

Predicting challenges to student learning in a learning study: Analysing the intended object of learning

Challenges to student learning

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Abstract

Purpose – This study determines which aspects of the intended object of learning (planned by teachers during the first phase of a learning study) is made discernible from a learners' perspective. In a learning study, the intended, enacted, and lived object of learning are considered. This study focuses on the learning material used by teachers while designing a lesson.

Design/methodology/approach – In many learning studies, variation theory is used to design lessons, which predicts difficulties in and possibilities for student learning. The data consisted of a lesson part – instruction through a video-recorded dance choreography – employed to enhance primary school (in a Swedish context, grade 4) students' dancing skills in the subject of Physical Education and Health. The choreography comprised five different sequences, where a variation occurred when the subsequent (new) sequence was applied to the previous movement pattern. The sequences acted as building blocks, where the students' transitions from one movement pattern to another were logical and distinguishable.

Findings – The results of this study show in what way an analysis of learning material, based on variation theory, can help teachers take into account the level of complexity of the object of learning. The results also identify which parts of a lesson design can be predicted to present a higher degree of challenge and by that more difficult to grasp, especially for students with different educational needs.

Originality/value – Lessons may be designed based on theoretical assumptions to ensure effective classroom learning and provide guidance to teachers based on student needs.

Keywords Variation theory, Learning study, Intended object of learning, Physical education and health, Primary school students

Paper type Research paper

1. Introduction

A learning study is a collaborative and iterative model for teachers to develop their knowledge of the relationship between the instruction design and the learning offered to students. In learning studies, while designing instruction, variation theory is used as a guide to identify what is critical for the learner to discern (Holmqvist *et al.*, 2008; Runesson, 2017). However, in reality, designing instruction based on theoretical assumptions to create effective classroom learning is rare (Iqbal *et al.*, 2021). This

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study investigates how variation theory can be used in predicting challenges to learning with regard to the school subject Physical Education and Health (PEH) in a Swedish context, particularly the element of “dance and movement to music”. It is done by analysing the *intended* (planning phase) object of learning. Data was collected during a collaborative learning study with teachers and the researcher. All the steps in the iterative model were used; however, this study focused on the planning phase, with particular consideration of teachers’ intentions when designing the lesson.

In the Swedish curriculum for the K-9, movement capacity is a central subject-specific ability that students should be offered the opportunity to develop in the PEH (Swedish National Agency for Education [SNAE], 2018). When a dance activity is scheduled in this subject, it mainly entails learning “dance and movements to music” (SNAE, 2018, p. 49). Dance movements are structured according to the purpose of the exercise; they are a form of training and warm-up activity to imbibe music, pace, and rhythm in games (Lundvall and Meckbach, 2007; Mattsson, 2016) or assessment of movements. The teacher’s goal is not primarily to conduct a dance intervention in which students acquire a specific artistic form (Mattsson, 2016). Instead, it is to offer the latter an additionally holistic opportunity to develop knowledge in planning, applying, and evaluating various physical activities.

With regards to learning to dance, creating a specific movement pattern requires educators to work more qualitatively in designing teaching situations where students are offered the prospect to advance their movement abilities (Bergentoft, 2018; Holmqvist Olander and Bergentoft, 2014). However, not all students are familiar with dance, like it, or even believe that they can perform. Needham-Beck and Aujla (2020) investigated barriers to dance among young people with disabilities and highlighted the need for a “reliable tool specific to inclusive settings that enable young dancers with disabilities to demonstrate their skills and competencies” (p. 7). Considering the teachers’ perspective, they (Needham-Beck and Aujla, 2020) argued for a greater understanding of students’ sensitivities while assessing their skills. Instructors must focus on achieving specific positions and pay greater attention to movement and performance quality. In addition, according to Nyberg (2015), dancing is associated with various difficulties, such as expressing oneself by moving in specific ways (e.g. to perform a certain movement pattern). Nyberg (2015) highlighted that, in addition to problems in formulating knowledge in general, a movement pattern presents an even more significant challenge. Nyberg (2015) states that students’ previous experiences influence their experience of the movement they are required to learn. The foreground of teaching is, thus, not about correcting errors but about providing opportunities to experience movement in a more complex way. From this perspective, a teachers’ task is to plan for opportunities through which students can discern and experience more aspects of the way of moving that they are expected to master. Thus, the teachers’ intended object of learning – what they plan for the students to learn – becomes important to gauge the knowledge the students are offered.

This study is part of a longitudinal two-year practice-based school development research project in the Swedish context to improve the K-5 level, and focuses on increased opportunities for collaborative professional development to attain content-inclusive teaching (Lelinge and Alwall, 2022). A central idea underlying the whole project was to link the research questions directly to the teachers’ identified needs for development, where, by involving the teachers, the research methodology became part of the improvement strategy (Lelinge and Svensson, 2020). To better understand how instruction is designed to meet students’ different educational needs, the guiding research questions in this study were as follows: What aspects of the object of learning are to be made discernible for students, and what are the challenges to learning that can be predicted using a theoretical analysis?

2. Theoretical assumptions

Teaching and learning are subject to substantial research, and different perspectives can be chosen based on the results sought. For example, [Lo and Marton \(2012\)](#) argued that there was great potential in offering variation theory to teachers “[...] in the sense that it provides an additional theoretical component to guide decisions about teaching” (p. 21). However, variation theory can also serve as a tool to investigate what can possibly be discerned in a learning situation and create learning opportunities regardless of whether or not it takes place within the framework of a learning study ([Runesson, 2017](#)). When it comes to learning studies, formulating a specific object of learning is a central aspect. The object of learning takes shape with a starting point in what the students have difficulty learning or what the teachers experience difficulty in teaching ([Carlgren, 2017](#)). In this study, it is the teachers’ perceived difficulty in teaching all the students specific movements such that they, regardless of whether or not they have special needs, learn the intended object of learning during a lesson. In this study, the teachers offered the students a video-recorded dance choreography as teaching material to investigate how the choreography can be anticipated and designed. Finally, this study addresses the first phase of a learning study, the intended object of learning, to understand how to construct learning sequences. To this end, variation theory was employed to direct the focus of the learning study to the object of learning through video-instructed dance choreography. In this framework, *learning* is defined as a qualitatively developed understanding of a specific object of learning, a phenomenon, or a developed skill ([Marton, 2015](#); [Marton et al., 2004](#)). The theory builds on an assumption about learning, including the need for the simultaneous discernment of aspects.

According to [Holmqvist Olander \(2014\)](#), the object of learning is central in variation theory, that is, “the knowledge or ability the lesson intends to develop in the students” (p. 1). Although the object of learning is related to the subject’s current curriculum, it differs in part from a learning objective. The latter focuses on what the students need to know in the long term, whereas the former is a short-term yet important part of knowledge that they must acquire ([Holmqvist Olander, 2014](#)). Thus, the object of learning is an interpretation and breakdown of the syllabus objectives, which enables the planning of lessons and gradually and systematically develops students’ knowledge of the goals (*ibid*). Generally, three phases ([Holmqvist Olander, 2014](#), p. 2; [Holmqvist et al., 2018](#), p. 4; cf. [Holmqvist, 2021](#)) are addressed according to the object of learning, which are as follows:

- (1) The planning phase is based on the knowledge that the teachers have about the students’ pre-understanding as well as the content learning that they want the latter to discern and learn (the intended object of learning).
- (2) The implementation phase relates to the way the content is handled during the lesson (the enacted object of learning).
- (3) The follow-up phase refers to the knowledge or the ability that the students develop during the lesson (the lived object of learning).

The assumptions of variation theory can be used to systematically develop teachers’ awareness of how they choose to treat the teaching content ([Marton, 2015](#)). It significantly affects students’ learning outcomes ([Marton and Pang, 2006, 2013](#)). One such example is the research conducted by [Kwok and Chik \(2005\)](#), where over 27 learning studies were conducted based on the assumptions of variation theory. Their study demonstrated that low-achieving students develop their knowledge the most when teaching is structured and designed according to variation theory. By measuring students’ understanding by using pre- and post-tests, [Kwok and Chik \(2005\)](#) reported that teachers could utilise this information to design the teaching content based on the assumptions about what needs to be made discernible.

It proved to be particularly beneficial for students who experienced the most significant difficulties. The more the object of learning addresses “the critical aspects of the measurement’s areas in the attainment test, the better the students can achieve in those tests’ (Kwok and Chik, 2005, p. 124). They showed that it is possible to cater to individual differences when educators worked with variation theory to gain new knowledge in collaborative teams (cf. Holmqvist, 2006).

According to variation theory, to enable learning, the following three integral components are required: discernment, simultaneity and variation (Holmqvist and Mattisson, 2008; Holmqvist, 2011; Lo, 2014; Marton, 2015; Marton and Booth, 1997). Furthermore, “[l]earning, from a variation theory point of view, implies differentiation rather than accumulation” (Kullberg *et al.*, 2017, p. 560; cf. Marton, 2015). For example, students need to discern the tempo of the specific dance, while simultaneously being aware of the right and wrong tempos, and perform the correct body movements. If they cannot determine what is to be imbibed (tempos and movements), learning cannot occur. For them to learn all the movements in the choreography, they should not only be able to maintain the appropriate tempo but also simultaneously understand that the dance has a particular rhythm, coordination and flow. In other words, they must manage these different parts concurrently, which is essential to combine all the parts together as a whole (Chik and Lo, 2004). According to variation theory, students will be unable to develop the knowledge needed to absorb the diverse parts of the dance and, in turn, form the whole until they have experienced a variation of movements and tempos. Therefore, it is necessary for them to experience different tempos in other dances prior to the current one. In variation theory, the critical aspects concern the object of learning that students must discern to achieve learning (Holmqvist, 2021; Holmqvist and Selin, 2019; Marton and Tsui, 1997; Runesson, 2017). A fusion pattern occurs when several aspects vary at once. Runesson and Mok (2004) claimed that the dimensions of variation that exist in the learning environment are essential to learn what is possible to study. If different dimensions of variation are opened up simultaneously, the students can potentially discern all these aspects at once.

The variation theory distinguishes between two aspects of the object of learning, both having prominent roles: specific and general (Lo, 2014). The direct object of learning (the specific aspect) usually refers to the content, such as in this study, which could be the tempo, rhythm, movement, and coordination of the dance. However, the indirect object of learning (the general aspect) concerns what the students should be capable of doing with the content and the abilities – in this case, dance. For example, synchronising with the tempo by counting the rhythmic pulses, distinguishing the different steps in a choreography, and explaining why the arms are used in certain movement combinations is related to the quality of the learning itself (cf. Nyberg, 2015). These two aspects of learning can be translated into “what” and “how”. The former refers to the direct object of learning, whereas the latter denotes the indirect learning and skills that the learner should develop (Marton and Booth, 1997). This study examined the intended object of learning. Furthermore, how the learning material intends to promote learning could be understood with respect to its complexity by analysing what aspects are offered to discern.

3. Method

3.1 The Study context

This study was based on a video-recorded learning material that was considered as the unit of analysis. It was collected during a larger, practice-based professional development project involving an entire primary (K-5) school in a major city in Sweden. The project lasted for two years (2017–2019) (Lelinge and Alwall, 2022). The intended and overall aim was to develop various learning collaboration models for the teachers’ daily work, including lesson and learning studies.

3.2 Data collection

The analysis in this study relies entirely on a video-recorded choreography, based on which the teachers staged the intended lesson. This material was intended for the students to watch and learn. The video-recorded choreography showed six students (not enrolled in the current school) aged 10–14 years, illustrating the steps of the dance. The video lasted 3 min and 17 s (<https://www.youtube.com/watch?v=CuIMHhMbUuc>).

3.3 Variation theory analysis

In this study, the analysis focused on the patterns of contrast, generalisation, and fusion that were identified to discern the movement patterns in the dance choreography. The discerned aspects could be separated into a series of actions that could subsequently be combined into new patterns of the movement choreography.

In the first step of the variation theory analysis of what was offered to students to learn through the video instruction of the dance choreography, aspects of dance and body movements that the students were to discern to separate them from the dance choreography were identified. In the second step, the choreography sequences (or parts) were identified as a whole of the parts (movements). It meant recognising what aspects varied in the different sequences and what were constant (invariance); the pattern of variation found in each step and sequence was clarified. The five distinct sequences (main parts) of the dance were named “march”, “sidewalk”, “V position”, “circular movements” and “robot moves” (see Results, Tables 1–5). Movements (parts of the sequences) were identified in the choreography, second by second. In the third step of the analysis, the dominant movement patterns were distinguished: arm, leg, and hip movements. A part of the analysis of the movements was also to distinguish the varied student positions in the room, which affected the available space for other students’ movements; it formed an important aspect. This factor relates to the individual dancer’s part in the dance as a bigger whole, consisting of the entire group of students. The final step was to determine what among the previously identified aspects of the dance could be considered critical for the object of learning, which predicts more difficulties in the complex patterns of variations in a sequence. The variation theory analysis and the significant concepts of the theory, thus, facilitated a deeper understanding of the dance.

The analysis emphasised which aspects of the object of learning were discernible and what pattern of variation was used. The patterns indicated degrees of difficulty, as contrast was utilised initially, and fusion when the students possessed certain pre-knowledge of the studied field. Therefore, the analysis was based on the choreography to be performed, which is the intended object of learning.

3.4 Ethical considerations

As the unit of analysis in this study is to analyse the intended object of learning – video-recorded dance instructions – no ethical considerations have been in focus for the empirical study. Apart from that, the Swedish Research Council’s guidelines for good research practice (2017) have guided the ethical considerations.

4. Results

The first step of the analysis revealed that the dance choreography consisted of five different sequences that the students needed to distinguish and develop to combine (different sequences) into a whole dance. Additionally, the variation theory analysis focused on those aspects that were discerned, both separately and simultaneously, in the movement patterns. It identified both single and series movements and how they were repeated in diverse ways. Furthermore, it recognised four aspects that were evident with respect to the focus of the movements: the movement of the arms, hips, and legs, and the position of the learner in the room. The video-recorded choreography used different patterns of variation that the learner had to discern. The

movements of arms, hips, and legs, as well as the placement of the learner in the room were occasionally offered simultaneously in the form of a fusion pattern; for example, the movements of arms and legs, and the placement of the learner in the room changed. Thus, the choreography required a simultaneous discernment of different movements that enhanced the degree of difficulty and predicted what students would find challenging. In addition, the positioning of the arms needed to be recognised – whether a static position should be used or if the arms need to be moved repetitively in a horizontal or vertical line. Similarly, the material allowed the students to distinguish the movement patterns of the hips, in connection with that of the arms and legs, concurrently and synchronously with the music and their peer group.

The analysis of the dance demonstrated that it had five distinct parts that were repeated: march, side-walk, V-position, circle movement, and robot movement (Tables 1 and 5). Each movement is described in the following subsections, including the time for the sequences, how often they were repeated, and the complexity of how many movements varied during the sequence. Another aspect that the students needed to determine and master synchronously with the other dancers was their positioning in the room. In the five dance parts, there were a total of 65 movement (step) patterns, which were divided into eight sequences in total. All the sequences contained a different number of sets and were repeated varying numbers of times. The analysis indicated that the dance choreography was relatively complex, with several different movements and variations. It might have challenged the students with special educational needs to learn the choreography during an ordinary lesson as they also had to consider various movements synchronously with other dancers besides keeping track of where to be positioned in the room.

4.1 The march

Table 1 contains a marching variation pattern where the arm and leg movements constitute a dominant variation; furthermore, the former is in the foreground and occurs the most frequently in the whole choreography.

Activity	3 min 17 s		Movement arms		Movement hips		Movement legs		Position in the room	
	Step	Min. Sec		V/IV		V/IV		V/IV		V/IV
1	0.15	Swinging arms at a 90° angle close to the body	V	No hip movements	Marching forward, 8 steps	V	Repeated position forward	V		
2	0.19	Arms at a 90° angle beside the head	IV	No hip movements	Horse riding position	IV	Jumping on the spot	IV		
3	0.20	Arms close to the body	IV	No hip movements	Legs close together	IV	Standing	IV		
4	0.21	Right arm above the head, waving	IV	No hip movements	Jump. Legs close together	IV	Jump	IV		
5	0.23	Same as step 2	V	No hip movements	Marching backwards 8 steps	V	Repeated position backward	V		
6	1.40	Same as step 2	V	No hip movements	Marching steps on the spot, 8 repetitions	V	Same as step 2	V		

Table 1.
Sequence A.
The March

The marching sequence was the most common in the entire dance; it reappeared on 25 occasions. It contained four different dance movements from the beginning of the choreography to its end. This part of the dance was found to be less challenging; it was due to the fact that the pattern used was mainly contrasting, where the arms and legs movements were contrary and followed each other in a synchronic manner, and two of the steps were the same as those in step 2. In addition, many movement parts were invariant, as the positions of the body parts did not vary during the movements. Moreover, a pattern of generalisation was used as the students repeated the same movement several times, regardless of the tempo and rhythm they followed. They needed to distinguish the movement patterns from the music.

4.2 The side-walk

This part of the dance was more challenging, as it offered the students the opportunity to repeat similar movements and encouraged them to discern the pattern synchronically with their peers at the same pace and rhythm. The movement parts in these sections included all three body parts; moreover, all but one movement had a variation in the positions of the arms, hips or legs simultaneously. However, the arm movements were identical in three of the four movement steps, whereas the movements of the hips and legs, and the positioning of the student in the room differed.

Activity 3 min 17 s		Movement arms	Movement hips		Movement legs		Position in the room		
Step	Min. Sec		V/IV	V/IV	V/IV	V/IV	V/IV		
1	0.30	Arms at a 90° angle beside the head, wagging right, left, right, and left	V	Moving hips and legs at the same pace	V	Side-walk, the right leg first, followed by the left leg, 4 side steps	V	To the right	V
2	0.34	Arms at a 90° angle beside the head, wagging left, right, left, and right	V	Moving hips and legs at the same pace	V	Side-walk, the left leg first, followed by the right leg, 4 side steps	V	To the left	V
4	0.38	Same as step 1	V	Moving hips twice to the right, twice to the left, 2 times	V	Heel lift right/left	V	Fixed	IV

Table 2.
Sequence B.
The side-walk

The leg movement consisted mainly of a jumping side-walk. Furthermore, the students needed to discern the hip movements used for the first time in three different movement patterns. A pattern of generalisation was employed for the movements of the arms, hips, and legs that were included distinctly in different parts. A pattern of fusion was also utilised as several movements and positions were incorporated simultaneously. The variation in the movement positions in each part made sequence B more challenging than sequence A.

4.3 The V-position

The V-position movement of the arms framed the movement pattern in sequence C. The arm movements that the students needed to discern were in four different positions: clapping hands above the head in a V-position, holding the arms in a V-position above the head,

occasionally waving the arms above the head, and swinging the arms from the right to the left in front of the stomach. The hips were again excluded from the pattern of variation; furthermore, most moving parts did not varying body part positions. In total, four of the six leg positions were in the V-position. The position in the room was invariant, as the students were not supposed to move in the room. Therefore, the pattern of variation used was mainly contrasting, as the students performed arm and leg movements that were contrary to each other; however, in the last movement, they utilised swinging arm movements while simultaneously discerning different leg movements.

Activity 3 min 17 s		Movement arms	Movement hips		Movement legs		Position in the room	
Step	Min. Sec		V/IV	V/IV	V/IV	V/IV	V/IV	
1	0.45	Clapping hands above the head, 6 times	IV	No hip movements	V-position, knee-bend, 6 times	IV	Fixed	IV
2	0.51	Arms in the V-position above the head	IV	No hip movements	V-position, stand upright	IV	Fixed	IV
3	0.52	Arms bent against the knees	IV	No hip movements	Straddle legs, bend knees	IV	Fixed	IV
4	0.53	Swinging arms right-left, in front of the stomach, 6 times	V	No hip movements	One stretched, one bent, swinging, 6 times	IV	Fixed	IV
5	1.05	V-position above the head, waving, 6 times	V	Moving hips right left, right left, 6 times	V-position, moving legs right, left, 6 times	V	Fixed	IV
6	2.04	Same as step 5	V	Same as step 5	Same as step 5	V	Same as step 5	IV

Table 3.
Sequence C. The V-position

4.4 The circle movement

Sequence D was relatively short, and lasted five seconds; its movements comprised waving the arms from side to side and up and down above the head. The leg movements included dancing and moving the shoulders in a 360° pattern; the arms and legs move simultaneously and synchronically with the other dancers. This 360° movement was new.

Activity 3 min 17 s		Movement arms	Movement hips		Movement legs		Position in the room	
Step	Min. Sec		V/IV	V/IV	V/IV	V/IV	V/IV	
1	1.08	Arms waving from side-to-side and up-and-down above the head	V	No hip movements	Moving in a 360° pattern	V	To the right	V

Table 4.
Sequence D. The circle movement

The transition to the subsequent sequence (E) occurred with a pause in which the students stood in a frozen position with their hands crossed over their chests and their legs straight. This movement was also new.

4.5 The robot moves

The pace of the music slowed down, and the music suddenly started with a strong drum beat to mark the beginning of a new sequence. The students had to distinguish that the patterns were constant movements or, in other words, that the actions in the robot dance had the same rigid style, regardless of whether they worked to differentiate between straight rigid arms that fell down or up, the legs that took a stiff step forward, or the hips that moved firmly to the left or the right. As this movement formation occurred only toward the end of the choreography, it could be interpreted that the students understood the construction, parts, and the whole of the dance before the robot style was performed. The variation in the robot style was additionally complex, as compared to the previous sequences (A–D), based on the fact that the students’ arms, legs, and hip movements were stiff. Another challenging aspect was that the students needed to move synchronously with their peers in all other dance sequences, while, in the robot dance, they did not move in the same direction: one stepped to the right, the other to the left. It could be problematised in that the students could distinguish the movement pattern quickly due to the same movement being contrasted in different directions. The pattern used in this sequence was fusion, in which diverse aspects varied simultaneously.

Activity 3 min 17 s		Movement arms	Movement hips		Movement legs		Position in the room		
Step	Min. Sec		V/IV	V/IV	V/IV	V/IV	V/IV		
1	2.14	The right arm at a 90° angle beside the head, the left arm at a 90° angle beside the hip, fingers pointing downward	IV	Hips fixed to the left	IV	Right leg a small step to the right forward, left leg straight behind	IV	Robot style	IV
2	2.15	The left arm at a 90° angle beside the head, the right arm at a 90° angle beside the hip, fingers pointing downward	IV	Hips fixed to the right	IV	Left leg a small step to the left forward, right leg straight behind	IV	Same as step 1	IV
3	2.16	The right and left arms in front of the body at a 90° angle	IV	No hip movements		Same as step 2 in sequence C (Table C)	IV	Same as step 1	IV
4	2.18	Left arm straight down	IV	No hip movements		Right leg turns to the right side	IV	Fixed, body leaning down on the right side. Robot style	IV
5	2.19	The right arm at a 90° angle in front of the body, the left arm at a 90° angle beside the hip, fingers pointing downward	IV	No hip movements		Same as step 2	IV	Same as step 1	
6	2.20	The right and left arms in front of the body at a 90° angle	IV	No hip movements		Same as step 2	IV	Fixed, body leaning down on the left side. Robot style	
7	2.21	Knotted fists at the waist	IV	Hips fixed to the left	IV	Same as step 1	IV	Same as step 4	
8	2.23	The right and left arms in front of the body at a 90° angle	IV	No hip movements		Same as step 2	IV	Fixed. Robot style	
9	2.25	Arms straight above the head, the V-formation	IV	No hip movements		Same as step 1	IV	Same as step 4	

Table 5.
Sequence E. The robot style

This dance style could initially be experienced as a disorganised sequence for the students to discern the movement patterns; however, it seemed to indicate that they should perform the same movements, albeit in varying order. Apart from moving in different directions synchronously, it was the rigidity in the dance style that the students must discern; although this was maintained constantly (i.e. stiffness is constant), the movement patterns varied. Stiffness was the only constant when the patterns differed, thereby allowing the students to distinguish the character of the robot. As the dance primarily had the same character in addition to the robot style, it might have contributed to the students being able to determine the characteristic rigidity of the robot style. According to the variation theory, it is about keeping the variation minimal (Marton, 2015) or, in other words, having constant movements. Another difference in this pattern was that the students had to discern why the robot movements were different, in order to recognise the idea behind the rigid style. Their positioning in the room was fixed.

5. Discussion and implications

To better understand how instruction is designed to meet students' needs, this study employed variation theory to analyse the intended object of learning, thus indicating the parts of the instruction that might be challenging for the students. A video-recorded dance lesson was studied as a part of the learning material. The results showed which aspects varied and how many of them differed simultaneously, such as the movements and positions of the body parts, and the dancers' positions in the room. The analysis demonstrated the patterns of variation used and revealed that some parts could be predicted as being more challenging than others, based on an additionally complex pattern of variation (fusion) or a high degree of variation in positions involving different moving parts (such in the robot style). For a teacher who is supposed to design lessons based on students' pre-knowledge, it is crucial to have the skills to plan the instruction as suitable for the latter's needs and abilities. The intended object of learning – the educators' lesson plans – is significant in creating powerful learning possibilities for the students (Holmqvist Olander and Bergentoft, 2014; Holmqvist and Mattisson, 2008; Marton, 2015).

In many countries, such as Sweden, the methods for designing lessons are still relatively unexamined in teacher education (cf. Holmqvist, 2006; Holmqvist *et al.*, 2018; Mårtensson, 2015; Nyberg, 2015). Instead, the focus is on teachers' preparation for teaching (cf. Holmqvist, 2021). This practice renders it difficult for instructors to develop the skills to determine the kind of instruction that affects students' learning outcomes in various ways. By using variation theory, this study showed how the focus of variation in the aspects of the intended object of learning could be challenging for the students in primary school (K-5). The knowledge would provide the teachers with the skills to design lessons that meet their students' requirements more accurately (Lo, 2014; Marton, 2015).

In talking about students' needs or requirements, it is important to remember the project's overall objective of promoting content-inclusive education. It means looking at the entire student group as a population with diverse needs, where the pedagogical measures should aim to achieve improved learning for everyone. Teachers need to be aware that if the intended object of learning involves predicting challenges for student learning in a learning study on specific skills, it must be made possible to discern their critical aspects simultaneously. It could further mean that applying variation theory to a learning study should involve providing a sharper theoretical grounding and curriculum-grounded knowledge, to make the necessary conditions of learning, such as being aware of the dynamic nature of the object of learning, understandable. To design this powerful lesson, it is, in other words, necessary that “[...] teachers' professional competence, meaning their competence for promoting students' learning by forming patterns of variation, is then also developed” (Vikström, 2008, p. 232; cf. Runesson, 2017).

The variation theory analysis made it possible to identify the different aspects of the dance that the students were offered to distinguish. According to Marton *et al.* (2004) and Runesson (2011, 2017), a person must experience the variation of the aspects of the intended object of learning to obtain new knowledge. For example, to discern a movement pattern that is different from another (for instance, between the march and the robot style), it is not enough to discern the sameness (Marton and Pang, 2013). The students must also have experienced variation in these diverse patterns (Kullberg *et al.*, 2017). Subsequently, a novel experience is created. Marton *et al.* (2004) argued that the students need to be aware of both patterns simultaneously. In the dance movements of this study, eight sequences were divided into five distinct dance parts that were repeated: march, sidewalk, V-position, circle movement, and robot moves.

Variation theory has also been used to identify which aspects are in the foreground and the background during the instruction. This study contributes to teachers' understanding of the degree of difficulty they incorporate into their lesson design and the challenges they can predict regarding their students' learning. The theory analysis made it possible to distinguish and separate what parts of the object of learning the students were supposed to discern, namely the different dance steps, including the movements and positions in combination with the music. The results also highlighted how variation theory could be used as an analytical tool to examine the intended object of learning, to predict higher degrees of challenges for the students, and, in turn, what may be more difficult to grasp, especially for students with different educational needs. Additionally, it might facilitate the development of the teachers' skills to determine the kind of instruction that affects students' learning outcomes in various ways.

The methodology of this study suggests new opportunities for teachers to plan their upcoming dance lessons in the PEH and facilitate the content selection in ways that increase their students' content knowledge and establish an inclusive practice. Despite the fact that this study was small-scale and comprised limited participants, it offered several important outcomes. Regarding practice, the variation theory approach is not only a powerful tool for assessing the intended object of learning – that is, the dance choreography – but also a valuable tool for identifying the critical aspects of this object of learning (cf. Nyberg, 2015; Vikström, 2008).

In light of its results, the study provides enlightenment to people working in school-orientated professions. There is an urgent need to design teaching based on theoretical assumptions, to create effective classroom learning and to lend guidance for teachers to design lessons based on different educational and student needs. Variation theory could open up a unique kind of knowledge generation by studying the intended lesson processes that occur when students try to understand something they have difficulty with or that teachers find challenging to teach. This study contributes to the teachers' planning phase and the content learning that they want all students to discern and develop.

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