop additional theoretical assumptions, a different and more applied set of research questions, and a theoretically-based set of pedagogical practices. In this sense, the two traditions are different. In addition, phenomenography is used by researchers only, whilst variation theory is used by both researchers and teachers. In this sense, phenomenography could be described as the 'pure' and variation theory as the 'applied' arms of the same research tradition.

But in focusing on the development of variation theory, it is easy to miss that phenomenography has also changed and developed over the same time period. Phenomenography of the 1970s-1990s is not the same as phenomenography of the 2000s. In this presentation, I will describe the development of phenomenography over time, and contrast phenomenography and variation theory in terms of key approaches and foci, drawing out the ways in which they can act together to mutually enhance educational impact.

## **Keynote 2: Angelika Kullberg**

***Title: 25 years of research on teaching and learning in the phenomenographic research tradition – the core, the diversity, and the potential***



The keynote highlights the development of a strand of research within the phenomenographic research tradition focusing on teaching. Since the first studies on teaching in the late 1990s, research has evolved to often include analyses of both teaching and learning, suggesting relationships between the two. The introduction of lesson study to the Western world, and thereby the practice of conducting learning studies, has played a significant role in this development. What has been learned from these 25 years of research on teaching? The presentation illustrates major findings and explores the core, diversity, and potential for research on teaching and learning.

# Parallel sessions I

**BLÅSENHUS Room 11:131**

## **A1 Ways of seeing appropriate vocational mathematics knowing**

**Author:** Hanna Knutson

*University of Gothenburg*

A phenomenographic interview study was conducted, concerning vocational mathematics knowing, appropriate to acquire within upper secondary vocational education. Nine teachers in mathematics, or construction work vocational subjects, were interviewed, starting from a set of four textbook-type tasks. The tasks were all, in various ways, related to the geometric concept of similarity and to a construction work vocational context. The interviewees were asked to describe the content area represented by the tasks, to pinpoint the most important aspects of the topic, and to exemplify how these aspects might be explained to a student. The answers given to the questions were assumed to reflect their ways of making sense of the phenomenon, that appeared to them through the tasks and the subsequent questions. The phenomenon that the tasks were considered to represent, could be described as 'appropriate vocational mathematics knowing'. The result of the phenomenographic analysis is an outcome space of seven categories of description, showing that vocational mathematics knowing is perceived to entail, for example: 'remembering mathematical facts and procedures', 'grasping vocational mathematics in practice', and 'understanding vocationally relevant, mathematical concepts', together with various ways of combining, connecting, and integrating these aspects.

## **A2 Prospective teachers' learning from learning studies about early mathematics**

**Author:** Rimma Nyman, Pernilla Mårtensson and Angelika Kullberg

*University of Gothenburg*

**Keywords:** Learning study, variation theory, mathematics education, arithmetic, prospective teachers.

Common reasons for using learning study in teacher education are to help prospective teachers develop their instructional design skills and teaching competency during teacher training. Previous studies show that prospective teachers express that learning study and the variation theory of learning have the potential to support them in focusing on students' learning and their different ways of understanding, as well as in preparing and improving lessons. However, previous studies have foremost been small scale and not focused on prospective teachers learning of teaching from learning studies on larger scale. In this project four cohorts of prospective teachers learning from learning studies about arithmetic in early grades conducted at two universities are investigated. The aim of this paper is to show what the prospective teachers learned from participating in the learning studies. Variation theory is used to analyse prospective teachers' written examination task about the learning study as well as the lessons taught in the learning studies. Findings suggest that prospective teachers become more sensitive towards students' learning of the specific content and explicates what the critical aspects of this content are.

## **BLÅSENHUS Room 11:128**

### **B1 A phenomenographic investigation of Arabic-speaking first-year Engineering student conceptions and strategies of learning English as a foreign language**

**Author:** Amjad Owais and Tanya Hathaway

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**Keywords:** Phenomenographic, learning English as a foreign language, Science, Engineering students

In a globalized world, English continues to be considered the language of science, impacting the delivery of higher education in non-Anglophone countries. Studying through the medium of English is increasingly a requirement for students in undergraduate degree programmes in higher education institutions where English is a non-native language. The United Arab Emirates is no exception to this. Accordingly, this study used phenomenography to investigate Arabic-speaking Engineering students' conceptions of and approaches to learning English as a foreign language. We identified four qualitatively different ways students conceive of learning English as a foreign language: (1) developing meaning through cultural experience, (2) realizing personal goals and enjoying learning, (3) developing language competency, and (4) meeting the compulsory enrolment purposes. Further analysis revealed qualitative variation in university students' approaches to language learning within a binary of deep and strategic approaches. Differences in language learners' intentions and strategies across the approaches have implications for students' educational gain, as language learning strategies influence the level of language proficiency attained. Furthermore, the findings of this study offer an empirically based framework for guiding the development of enhanced teaching practice in similar settings.

### **B2 The potential of Learning Study in enhancing cultural heritage learning for culturally diverse children in kindergarten**

**Author:** Wai Ming Cheung and Serene Chan

*Faculty of Education, the University of Hong Kong, Hong Kong*

**Keywords:** learning study, cultural heritage, culturally diverse children, museum

Learning Study has been working effectively since 2001 aiming at developing the capabilities that students are expected to acquire during a limited sequence of lessons in the classroom. With the success of Learning Study in advancing education these two decades, this study extends its potential outside the classroom, i.e. in a museum. Learning Study helps teachers discern the object of learning and its critical aspects. In turn, teachers help students learn by systematically varying what can be varied. In this study, a group of diverse students of both local and multicultural backgrounds are brought to the Hong Kong Palace Museum. The aim of this visit was for students to learn about cultural heritage and develop their capabilities of cultural awareness and sensitivity. Several exhibits were chosen as they reflected life in the Palace (e.g., the emperor's dragon robe, a gold-plated teapot, etc.). The way of presenting the exhibits varied, and the children learned through the guides' commentary, their costumes, the props used, and the utilization of the five senses, e.g., the chime of an antique clock. The findings highlight the effectiveness of Learning Study in a carefully curated museum visit for enhancing cultural heritage learning for culturally diverse young children.

# Parallel sessions II

BLÅSENHUS Room 11:131

## C1 Which is better, Induction, Contrast, or Control? An intervention study to test the conjecture of Variation Theory

**Author:** Lam, Ho Cheong

*Department of Early Childhood Education, The Education University of Hong Kong, Hong Kong*

**Keywords:** experimental design, Induction and Contrast, intervention study, learning, variation theory

Variation theory of Professor Ference Marton (Marton, 2015; Marton & Pang, 2013) is becoming popular for use in enhancing learning in classrooms. This presentation reports the results of a large-scale intervention study that put this theory to test in the context of teaching Chinese characters (Audience is not assumed to have any knowledge of Chinese). The study adopted a pre- and (immediate and delayed) post-test experimental design with three instructional conditions: Induction, Contrast, and Control. Induction assumed that children learned by observing the same linguistic feature in the characters, while Contrast, adhering to variation theory, assumed that children learned from the differences in the linguistic feature. In Control, the characters were sorted and paired up randomly without any systematic effort to arrange the characters like Induction and Contrast. 375 children from 5 kindergartens were randomly assigned to one of the three conditions. The same set of characters were taught in the three conditions but the characters were paired up differently according to the conditions. The results were: (i) Contrast outperformed both Induction and Control with statistical significances. (ii) Control did better than Induction but without statistical differences. (iii) All three conditions showed statistically significant improvements between the pre- and post-tests.

## C2 The concept of experiencing and imagining

**Author:** Anna Backman

*Department of Literature, History of Ideas, and Religion, University of Gothenburg, Sweden*

**Keywords:** synchronic simultaneity; experiencing; imagining; picture books

Vygotsky's description of children's previous experiences building children's ability to imagine could, in variation theory terms, be described as aspects discerned with diachronic simultaneity making children's imagination possible. However, according to variation theory, aspects can be discerned in two ways, either with *diachronic simultaneity* or with *synchronic simultaneity*. Against the background of Vygotsky's explanation of children's imagination and new variation theory research on children's imagination in picture book reading activities, a need arose to investigate whether discernment with synchronic simultaneity can enable children's imagination, in a similar way as discernment with diachronic simultaneity seems to do. An exploratory study was therefore carried out (Backman, 2023b) which resulted in a theoretical idea, stemming from variation theory, that discerning aspects, with synchronic and diachronic simultaneity, makes children's imagination about the phenomenon possible (Backman, 2023b, forthcoming). This in turn raises the question of what differentiates between the concept of experiencing and imagining if both relate to aspects of phenomena that are discerned by the children. The purpose of this presentation is to discuss the variation theory concept of experiencing, in relation to the concept of imagining.



## **D1 PBL tutors' conceptions of teaching problem-solving: A phenomenographic exploration**

**Author:** Natia Bendeliani

*PhD candidate, Eötvös Lorand University, Budapest*

**Keywords:** conceptions, problem-solving, university teacher, phenomenography, PBL

This study introduces the preliminary stage of an ongoing exploration into academics' conceptions and practice of teaching problem-solving (CoTPS), with a primary focus on comprehending the (Problem-Based Learning) PBL tutors' conceptions of teaching problem-solving (TPS). By examining how PBL teachers conceptualise TPS, we seek to develop a model to evaluate existing practices and identify potential gaps and misconceptions in a broader context. Problem-solving is taught and practised in many higher education institutions across many disciplines. However, there is a lack of structural understanding of how to teach PS, considering the specific principles and methods associated with PS pedagogy. Literature analysis has shown that at least three fundamental aspects should be considered when assessing teaching PS: precisely the nature of the 'problem' in the instructional practice, the process of how PS is taught and the role of the teacher. Therefore, the qualitative interviews we conducted with PBL teachers at Linköping University focused on finding their conceptions of given dimensions. This conference paper aims to showcase the diverse categories emerging from a phenomenographic analysis, seeking to identify qualitative variations in their experiences while illustrating the structural and hierarchical relationships within and between categories. The subsidiary aim of this conference paper is to foster discussion on the applicability of phenomenography in addressing the complexities of teaching problem-solving.

## **D2 Critical aspects in problem solving tasks in preschool.**

**Author:** Selma Music

*University of Gothenburg*

**Keywords:** Mathematics, Early childhood education, problem solving

This paper is part of an ongoing study focusing on learning opportunities in mathematics in preschool settings. One of the aims of this sub-study is to identify learning opportunities in activities involving problem-solving and to highlight critical aspects that emerge during these activities. The study presents critical aspects that become evident when children solve arithmetic problems and when they create similar problems. Analyzing video material of children's work on the selected tasks, it enables the identification and comparison of critical aspects that emerge when children solve tasks compared to when they construct similar problems. In this way, it provides an opportunity to understand both children's and educators' perspectives on problem tasks. The results of the sub-study may help to understand similarities and differences between children's and educators' understanding of problem tasks, and hopefully shed light on children's development of their problem-solving abilities.

# Parallel sessions III

**BLÅSENHUS Room 11:131**

## **E1 What is meant by a professional arena at an upper secondary school in Sweden?**

**Author:** Ulrika Bergstrand; Lena Bylund; Magnus Larsson

**Keywords:** Professional arena, variation theory, Cultural Historical Activity Theory

In this *ULF-project*, researchers together with active teachers explore how it is possible to establish a link between teaching related questions posed by teachers and the ongoing research efforts, within the framework of a professional arena. How can a sustainable collaboration between academia and teaching practice take place? To examine this, we focus on a specific subject content, *the equation of linear functions* ( $y=kx+m$ ). In our practice, this has been a challenge for teaching. To specify the object of learning, variation theory along with Cultural Historical Activity Theory inspired by Davydov (Tambour, 2019) has been used. The overarching question “What does the knower know?” act as a mediating tool to discern and develop reasoning (Carlgren, 2023; Kullberg et al., 2017). This design takes teachers’ point of view as a starting point, rather than researchers’ preconceived notions of what constitutes an interesting subject of study in schools. The arena could be a tool to strengthen the teacher’s professional development through a locally designed competence development initiative in an educational setting characterized by changes.

## **E2 A learning opportunity for Quantitative Research Methods Course: A Variation Theory Perspective**

**Author:** Hanan Innabi

*University of Gothenburg*

**Keywords:** sustainable learning, variation theory, complexity, higher education, statistics

As part of an ongoing research project that aims to determine what makes learning statistics sustainable, this paper highlights a learning opportunity that intended such learning. Sustainable learning is described as learning that enables students to handle novel situations in powerful ways, both now and in the future. What has been learned can be expanded and applied in other settings beyond formal instruction. The conjecture of this paper is that variation theory provides certain opportunities for designing teaching that supports sustainable learning of statistics. The context of the investigation is a university course on quantitative research methods where the object of learning is “the capability to use statistical reasoning to solve quantitative research problems”. A description of how and why this macro level learning opportunity was designed for such a complex object of learning is presented in this paper.

## **E3 Agential Variation Theory: Post-humanist Performative Account of University Biochemistry Students Learning with External Representations of Protein**

**Author:** Song Wang, Stanley M. Lo, Rou-Jia Sung, Thomas J. Bussey

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**Keywords:** Agential realism, representation, science education, university, variation theory

Representation is an important issue in science education research for two reasons: (1) the use of external representation in teaching is ubiquitous as microscopic entities are not directly visible, and (2) the study of learning relies on linguistic representation of student conceptions as thoughts are not directly visible. Therefore, the challenge of representation is making the invisible visible and, more specifically, making differences visible, such as differences among submicroscopic entities or differences among students. In this study, we expand phenomenography and variation theory to explore the implications of engaging with philosophical assumptions that attempt to unsettle normative worldviews in science education research by working towards two goals: (1) to engage with relational ontology of agential realism and develop agential variation theory as a framework for exploring the potential of conducting research from post-humanist perspectives and (2) to pilot a corresponding qualitative methodology using representational practices in university biochemistry education as the study context. Our results (1) describe a shift from thinking about variations within science knowledge in phenomenography to thinking about variations within cultural practices of science education and then (2) discuss considerations of agential variation theory about learning with external representations in university biochemistry education.

## **BLÅSENHUS Room 11:128**

### **F1 Phenomenographic study of university teachers' perceptions of mathematics in STEM disciplines**

**Author:** Giulia Polverini, Ebba Koerfer, Anna Eckerdal, Maja Elmgren, Lars-Henrik Eriksson, Roger Herbert, Felix Ho, Lisa Freyhult, Andreas Solders

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**Keywords:** STEM, role of mathematics, university teachers, semi-structured interview

This study delves into how the role of mathematics in STEM higher education is experienced by university teachers, a relatively unexplored perspective. Through a phenomenographic analysis of 16 semi-structured interviews, we could investigate teachers' perceptions of mathematics in their subjects, i.e. chemistry, computer science, geoscience and physics. We identified five distinct and hierarchically inclusive categories of conceptualisation that span across the surveyed disciplines. These categories range, with increasing level of sophistication, from teachers viewing mathematics as a computational tool to recognizing it as a fundamental philosophical underpinning of their respective disciplines. How our categories relate to previous research, mainly on students' perceptions of the role of mathematics in STEM disciplines, is discussed. Finally, we considered potential implications for teaching based on our findings. Teachers' perceptions of mathematics are not just theoretical positions but have direct didactic implications since they influence their teaching methods. This may, in turn, shape students' perception and understanding of the discipline, which is a determining factor for their success in STEM higher education.

## **F2 Teaching the evaluation of psychological perspectives' explanatory power in upper secondary school**

**Author:** Anja Thorsten, Alexander Wensby, Rebecca Holmberg, Karin Malmquist  
*University of Gothenburg, Sweden*

**Keywords:** teaching psychology, evaluating psychological perspectives, phenomenography, Variation Theory

The purpose of the study is to contribute to knowledge about how to teach students studying psychology in upper secondary school to *evaluate the explanatory power of different perspectives in psychology*. The study was conducted as a Learning study in three cycles, each cycle consisting of pre-test, research lesson, post-test and analysis. The theoretical and methodological framework is phenomenography and Variation Theory.

The study started with an analysis of an assignment from 48 students that were asked to evaluate the explanatory power of three psychological perspectives in relation to explaining stress. Eight of the students were interviewed. The interviews and the assignments were analyzed inspired by phenomenography, resulting in an outcome space with five categories. Based on the categories six critical aspects were identified.

The lessons with the students were designed to make the critical aspects discernable by using contrasts. During the Learning study-process the critical aspects were revised, and the patterns of variation were specified. In the tentative results six critical aspects were identified, which are connected to a) perceiving various perspectives, and b) grasping the concept of evaluation in relation to psychology.

## **F3 How do Chinese primary school literacy teachers conceptualise YuWen?**

**Author:** Yuxin Liu  
*University College London IOE*

**Keywords:** Teachers' conceptions; Chinese primary school literacy education; YuWen

This ongoing doctoral research project investigates how Chinese primary school teachers conceptualise YuWen. YuWen is the name of the official Chinese literacy curriculum (in Mandarin), which is the phenomenon that YuWen teachers experience in their daily teaching practice. 21 Chinese primary school YuWen teachers participated in this qualitative research, including both males and females. They came from different socioeconomic areas of the Chinese mainland and had different years of teaching experience in various administrative positions in schools. This qualitative research applied phenomenographic and narrative approaches. Under each approach, the data collection and analysis process followed different rules. The phenomenographic findings so far show that there are three different ways of conceptualising YuWen, including conceptualising YuWen as 1) the task of what I need to do, which is the object of teachers' works; 2) what I teach my students to learn, which is the object of students' learning; and 3) a space to carry one's subjectivity, which is an embodiment of subjectivity. The critical aspect of the first from the second conception is whether different subjects are involved. The critical aspect of the second from the third conception is the change from subjectivity to intersubjectivity.

# Parallel sessions IV

**BLÅSENHUS Room 11:131**

## **Symposium: What is powerful in powerful knowledge? Phenomenographic studies of powerful knowings**

**Chair:** Pernilla Ahlstrand, *Gothenburg University*

**Discussant:** Professor Gerlese Åkerlind, *Australian National University*

The aim of the symposium is to connect results from phenomenographic studies of subject specific knowings (in terms of ways of experiencing) to the discussion of powerful knowledge (PK) as formative and cultivating content in school (Young & Muller, 2019; Hordern, 2022). Based on examples of phenomenographic studies on knowings of specific knowns within different school subjects, we will describe and discuss the powerfulness of such knowings.

Phenomenographic studies explore different ways of experiencing specific knowns. Ways of experiencing are considered as correlating with ways of knowing (Carlgren, Ahlstrand & Nyberg, 2015). More complex ways of knowing are characterised by the simultaneous discernment of increasingly differentiated aspects of a phenomenon (Marton and Lo, 2007). From such a perspective there are more or less powerful ways of knowing the same known. This implies that the powerfulness of PK is not firstly in the known but rather in the knowing of this known.

Examples of knowings of specific knowns will be described and discussed in terms of their powerfulness, i.e. subject specific capabilities as transferable powerful knowings.

### **G1 Paper 1: Powerfulness as capacity-building ways of knowing**

**Author:** Ingrid Carlgren

*Stockholm University, Sweden*

**Keywords:** Powerful knowledge, phenomenography, capacity building, knowings, knowns.

The idea of powerful knowledge (PK) as knowledge that all students should be entitled to arose in the field of curriculum studies but has been widely adopted within several subject didactical fields. While knowledge is treated as a public good ) in the curriculum field (Muller & Young 2019) it is treated as a means for the cultivation of human powers in didactic. In my contribution I will explore the cultivation aspect of the powerfulness in PK by shifting focus from PK as *knowns* to powerful *knowings* (Carlgren, 2020). This distinction can be related to the distinction between Bildungsinhalt and Bildungsgehalt (Hopmann, 2007). Phenomenographic studies of knowings have shown how the same known can be experienced and conceived in different ways. These ways of knowing are more or less powerful. The powerfulness is thus in the knowing of the known rather than in the known as such. Different subjects will foster different sorts of capabilities which become dispositions for power in different situations. It is important to bring these powers to the forefront in order to discuss the powerfulness of school subjects.



## **G2 Paper 2: Powerful knowledge in story-writing**

**Author:** Anja Thorsten

*Linköping University, Sweden*

**Key words:** story-writing, phenomenography, powerful knowledge, reader's perspective

The purpose of the presentation is to discuss powerful knowledge in relation to story-writing. The presentation is based on a study about story-writing for nine- to ten- year-old students in which stories from 62 students, and interviews with 13 of them, were analyzed focusing on how 9-10-year-old students experience the use of descriptions in story-writing. Based on a phenomenographic analysis five categories were found: Descriptions as to... (A) create an engaging holistic experience for the reader, (B) affect the mood of the reader, (C) transfer inner images, D) report detached details, and (E) list events. A is the most complex category.

In the most complex category, but also in the others, the students' ability to take the perspective of the reader was central. This ability is not only related to story-writing, but also to other writing genres. Beyond writing this ability is also central in relation to seeing things from someone else's perspective. During the presentation I will discuss if the awareness of the reader might be a powerful knowledge that when learned in relation to a specific object of learning to some degree might be transferable to other objects of learning.

## **G3 Paper 3: Movement capability as powerful knowing**

**Author:** Gunn Nyberg

*University in Agder, Norway, Dalarna university, Sweden*

**Key words:** Physical Education; Movement Capability; Phenomenography

This presentation will draw from findings from a study of which the aim was to develop students' movement capability in the context of physical education in upper secondary school. The object of learning, presented for the students was to carry out a specific movement called 'house hop' (i.e. a 360-degree rotation initiated on the ground and completed in the air). The students were video filmed during imitating a sequence of movements of which house hop turned out to be relatively new to most of the students. The findings show seven different ways of knowing house-hop as well as several aspects to discern in order to know the movement in a complex way. Structural aspects discerned simultaneously in the most complex way of knowing house hop enable students to approach and learn other ways of moving. The findings, such as experiencing one's own way of moving and experiencing relations between different ways of moving are discussed as powerful knowings in the area of physical education as well as in society's movement culture in general.

## **G4 Paper 4: Systems thinking as an aspect of powerful geographical knowing**

**Author:** Lotta Dessen Jankell  
*Stockholm University, Sweden*

**Key words:** systems thinking, geography teaching, powerful geographical knowing

This presentation aims to discuss systems thinking as an aspect of powerful geographical knowing. At the core of geographical knowing is the understanding of relations between human, nature and places. This relational understanding has become increasingly challenging for students as the content of geography education has become more complex. A study made with 90 upper secondary students shows that systems thinking can become a powerful way to understand complex issues. However, phenomenographic analyses of interviews made with 25 students shows that the understanding depends on how the students experience the idea of constructing system models into a complex web of causal relations. When the modelling was experienced as a way to construct the real problems, the students could use the interconnected web of connections to interpret the issues. The actions became powerful since they could also transfer the knowing to another geographical problem. If students on the other hand experienced the modelling as a way to connect concepts correctly into causal relations, the knowing was limited to a specific task and the idea of systems was not discerned. How students experience the systems idea through the modelling task thus determine if systems thinking becomes a powerful aspect of geographical knowing.

### **BLÅSENHUS Room 11:128**

#### **Symposium: Investigating teaching-learning relationships for two different objects of learning and forms of teaching: teaching design, measuring learning outcome and moving beyond learning study**

**Author:** Åke Ingerman, Ulf Ryberg, Jenny Svanteson Wester, Aho Shokraiefard, University of Gothenburg, Sweden  
**Discussant:** Professor Gerlese Åkerlind, *Australian National University*

**Discussant:** Malin Tväråna, *Uppsala University*

This symposium concerns results from a project that aims to move beyond learning study as a format for developing teaching and learning for a specific object of learning into a systematic comparison of the outcome of teaching across several classrooms and different forms of teaching, given similar ways of handling the same lesson content in terms of critical aspects. The project has a design that has allowed that two similar, but distinct, lesson designs are compared – one which is structured in the traditional form of whole class teaching (with elements of individual work), while the other has several integrated elements of small-group discussions. The project encompasses teaching and learning regarding two objects of learning, both in the context of teaching in Swedish grade 6 (12 year old): addition and subtraction of negative numbers and the constitution of matter in terms of atoms. The number of participating students is relatively large and the students' knowledge with respect to the object of learning is investigated before and after teaching using a validated test instrument with appropriate focus.

The four contributions focus on different results from the project. The first and second reports on the resulting teaching designs of matter and negative numbers, respectively. The third discusses the construction of a valid test, used to measure the learning outcome from teaching. The fourth reports on the relationships between teaching and learning for the different objects of learning and different forms of teaching and presents conclusions from the study as a whole.

## **H1 Paper 1: Towards a teaching design regarding the constitution of matter**

**Author:** Jenny Svanteson Wester, Ulf Ryberg, Åke Ingerman  
*University of Gothenburg, Sweden*

**Keywords:** Learning study, Variation theory, matter

The concept of matter has been shown to be a cornerstone in learning science and a large number of studies show students have significant difficulties in establishing an adequate understanding of the particle nature of matter. The aim of this study is to systematically identify and test ways of teaching in Grade 6 that facilitates the students' understanding of matter. The teaching design is based on variation theory and is developed in an iterative process by using learning study as a research approach. Two lessons were designed, seen as a basis for further teaching related to the concept of matter. Different arrangements of teaching, whole-class instruction with individual work and whole-class discussions with small-group discussions are also considered as constituting these ways of teaching. This presentation reports results related to the defined object of learning, the identified critical aspects and how the critical aspects were enacted by the activities during the lessons and what the students learned related to the object of learning. The results also show that students' learning increased to a somewhat greater extent when they participated in the lessons with small-group discussions.

## **H2 Paper 2: Addition and subtraction with negative numbers - a systematic study of the relation between teaching and learning**

**Author:** Ulf Ryberg, Jenny Svanteson Wester, Åke Ingerman  
*University of Gothenburg, Sweden*

**Keywords:** Learning study, Variation theory, negative numbers

This presentation reports on a study that investigated how the design of a 120-min teaching unit affected grade-6 students' learning about addition and subtraction with negative numbers. The study, which is part of a larger project, included a total of 129 students. The teaching design was based on variation theory and was developed in an iterative process involving five cycles using learning study as research approach. Compared to a typical learning study, however, the approach within this project was somewhat modified. Rather than starting with defining the object of learning and trying to identify which aspects were critical for students' learning, these were derived from previous learning studies on negative numbers. Furthermore, the study also involved a comparison between two different teaching arrangements – teaching implemented through instruction and individual work versus teaching in which content-oriented small-group discussions were integrated with whole-class discussions. The result of the study involves a detailed description of the final teaching design, that is, in what ways the content were handled to make the critical aspects visible for the students. The result indicates a slightly higher, but not significant, progression for the students who were taught through instruction and individual work.

### **H3 Paper 3: Exploring a validity process in test development in a learning study**

**Author:** Aho Shokraiefard, Frank Bach, Åke Ingerman  
*University of Gothenburg, Sweden*

**Keywords:** Assessment, knowledge test, validity, learning study, matter, negative numbers

Research in the learning study tradition primarily focuses on developing what might be possible to learn about during one or a few lessons. Analyzing and developing teaching has been central, while, in contrast, little attention has been paid to how the learning outcome is assessed. In this paper, we explore and discuss the process of test development and validation in a learning study project in Swedish compulsory school regarding teaching and learning of negative numbers and the constitution of matter. We offer concrete descriptions of how validating the claims of the test in relation to the claims of the educational research may be carried out in a specific case. This article aims to increase awareness of the consistency and fragility of assessment instruments by describing an example of an adequate validation discussion and providing a fair, reliable, and valid description of the research results, including some limitations.

### **H4 Paper 4: Learning study-developed designs for negative numbers and matter in two forms of teaching - A systematic comparison of instruction based teaching and discussion based teaching with small groups**

**Author:** Åke Ingerman, Ulf Ryberg, Jenny Svanteson Wester, Aho Shokraiefard  
*University of Gothenburg, Sweden*

**Keywords:** Learning study, Variation theory, negative numbers, matter, comparative design

The study reported is a didactic classroom study with intervention characteristics, emanating from and being in congruence with the learning study tradition. It contrasts, for two objects of learning, teaching using instruction and individual work with discussion and small-group discussions, of which both forms are common forms in teaching mathematics and science. For the two specific objects of learning – addition and subtraction of negative numbers and the constitution of matter – adherent lesson designs were developed through learning study. In the study teaching designs enhancing the same critical aspects but are different in form, for a) instruction and individual work and b) discussion in whole class and small groups are compared. The students' learning is measured through a comprehensive and specifically developed and validated knowledge test for each object of learning. The results show stable and significant gains across 10 classrooms in three schools with almost 200 students participating in the teaching designs for each object of learning. There are differences between the two forms of teaching, albeit not significant and in different directions for the two objects of learning.

# Parallel sessions V

**BLÅSENHUS Room 11:131**

## **I1 Engineering students' experiences of writing in groups during bachelor thesis projects**

**Author:** Anthony Norman

**Keywords:** Phenomenography; collaborative writing; higher education

Writing plays a key role in higher education and research has shown that students' conceptions and experiences of writing can affect many aspects of their writing. This research has focused more on individual writers, and often from a cognitive or motivational-affective perspective. Writing a bachelor's thesis (BT) is complex, and doing so in a group adds another layer of complexity. Hence, understanding students' experiences of writing a BT in a group offers rich opportunities to better understand our students and the learning context, for which phenomenography was chosen as a suitable research approach.

This study captures students' experiences of writing in a group during a BT project, in a STEM context, with students from a mix of programs. 11 students were interviewed, with variation across group size and program, providing rich background and experience. Through extensive piloting, the interview approach was refined, with conversation centered on concrete experiences students saw as part of their experience of 'writing in groups'. Unstructured follow-up questions grounded the interviews in those experiences, encouraging opportunities to reflect on the phenomenon. Results in the form of an outcome space will be presented at the conference.

## **I2 Upper-Secondary School Students' Source-Based Writing Skills: Critical Aspects of Learning**

**Author:** Josefin Hellman

**Keywords:** source use, writing instruction, phenomenography, variation theory

This paper explores the source-based writing skills of secondary school students, and what can be taught to develop their skills. The data in this study were collected as part of an ongoing learning study based on phenomenography (Marton & Booth, 1997) and variation theory of learning (Marton, 2015). The learning study focuses on the use of sources in the first language classroom of 16- to 18-year-old students in a municipal upper secondary school in Sweden. To date, there is no previous research on how phenomenography and variation theory can contribute to understanding how source-based writing can be taught in secondary school. The findings are based on 73 texts written by students in the subject Swedish and 11 interviews based on the students' texts. Before the interviews, I read the students' texts and prepared questions about their use of sources. I used phenomenography to describe four different ways of experiencing source use and variation theory to identify four critical aspects of learning this skill. To use sources in the most developed way, students needed to discern that: 1) source recognition varies with literacy practice, 2) ideas from sources support arguments in their own writing, 3) their own ideas are separated from those of others, and 4) sources are compared and evaluated throughout the writing process. These critical aspects can contribute to teachers' professional knowledge base and be used when planning the teaching of source-based writing.



## **BLÅSENHUS Room 11:128**

### **J1 Operating room nurses' perceptions of team communication when learning new technology in the operating room - a phenomenographic study.**

**Author:** Irini Antoniadou, Astrid Lindgrens, Sebastiaan Meijer, Gunilla Björling, Karin Pukk Härenstam, Janet Mattsson

**Keywords:** operating room, perioperative care, learning, teamwork, patient safety.

To uncover operating room nurses' perceptions of teamwork and learning processes in the paediatric field. Design: A qualitative, phenomenographic study based on narrative semi-structured interviews. Methods: A phenomenographic method was used to capture how different operating room nurses perceived and understood various aspects of teamwork and learning in the operating room, as they themselves understood it. Narrative interviews, with semi-structured questions used to capture their perception of teamwork and learning. Ten operating room nurses, employed in four Swedish hospitals at their paediatric operating departments, was individually interviewed. A phenomenographic analysis used to gain deeper understanding of the phenomena. Results: Three categories were uncovered describing teamwork: The category communication highlighted how nurses perceived teamwork as an act of communication, the category interdisciplinary work, highlighted the interplay going on between participant in the team both verbally and non-verbally to work as a team with shared understanding of the task. The category relations highlighted how the teamwork consisted of relations that was developed over time containing shared communication and focus on patient needs during surgery, being prepared and able to distribute necessary nursing care. Furthermore, the operating room team's perception of how a team work together, influenced the value of perioperative care as well as task performance. Conclusion: Depending on how the team member understands how the team work together, different awareness on the patients' needs is conveyed. A pivotal importance for patient safety to enhance joint inter professional learning activities with purpose to increase awareness and tolerance for different understanding how to teamwork and mature together. The outcome of this study important for future professionals within operating room considering learning in team. Altogether, affects inter-professional knowledge development and patient safety within the paediatric field.

### **J2 Turns out, it's not "just basic biology": Natural gender and sexual diversity education in the undergraduate biology classroom**

**Author:** Kris Troy, Alison Cerezo, Ruth Finkelstein, Marcos García-Ojeda, Stanley Lo, Michael Wilton  
*University of California (UC), Santa Barbara, USA*

**Keywords:** Phenomenography, LGBTQ+, curriculum, conceptions, undergraduate

Biology is the study of life in all its diversity— we see multiplicities of life strategies, adaptations, and niche exploitations by organisms on Earth. This diversity includes variation in sex and gender, as well as sexual, romantic, and related relationships. However, current literature suggests that undergraduate biology courses in the United States focus on a cisheteronormative version of the diversity of life. Additionally, literature suggests that LGBTQ+ students perceive STEM disciplines as hostile and unsupportive, that they hide their LGBTQ+ identities as career researchers, and that they perceive a

conflict between their identity as a LGBTQ+ person and as a scientist. Still, biology instructors have the unique ability to address these inequities and misconceptions by including course-relevant examples of natural phenomena that counter these narratives in their curricula. We want to understand how these examples are understood by the individuals educating college biology students-- the instructors. By conducting phenomenographical interviews, we will characterize the conceptualizations of undergraduate biology instructors relating to these examples. We expect that this study will elucidate potential foci where counter-narrative biology curricula could be leveraged in the future, and to instill a more accurate understanding of core biological concepts for all students.

# Parallel sessions VI

**BLÅSENHUS Room 11:131**

## **K1 Phenomenographic Research Methodology: Possibilities & Potential for the Context of Time, Space and Situational Circumstances through Bodily Experiences**

**Author:** Hinna Amid

This paper makes a case for employing phenomenographic research methodology with a focus on the contextuality of time, space and situational circumstances experienced *through* body subjectivity when exploring mature male students' experiences of higher education (HE) in England. Up until now, phenomenography has mostly been used in educational research, exploring students' conceptions of learning, whereas this study employs phenomenography to explore student conceptions and experiences occurring in different contexts. These conceptions are constrained by each student's own unique experiences, perceived through bodily senses while being in the world, occurring in their own specific socio-cultural, temporal, and situational contexts. It is making sense of things in relation to one's own context, as one exists in the world through body subjectivity, which is different for each individual, and will also vary from other instances, at any given point in time and space. The context of time and situational circumstances provides a deeper and more complex understanding of the phenomenon of HE, hence maximising variation in the ways these students conceptualise and experience HE. These are captured through creative data collection methods of visual timelines and Lego modelling. Initial categories of description emerge from reflection within each student, which are further condensed through similarities and differences of collective experiences across groups of student.

## **K2 A phenomenographic investigation into international students' experiences of AI-assisted academic writing in UK higher education**

**Author:** Sophia Mavridi

*Lancaster University*

**Keywords:** International students; higher education; AI in education; AI-assisted writing; academic writing; L2 writing; phenomenography

Phenomenography is being increasingly challenged to navigate the complexities of an evolving higher educational landscape. A significant aspect of this evolution is the internationalisation of higher education, leading to a rise in students pursuing their studies in a second language. This transition introduces distinctive linguistic and cultural issues, necessitating innovative pedagogical solutions. Amidst this complexity, the rapid development of Artificial Intelligence (AI) has profound implications, particularly for academic writing, calling for a deeper exploration of student experiences with AI. However, the existing literature on such issues often emphasises the viewpoints of educators and decision-makers, leaving the student perspective largely unexplored.

To illuminate this perspective, this study employed a phenomenographic approach, conducting interviews with 30 undergraduate and postgraduate international students across 26 UK higher

education institutions. The aim was to explore the qualitatively different ways that this group experiences and conceptualises the phenomenon of AI-assisted academic writing. This presentation will share the findings from this investigation, highlighting the developed outcome space, including each category of description and the structural relationships between them. It will provide fresh perspectives on AI-assisted academic writing ultimately informing pedagogical practice and positioning phenomenography as a methodology that can address the complex issues facing higher education today.

### **K3 Structure and Meaning as Co-Constituting. Findings in Research on Students' Lived Experiences of Learning**

**Author:** *Kristina Ahlberg*

*Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg, Sweden*

**Keywords:** Dual and Simultaneous Focus catching Dynamics of Learning

Learning is within Phenomenography defined as *Changing one's Way of Seeing a Phenomenon* (Marton, 1986). Whether it is possible to describe one's own awareness did early interest researchers (Brentano, 1874/1995; Husserl, 1907/1995). One methodological question for research on learning as change in awareness is: How to enable participants to describe changes in their own awareness? (Ahlberg, 2004).

Empirical knowledge is presented, of what students experienced to have constituted changing way of seeing a phenomenon. The change in awareness is theoretically explained as dynamics between Structure of Experiencing a Phenomenon and perceived Meaning of it (Marton, 1986). Methodology is argued for, based on a dual and simultaneous focus. A method is presented to form knowledge of changing one's way of seeing a phenomenon, as a change in awareness (Ahlberg, 2005). The method combines approaches by Brentano (1874/1995), Husserl (1907/1995) and Marton & Booth (1997) — and challenges assumptions by Wittgenstein (1953).

The results have been analysed according to theories of understanding, learning and awareness (Brentano, 1874/1995; Husserl, 1907/1995; Dewey, 1910/1991; Rubin, 1915; Wertheimer, 1923; Koffka, 1935; Köhler, 1947/1992; Wittgenstein, 1953; Marton, 1986; Marton et al, 2004).

### **BLÅSENHUS Room 11:128**

#### **The potential of developing teaching practice in the school subjects of dance and theatre using variation theory**

**Author:** Pernilla Ahlstrand & Ninnie Andersson

*Department of Pedagogical, Curricular and Professional Studies, University of Gothenburg, Sweden;*

*Department of Dance Pedagogy, Stockholm University of the arts, Sweden*

**Discussants:** Åke Ingerman, *University of Gothenburg, Sweden*, Viveca Lindberg, *Stockholm University, Sweden*, Vigdis Auune, *Norwegian University of Science and Technology, Norway*

In this symposium, three oral papers (Ahlstrand & Andersson) reporting on a research project will be discussed. The topic of the symposium is 'The potential of developing teaching practice in the school subjects of dance and theatre using variation theory'. Three discussants, Åke Ingerman, Viveca Lindberg and Vigdis Auune, who are members of the project's advisory board, will each discuss one paper. The content of the three papers addresses variation theory from three different approaches: methodologically, theoretically, and conceptually. The design of the research project involves a method

called action(re)call, allowing the researcher to stop the rehearsals of a stage production with the aim of identifying objects of learning embedded in the process of creating a performance. The stops take place in relation to the teacher's feedback on the students acting, the feedback is seen as a professional judgement of subject-specific know-how. The findings exemplify how variation theory can be used when planning, implementing, and analysing teaching. The purpose of the symposium is twofold. Primarily, the utilization and rendering of variation theory will be discussed. The second purpose is to discuss how the findings can have potential to both develop and challenge the teaching practices in the school subjects of dance and theatre.

## **L1 Paper 1: Embedded know-how in feedback: Studying performative knowing in theatre**

**Author:** Pernilla Ahlstrand & Ninnie Andersson

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**Keywords** action(re)call, theatre, performative knowing, feedback, teaching, assessment

The aim of this paper is to introduce and discuss the method action(re)call as a way to study subject-specific know-how. The method allows the possibility of beginning to articulate performative knowing which, as earlier research has shown, tends to be taken for granted by teachers and can be challenging to verbalize. The articulation is important when teachers and researchers are systematically planning research lessons, using variation theory. Contrast, is one of the patterns of variation in variation theory (Marton 2015). In the filmed material it appears that both the teacher and the students use contrasts to clarify what they mean, for example Student 2 says: "[you] Focus more on the co-actor than what you say yourself". This is an example that could be used when planning whole-class situations. The teacher can plan for and create teaching situations where the students can be offered a variety of experiences of how to act (e.g. "focus on the co-actor" in contrast to "focus on yourself") in the acting situation. When working with the method action(re)call, the teacher and students can become familiar with and pay attention to similar situations and use them in whole-class teaching.

## **L2 Paper 2: Variation theory as teaching theory in the theatre classroom**

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*Department of Dance Pedagogy, Stockholm University of the arts, Sweden*

**Keywords:** Variation theory, theatre, feedback, ways of knowing

The paper aims to present and discuss parts of the findings from a research project. Filmed material from specific teaching situations, where feedback is given, has been the starting point for analysing and planning similar teaching situations in research lessons. When the research team, including teachers and researchers, were planning research lessons, variation theory was used as a teaching theory. The aim of using variation theory is to develop teaching practices in the school subject of theatre at upper secondary school level in Sweden. The design of the study is based on a method, action (re) call, which provides opportunities to stop the teaching situations where feedback is given and where subject-specific know-how is identified. The specific situations are used when planning the research



lessons. In this paper findings from one of the research lessons are presented. The findings show how variation theory was used in analysing and facilitating teaching in the classroom. It suggests that teachers can use variation theory as a way to strengthen the student's way of experiencing specified objects of learning.

### **L3 Paper 3: From tacit to explicit. A study exploring patterns of variation.**

**Author:** Pernilla Ahlstrand & Ninnie Andersson

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*Department of Dance Pedagogy, Stockholm University of the arts, Sweden*

**Keywords:** Theatre, variation theory, patterns of variation, upper secondary school

The paper presents findings from a research lesson in theatre as a school subject at upper secondary level in Sweden. The research lesson is one of five and is part of a larger design in a research project with the aim of developing theatre teaching practice. In the transcripts of filmed material, we follow how the teachers are using variation theory as teaching theory. In planning the research lesson, the teacher and the researcher used variation theory, starting with the patterns of variation contrast and generalisation. During the research lesson the pattern of variation fusion was used as an answer to both the students acting in an improvisational exercise and the students observing and reflecting on what happens in the improvisation when different patterns of variation are used. The research lesson is an example of using variation theory both when systematically planning teaching and when analysing spontaneous feedback in the teaching situation. This could lead to discussion and challenging of a theatre teaching practice described as being part of a tacit knowledge tradition.



## Collaborative Space session

Based on the success at our previous conference, we are excited to offer the Collaborative Space session once again for all colleagues to find opportunities to work in partnership and network. One of the great benefits of meeting at a conference is the opportunity for in-depth discussions with peers, fostering new ideas and connections. On Thursday afternoon during the conference, this session will provide a platform for these enriching exchanges.

The Collaborative Space session will feature several discussions, each with a different theme. These themes will cover both methodological issues and specific content areas, facilitating small group interactions, and focused collaborations. Join us to deepen conversations on ongoing and future research projects and to connect with colleagues in your field.

## Round Table

The conference theme delves into the core concepts, differences, and potential of Phenomenography and Variation Theory. On Thursday afternoon, we will host a panel discussion featuring five esteemed senior SIG 9 members. Each researcher will have a few minutes to reflect on the theme, drawing from the presentations and discussions they've participated in throughout the conference. This will be followed by an opportunity for dialogue within the panel and with the audience. We anticipate that this session will enrich the discourse and deepen our collective understanding of the fundamental core aspects, differences, and possibilities within our research field.

