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Simulating variation in order to learn classroom management

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ABSTRACT
Classroom management is an important part of learning to be a teacher. The variation theory of learning provides the insight that it is important to vary the critical aspects of any task or subject that is to be learned. Simulation technology is useful in order to provide a controlled environment for that variation, and text as a medium gives the opportunity to control exactly what aspects are presented to the learner. This study shows that text-based simulation has the potential to help the learner discern critical aspects of classroom management.

Introduction

Learning to lead a complex activity like teaching in a classroom, classroom management, is difficult (Cochran-Smith, 2015), yet this is an important part of learning to be a teacher (Wubbels, 2011). During their time in teacher training programmes, student teachers read about classroom management and attend lectures or seminars concerning the problems that may arise. But they have limited opportunity to test their knowledge: even though placement with schools is often provided, it is but a limited time (Jones, 2006; Little & Akin Little, 2008). Student teachers also worry that they will be unable to deal with more terminal disruptions such as outbursts and violence (Bru, Stephens, & Torsheim, 2002; Colnerud, Karlsson, & Szklarski, 2008) and student teachers leave their teacher training programme feeling unprepared for facing the reality in schools, especially challenges to classroom management and conflict resolution (Samuelsson & Colnerud, 2015). Furthermore, classroom management should not be seen as a technical or instrumental skill, but rather something that is ultimately dependent on judgement, which comes with experience (Biesta, 2009). The more the experience, the better the chance of making reasonable, appropriate decisions. One way of providing experience could be the use of simulation technology, as suggested by Brophy (1988).

Simulation technology has been used for educational purposes for a long time. As technology develops, simulations have gone from manually controlled film sequences (Kersh, 1965), via animated models of processing plants presented on computer screens (e.g. Ragnemalm, 1999) to breathing robotic patients in emergency care (e.g. van Heukelon, Begaz, & Treat, 2010) and virtual reality worlds that feature avatars that can be tailored to

resemble yourself – or a man-sized pink bunny – that move in an environment on screen that seems very real (e.g. Mahon, Bryant, Brown, & Kim, 2010). An early computer-based simulation for learning classroom management was constructed by Strang, Badt, and Kauffman (1987) who had a human interpret the actions of the student teacher into codes recognised by the computer and read aloud the responses from the four pupils. Interactive video (Overbaugh, 1995) and virtual worlds (Mahon et al., 2010) have also been used. Using video recordings of real people requires script and actors and gives much detail. A virtual world requires a lot of programming of environment and pupil behaviour and gives less detail. The human interface gives good control of exactly what details are presented to the learner but is completely dependent on the person.

Pedagogic framework

In the *variation theory of learning*, learning is regarded as a change in how something is perceived, experienced or understood (Marton, 2015). Learning to deal with certain situations involves learning to focus the important aspects of a situation, discerning these aspects from other, less relevant aspects. Variation is the key to developing the ability to see and discriminate relevant aspects (Marton, 2015; Marton & Pang, 2013). One way of providing experience of variation in a controlled fashion is the use of simulators, suggested by Bowden and Marton (2004).

In simulated classroom situations, student teachers can be given the opportunity to experience variations in a controlled fashion in order to facilitate learning to discern key aspects relevant to classroom management. In a simulation, the student teachers can also be provided with a variation of possible responses that illustrate different strategies and manners of leadership in the classroom and what the effects of that response might be. With the aid of such a simulation, student teachers can explore different strategies for managing the classroom and are able to see the consequences of their own strategies without negatively affecting real children. In order to experience variation clearly in a situation that changes with every interaction, it is valuable to be able to go back and change that interaction in order to experience the variation provided by other actions. Accordingly, systematic variations in critical aspects of classroom management should be created in the computer simulations, and the ability to go back and redo an action provided.

In a simulation, the student teacher can also be assisted in discerning relevant aspects by how the simulation is presented. In a detailed visual presentation (as in interactive video or the film clips from an ordinary lesson with real teachers and students which can be found on YouTube today), many aspects are presented, not all of which are central. A less detailed visual presentation might for instance be like the graphics of a computer game; showing the pupils as human figures that move realistically but with limited facial expressions and body language. This will provide fewer aspects, but may even provide misleading aspects (the faces and body language of the simulated pupils will be more impassive than reality unless a large amount of time is spent designing many nuances of expression). One way of controlling the number of aspects presented to the learner is to use text as a medium. In a text, only those aspects that are explicitly expressed can be taken into account. This does not mean that all the expressed aspects are perceived, only that there may be fewer to choose from.

Can text be used to provide pedagogical experience of variation in key aspects of a real world activity such as classroom management? This is the question examined in the project described in this paper. Next the design of the text-based simulation system is presented, then the method of evaluation and finally the results.

The design of SimProv

The creation of SimProv (short for Simulerade Provokationer, Swedish for simulated provocations) started with choosing the learning objective and context, i.e. situations that were interesting to test our ideas for a text-based computer simulation in. Initially, five possible situations that could be challenging for a student teacher were identified as relevant and possible to develop: (a) start of the lesson, (b) end of the lesson, (c) test, (d) handing out materials and (e) transition between types of work during a lesson (Carlgren, 1997). Each of these five situations test student teachers' ability to lead activities and especially to keep pupils' attention directed at the intended content. Two of these situations were selected for the initial experiment of feasibility. Consequently, SimProv was limited to (a) start of the lesson and (e) transition during the lesson. The next steps were to identify critical aspects related to these situations.

A number of contextual aspects of the challenges to leadership, such as different sorts of troublesome behaviours and frequency of the disturbances, were identified from theories and literature (Beaman & Wheldall, 2000; Beaman, Wheldall, & Kemp, 2007; Granström & Einarsson, 1998; Houghton, Wheldall, & Merrett, 1988; Lewis, 2001; Woolfolk Hoy & Weinstein, 2006). Some disturbances that were selected for inclusion in SimProv were late arrivals, pupils who question work mode and interrupt with less relevant questions.

Second, aspects relevant to the teacher's behaviour as a leader, such as models and strategies for handling disturbance, classroom climate and relations between teacher and pupils were identified (Samuelsson, 2008; Clunies-Ross, Little, & Kienhuis, 2008; Colnerud, 2007; Granström, 2007; Jones, 2006; Lewis, Romi, & Roache, 2012; Roache & Lewis, 2011). As a way of illustrating the variation in different ways to act as leaders, Lewin, Lippitt, and White's (1939), and Baumrind's (1971/1991) studies concerning social climate, leadership and fostering styles were used to identify four different leadership styles: (a) excessively authoritarian, (b) authoritative, (c) democratic and (d) compliant that could be varied. These four leadership styles differ with regard to how the teacher would deal with different sorts of situations and pupil provocations. Some examples of important aspects here are: how the teacher thinks about power, influence, distance (both mental and physical), visibility (of lesson plan), respect and care. Each aspect then has values, for example the aspect of influence varies between permitting the pupils no influence at all to allowing so much influence that no planning is possible. The ranges of values were sampled for the four different leadership styles, giving influence the discrete values: teacher permits no influence from pupils, teacher allows selected types of influence in controlled situations, teacher structures work to allow for many forms of influence from the pupils and finally teacher allows pupils to influence everything in an unstructured manner. The different leadership styles will employ these (and other) aspects in a slightly different (sometimes overlapping) manner.

Table 1 shows how some of the identified aspects were distributed over the four leadership styles.

Table 1. Leadership styles and their perception of the values of a selection of aspects.

Aspect	Leadership style			
	Authoritarian	Authoritative	Democratic	Compliant
Power	Teacher has all, makes demands	Teacher may share	Divided between teacher and pupils	Is in the pupils' hands
Influence	No pupil influence	At the teacher's permission, but the teacher guides	Systematically employed	Always allows influence
Distance	Aloof from the pupils	A certain distance is kept	Close, bordering on friendly	A certain distance is kept
Visibility of lesson plan	Does not show plan	Plan is visible	Plan is agreed upon and made visible	Has no plan to make visible
Respect	The pupils should respect the teacher	Respect is mutual and expected	Respect is mutual and carefully nurtured	No respect expected or given
Care	No care shown	Cares	Visibly cares	No care shown

Table 2. How the leadership styles differ in voice, body language, language and actions.

Expression	Leadership styles			
	Authoritarian	Authoritative	Democratic	Compliant
Voice	Takes command, demands attention with loud voice in order to start the lesson. Maintains control through obedience	Asks the pupils pay attention, as a way to start the lesson	Gathers the class actively, focus is on the start of the lesson	Conducts vague attempt to start the lesson, waits and lets the students silence each other
Body language	No interaction with pupils, extremely controlled body-language, shows that I am the leader	Openness and interest in the pupils, controlled body-language, shows that I will guide you	Relaxed body language and makes sure of joint responsibility, shows that we can do this together	Seems uncomfortable and uncertain as a leader, shows that you have to do this yourselves
Language	Criticises pupils publicly by naming them. Extreme I messages	Describes the content for the lesson. Clear You and I messages	Reminds about agreements, ask pupils to explain. Clear We together messages	Informs vaguely, expresses that it would be nice if the students would listen. Very vague You messages
Actions	Stands beside the lectern, keeps a distance to the pupils. Does not describe the content or the mode for the lesson. Provides less care about them	Chats with the pupils, includes all the pupils. Expresses care and faith in pupils' capability	Walks and talks among the pupils, expresses care and faith in pupils capability	Has no plan, neither argument for the chosen mode. Provides no care for the pupils, no faith

The second author then operationalised each of the four leadership styles and tried to separate their (1) voice, (2) body language, (3) language and (4) actions in order to provide space for varying the above-mentioned aspects in the simulation.

Table 2 shows how the different values for the aspects can expressed in voice, body language, spoken language and actions, in the context of the first situation (start of lesson).

Following this, textual narratives were created for the two identified situations (start of lesson and transition during lesson) that included the contextual aspects selected (absent pupils, interruption, etc.). The narratives were then split into different versions for the four leadership styles and the actions of the pupils tailored after pupils accustomed to each leadership style. Each narrative was then segmented by identifying points of variation, i.e. points in time where one or more aspects of the situation and expressions of leadership style could be varied. All this amounted to providing the user with descriptions of a moment and a choice between possible continuations (usually a reaction by the teacher but

sometimes a thought or elaboration). Each time a choice between the four different leadership styles is provided (approximately once per contextual aspect included), a sequence of two to five points of variation keep the leadership style invariant and varies the expressions, behavioural aspects and pupil responses (maintaining pupil responses appropriate to that leadership style), each providing four choices. At the end of each of these sequences, the storyline was again collected into a common point, and the next point of variation varied leadership style again. These sequences of points of variation can be called scenes.

It was deemed impossible to explore all possible combinations of values of all the aspects to be varied, thus the most probable and most interesting combinations expressed in earlier research were selected on the basis of the second author's experience from research on classroom management, including 10 years of observation studies in the type of classroom portrayed.

The simulation was realised as a hypertext structure that could be traversed in order to experience a complete storyline for each of the two chosen situations. For each point of variation, the storyline was divided into up to four strands, thus after 3 points of variation, there were 64 different stories of what has happened in relation to the start. The segmentation of the storyline into scenes described previously helped reduce the number of parallel storylines to a manageable amount, by bringing them together into a common moment regardless of what choices had been made previously. This reduced the hypertext complexity but still there were several bugs in the first version, where points of variations led to unintended new moments.

The hypertext structure was designed so that for each point of variation, one option was always to go back to the previous point (and from there further back), providing the option of traversing the entire structure thus experiencing every single variation included. Figure 1 presents a translation of the first screen of the simulation of situation (a) start of the lesson, including the first point of variation, providing a choice between four different leader styles (each represented by a paragraph) and a go-back option (for consistency reasons).

In order to verify that the language used and the events created would be perceived as realistic, the resulting hypertext simulation was tried on three expert groups: four teenagers currently in similar school situations, four teachers with several years of experience from working in secondary schools and four teacher educators. The third group was also asked to explore how the simulated teacher solved the situations in relation to the theoretical foundations. The experts did not explore the simulation exhaustively but spent from 10 to 70 min on this. All experts found the language and events realistic and all teacher educators meant that the structure and storyline should be useful in order to train student teachers on classroom management.

Method of evaluation

In order to examine if the hypertext simulation has the potential to allow the user to identify the variations in values of aspects presented, a study was designed where student teachers would run the simulation in pairs or small groups and verbalise their reasoning by discussing what options to select at each point of variation. It is assumed that if an aspect or a value is mentioned or referred to, it has been recently perceived. If there is currently such an aspect presented by the simulator, presumably it has been perceived from this presentation, otherwise it might have been presented recently or be part of a memory. If an aspect is mentioned by name, it can be assumed to be identified. If two values of an aspect are contrasted, it can be assumed that the aspect is identified. If only one value of an aspect is mentioned, the aspect may not be identified, but identifying the values is a prerequisite to identifying the aspect.

```
The classroom    A1
Tuesday  morning. You arrive at the classroom in time for today's first
lesson. Outside the classroom, several pupils have gathered. You greet
the pupils, and several return the greeting. You unlock the door and
enter the classroom. You leave the door open, as a signal to the pupils
that they may enter and take their seats, awaiting the start of the
lesson.

What do you do?

You await the start of the lesson silently sitting behind your desk.
The pupils are sitting at their desks, each at his or her own place.
You silently count to yourself the number of pupils and conclude that
two pupils, Filip and Oliver, are missing. Today again, you think to
yourself.

You write the contents of today's lesson on the whiteboard. You
simultaneously observe the pupils that enter the classroom. They are
chatting and you answer someone's question about yesterday's sports
event. The pupils sit down at their places. You note that two pupils,
Filip and Oliver, are missing, while you observe that it is time to
start the lesson and you go to close the door.

You silently, sitting behind your desk, count the number of students
and conclude that two pupils, Filip and Oliver, are missing. You
consider how you teachers are going to persuade them to join in, in a
better way. You note that it is time to start the lesson and go to
check that no-one is in the corridor, on the way to class. Two girls
leave their lockers. You nod in recognition and let them into the
classroom before closing the door. On your way back to your desk you
say "Good morning".

You enter and seat yourself behind the desk. You say nothing to the
pupils who enter the classroom. You wait behind your desk for the
lesson to start. The pupils sit down behind their desks, each in his or
her own place. You silently count to yourself the number, and conclude
that two pupils, Filip and Oliver, are missing. You see on the clock
that it is time to start the lesson and therefore go and close the
door. On your way back to the desk you note that the sound level is
already quite high and that some pupils are wandering about in the
classroom. You go and place yourself behind the desk.

Return to previous page.
```

Figure 1. The first screen of the text-based simulation (translated from Swedish).

The study was arranged in collaboration with a course on social relations, leadership and conflict management that was part of a teacher programme. The experiment session was to be mandatory but participation in the study voluntary. In order to be able to analyse the dialogue, it was to be recorded, and to enable comparisons with what is presented on screen, screen activity was to be captured.

Results

Data from 25 student teachers running the simulation were collected from several different sessions. Thirteen of the participants worked with slightly older children in vocational training programmes and twelve participants were certified teachers in training to become special needs teachers.

The participants were welcomed and informed about the research project and the exercise and asked to choose if they wanted to participate in the study. They played in pairs or triads randomly selected and were instructed to discuss the available options within the pair or triad, in order to ensure that they agreed upon the chosen option. They were also invited to explore the different options available (by going back and forth). The sessions were video recorded and screen activity was captured.

In order to examine if the participants were able to perceive the different aspects or their varying values from the textual presentation, the dialogue was analysed. Focus in the analysis was to search for phrases that indicated either the aspects or their values, either by direct mention or indirect reference.

In the following dialogue examples that show how the aspects and values were used, pertinent details concerning the context of the sample are given first, then a quote, translated from Swedish by the authors, and finally the relevant interpretation given.

The aspect of leadership styles

Context: The teacher in the simulation is introducing the work mode for the lesson. One option has them saying: "Today I think you should work individually", which is one way of verbalising a compliant strategy.

> B: it feels a bit, like, somehow wimpy: "today I think".
>
> A: I wouldn't say "I think", I'd say "today it's individual work coming up."
>
> B: It feels so vague: "Today I think", it feels like the students are going to run you down.

The participants react against the choice of words ("I think"), and find it implying weakness and indecision (characteristic of compliance), with which they are uncomfortable. This is interpreted as discernment of the compliant style.

In another context, the participants focus two options, one (indicated by "this") where the teacher starts by demanding that the students rise and greet them (excessively authoritarian), another where the teacher connects today's task to a plan earlier agreed upon, showing what has been done and what remains to be done (democratic).

> A: yeah. But this is more … More, like, authoritarian style. … I don't connect it to things we've done before or anything like that.

Here, the participant explicitly identifies one option as authoritarian and also discerns the different values for visibility of plan (the action of referring to the lesson plan, which is missing from the authoritarian option) and provision of motivation for today's activities (also missing from the authoritarian option). The explicit identification of the authoritarian leadership style is interpreted as discernment of the leadership style aspect, since you do not name something unless you need to separate it from something else. The mention of the two other aspects is done *in absentia*, which implies that two values for each aspect are identified (presence or absence of the action), thus the aspects themselves can be assumed to be identified.

The aspect of distance

Context: at the start of the "Start of the lesson" situation, the participants are looking at the text in Figure 1, and "two" refers to the second option.

> B: … Really, what's so nice about two is in my mind is that there is a communication with the students all the time. And I like that. First of all, I … I don't go sit behind [my lectern] and just kind of quietly expect … […]
>
> B: I feel that the other three [options] … There you are so … Really I'm a separate … species. And the students are their own separate species [laughs]. A bit like, that there is a … big difference between …

This participant identifies a difference in distance between the pupils and the teacher where option number two implies a closer relation to the pupils than the other three. Here two values are contrasted, which could be interpreted as the dimension (the aspect of distance) being identified.

The aspect of care

Context: two pupils are missing, being late, the option of asking the class if anyone has seen them is provided. Participant A first hesitates over this, mentioning that asking the class will draw the class' attention to the fact that they are missing.

> B: My students would think it was … weirder if I didn't ask
>
> A: (laughs) yeah, that's true, Yes because then it seems as if you haven't noticed it.
>
> B: Precisely. And don't care. And what does that represent?
>
>   […]
>
> B: … But then I have … cared, at that point anyway.

Participant B focuses on the class' perception of the teacher's care for the missing students, showing that displaying care to the class is important, while participant A initially focused the missing students and caring about them by not exposing their misbehaviour to the class. Thus both participants want to care but with different focus. Here only one value is identified, meaning that the aspect may not be identified.

The aspects of power and influence

Context: A dialogue between the simulated teacher and the class has just been read, where one pupil asks if they really do have to work by themselves. The teacher allows that a change of mode is possible if the class is agreed, a vote is taken and a change is agreed upon. This illustrates one approach to power (sharing) and influence (permitting). One participant comments:

> B: Sure, often true. Show of … have a show of hands to decide some things.

This shows an acceptance of the pupil's power and influence, although this may only mean that the participant is comfortable with this approach, not that this value is discerned as distinct from not allowing student's influence.

The aspect of respect

Context: The teacher in the simulation is explaining today's lesson-activities when someone, probably the two late students, tries to open the locked classroom door. The option referred to as "here" features a pupil rising to open the door.

B: no, so it is better that way. Then I think that eh … here (laughs). Here I interpret that … If you have the class figured …

A: Mm

B: eh … and a good relation. Which I think you have here, then it's quite alright that a pupil goes to open the door.

Participant B argues that if you have "a good relation" with the class, it is acceptable to have a pupil opening the locked door. Having a "good relation" can be interpreted as having mutual respect, which is one value of the aspect of respect.

Conclusion

The variation theory of learning maintains that it is important to be exposed to variation to learn to discern the aspects that are central to a task. The use of text as a medium permitted absolute control over what aspects were presented to the learner in every situation. In order to examine if text is a sufficient medium for providing experience of variation of key aspects in a task, a text-based simulation was developed in the context of classroom management. A great number of aspects pertinent to classroom management were identified from literature and values for those aspects varied in the text-based simulation that was implemented as a hypertext structure. The hypertext story was explored by the participants. The participants were found to be able to discern different leadership styles as well as several of the other values explicitly (e.g. excessive leader style, care, distance) or implicitly through acceptance or rejection of actions (e.g. compliant leader style, influence, respect). This does not mean that the aspects themselves have been identified, but discerning different values is a prerequisite to discerning the aspect itself (Marton, 2015). This type of simulation thus has the potential to help students learn to identify important aspects of classroom management.

Future work

On some occasions, participants noted that the tone of voice was not apparent from the text. This was intentional, to permit the reader to make assumptions fitting their interpretation of the context, but it is possible that sound illustrations of utterances would provide important aspects that have not been included. A version of SimProv with sounds is in the process of being developed.

One important aspect that is not represented in the text-based simulation is time. In reality, teachers deal with more than 1000 interactions each day (Jackson, 1968) and therefore it is often important to react very quickly to a provocation in the classroom, since even a few second's hesitation is interpreted as a response. It was decided to focus on forcing the users to reflect instead of react by eliminating the time aspect, since it was believed that inexperienced teacher students should reflect on their responses before enacting them.

Further work is also required to find the relative merits of text, still images and animation, and if there are types of aspects that require some specific medium.

Disclosure statement

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