What to do or what to learn -on communicating learning goals

Jorryt van Bommel, Marie Nilsberth, Anna Nissen, Michael Tengberg, Michael Walkert

What to do or what to learn – on communicating learning goals

Jorryt van Bommel, Marie Nilsberth, Anna Nissen, Michael Tengberg and Michael Walkert

Karlstad University, Sweden; jorryt.vanbommel@kau.se; marie.nilsberth@kau.se; anna.nissen@kau.se; michael.tengberg@kau.se; michael.walkert@kau.se

This paper reports the results from a large-scale video-observation study where 127 mathematics lessons were coded with regard to the way teachers communicated learning goals. Four consecutive lessons were collected in 35 classrooms (grade 7, students age 14) in Sweden. The PLATO-manual was used to code the lessons with a four-grade scale. The results show that teachers mostly communicate vague or inferred learning goals. Tasks are in line with these (inferred) learning goals and the teachers give clear instructions to students regarding what to do. Throughout lessons, teachers seldom refer back to the learning goals. However, half of the teachers occasionally express more detailed learning goals and relate the content of the lesson to a learning outcome.

Keywords: Learning goals, video-observation study, lower secondary school, interactions.

Introduction

> So, the coming lesson we will work from page 64 and work through task 83 to 94. For task 93 and 94 you might need a calculator which you can find in the cupboard here in front of the class. Don't forget to explain your calculations! Now let's get started.

When a teacher gives instructions such as the one above, students are given clear instructions on what to do and can immediately start working on the tasks. What is to be done has been clarified, but what is to be learned is vaguer. Further, no discussion is initiated on how or why students are expected to learn this. Research on instructional techniques in all core content areas has found that explicitly linking classroom activities to learning goals helps students understand the purpose of the instruction and make them feel motivated to engage with the ideas (Baker et al., 2002; Banilower et al., 2010; Spinath & Steinmayr, 2012). Further, clarity and explicitness of learning goals help students to create a context in their learning (Spinath & Steinmayr, 2012).

The situation presented above describes a rather common lesson start as observed in a large-scale video-observation study in grade 7 (14-year-olds) in Sweden (Tengberg et al., 2021). This LISA-study (Linking Instruction and Student Achievement) aims to capture different aspects of teacher instruction, in which the way teachers present their learning goals is one such aspect. In this paper data from the LISA-study will be presented with a specific focus on learning goals. It aims to answer the following question: To what extent and in what detail are learning goals communicated across lessons and classrooms in Swedish 7th grade mathematics?

Previous studies

Detailed and clearly communicated learning goals influence students' learning achievements (Hattie, 2009; Boden et al., 2019; Locke & Latham, 2002, Reed, 2012). Further, clear learning goals can motivate students (Spinath & Steinmayr, 2012) and clarify what is expected as an outcome of the lesson (English & Steffy, 2001; Hattie, 2009). Communicating learning goals enables both students and teachers to see connections between previous lessons and the current one but also to see connections between activities and instruction within a lesson (Vaughn & Bos, 2010).

Within a Swedish context, Hemmi and colleagues (2019) found that Swedish teachers, when working with Finnish curriculum materials, expressed their goals vague and implicit. This is in line with previous studies in Sweden (c.f. Boesen et al., 2014). In an interview-study, Fauskanger and colleagues (2018) found that Norwegian teachers preferred goals focusing on the content and supporting student learning. Yet, observing teachers' instructions on a large scale is relatively uncommon in the Nordic countries. In Sweden, a limited number of observation studies have been conducted either led by The Swedish Schools Inspectorate (2009), or as an evaluation of a nationwide mathematics professional development program (i.e., The Boost for Mathematics, Matematiklyftet) dedicated to the improvement of the teaching of mathematics (Ramböll, 2016: Österholm et al., 2016; 2021). One of the outcomes revealed that while lessons are often structured in terms of planned activities, they seldom start with a presentation of goals and purposes of the lesson, and teachers seldom leave time for reflection or evaluation of what was learned at the end of the lesson (Österholm et al., 2016; 2021).

Since the importance of communicating clear learning goals to students has been discussed and has been the subject of professional development initiatives in Sweden, this element deserves special attention. Also, the Swedish goal-oriented curriculum (Swedish National Agency for Education, 2011) pleads for an attention to communication of learning goals in class.

Background – the LISA-study

The LISA-study aims to capture the quality of teaching of different subjects in the Nordic countries. This article focuses on mathematics taught in Sweden. LISA uses an observation protocol (see below) to explore the quality of teaching. In Sweden, we observed 35 classrooms, taught by 31 teachers at 15 schools. Each classroom was video-recorded for three or four consecutive lessons in the middle of the school year, which resulted in 127 video-recorded mathematics lessons.

To obtain a representative sample and to match the national distribution, the schools were stratified according to different variables such as the schools' locality (urban/rural), the percentage of immigrant students; achievement level; the organization of the school (public/charter). Also, age, gender and qualifications of the teachers included in the sample varied which provided a fair and diverse representation of mathematics teachers in Sweden (for a more detailed description, see Tengberg et al., 2021).

Method

Video observations

In the present study, two cameras and two microphones were used to capture the teaching. One camera in the back of the class, capturing the teacher, and one in front of the class, capturing the students. The teachers wore a microphone so all their talk could be recorded. Another microphone was placed in the middle of the room to capture students' speaking. Students who did not want to be video-recorded were seated on one side of the classroom, and the cameras were adjusted in order not to capture that part.

Four consecutive lessons were recorded in order to enable reliable information and to capture enough variation of teaching practice, this choice was led by findings from previous studies (cf. Kane & Staiger, 2012). However, the question of how many lessons that are needed to capture a teaching phenomenon (like clarifying and communicating learning goals) has been raised by several researchers (Cohen & Goldhaber, 2016; Ho & Kane, 2013) and consensus has, so far, not been obtained.

Each lesson was divided into segments, 15 minutes each, constituting the unit of analysis. If the last minutes of a lesson did not make up a whole segment, these minutes were either included in the previous segment (if the segment was shorter then 7,5 minutes) or added as a new segment (if the segment was at least 7,5 minutes long). When analyzing a lesson, a division into smaller units, following the different stages of a lesson is advisable (Clarke et al., 2006). These stages correspond to the structural level a teacher adopts to a lesson and often follows 15-minute segments.

Observation protocol

The protocol for language arts teaching observation (PLATO) was used to code the video recorded lessons. It was first designed for observing lessons in language arts (Grossman, 2015) but has been used in other subject areas as well. For mathematics the observation protocol has been revised, which has resulted in qualitative criteria similar to those used for language arts, but valid for mathematics. In specific, the PLATO-element *purpose* attempts to focus on whether or not the learning goals are clarified, and if coherence is established between the tasks, activities and the learning goals. By doing so, the quality of instruction is coded on a four-grade scale. In the example at the beginning of this paper, no specific learning goal was communicated. However, an implicit goal (connected to the mathematical content of the exercises) can be inferred. This would score a '2' according to the PLATO-manual. General instructions like "Today we will learn about linear functions" would also score a 2 (Figure 1). If a teacher would communicate a more specific learning goal such as "Today we will learn more about the slope of a linear function in relation to the values a and b in the formula", this could result in a score of '3'. In order to score a '4', there should also be evidence that the students are aware of the purpose or that the teacher or the students refer back to the purpose during the segment. Each segment is coded separately and only for what is present during the segment. However, if a teacher or students refer back to a purpose that was presented more specifically during a previous segment, the coding will take that level of specificity into account in the later segment in order to score a '4'.

1 **Provides almost no evidence**	**2** **Provides limited evidence**	**3** **Provides evidence with some weaknesses**	**4** **Provides consistent strong evidence**
There is no clear learning goal in the class or the learning goal is not related to the development of mathematical knowledge or skills.	There is a learning goal communicated or inferred, that is connected to the development of mathematical knowledge or skills. The goal takes the form of a general topic or activity (e.g., "Today we will learn about linear functions", or "Now we will work on our division"). The lesson's activities may not align to the learning goal.	There is a clearly communicated, specific, learning goal that is connected to the development of mathematical knowledge and skills. The lesson's activities align to and target the specific learning goal. The teacher makes clear how the lesson will support students' development as users of mathematics.	There is a clearly communicated, specific, learning goal that is connected to the development of mathematical knowledge and skills. The lesson's activities align to and target the specific learning goal. There is evidence that students are aware of the purpose. The teacher or students refer back to the purpose during the segment. Teacher makes clear how lesson will support students' development as users of mathematics

Figure 1: Scoring criteria of *Purpose* in mathematics (adapted from Grossman, 2015)

Reliability

Video observations enable repeated analysis to capture important details and patterns to greater extend then observations in classrooms (Borko et al., 2017). Further, they enable joint coding. In the present study, around 40% of the data were scored jointly by two raters, in order to obtain and monitor reliability. The observers were all certified PLATO-raters. Certification was obtained after a four-day course and a test in which .80 reliability per item had to be obtained.

To obtain a reliability of .80 on PLATO, at least five lesson segments should be observed (Cor, 2011). In our study we have an average of 12,7 observed segments per teacher, with a minimum of 7 segments.

Ethics

The principals of all schools were contacted first after which our request for participation was forwarded to the teachers. Teachers and students were informed about the aim of the research and how the data would be used as well as their rights as participants. Questions could be asked prior to data collection. All participating teachers, students, and guardians of students signed an informed consent. As stated, students who did not want to participate were seated on one side of the classroom so they would not be captured on video. The research was conducted in line with Swedish guidelines on research ethics (Swedish Research Council, 2017).

Results

Learning goals per segment

Of all 403 segments, 358 segments scored a '2' (89%) on the four-grade scale. Often this was due to the fact that teachers only described the topic to work with in a broad way (e.g. "algebra", "functions", "fractions"), but on some occasion teachers would also refer back to previous lessons and just state that "today we will continue from where we ended yesterday". Thus, they would not make it clear how the lesson would support the students' development of mathematical competencies. Just as in the introductory example, teachers frequently instructed students on what to do "work from page 64 and work through task 83 to 94. Don't forget to explain your calculations", but did not explain why or what they were supposed to learn during the lesson.

One might assume that communicating goals would mostly occur during the beginning of a lesson, like in the following example (scoring a 3 or a 4): "We start with today's schedule. The goal is to be able to calculate part of whole and to be able to simplify and reduce fractions". Indeed, of the 41 instances where a score at the high end (3 or 4) was observed, 23 were observed in the first segment (Table 1). This means that, even when only the scores of the first segments of each lesson are included, still as many as 103 out of 127 segments (81%) scores a '2'. One could also argue that the goal of a lesson can be communicated at other stages of the lesson: for instance, at the end of a lesson. Looking at final segments, high scores of *purpose* occurred ten times out of 127 in the last segment of the lesson, which means that in just below 8% of the last segment of a lesson, teachers would come back to previously stated (implicit or explicit, vague or detailed) learning goals: "To sum up, todays lesson was about (…)". There were in total four segments where no learning goal at all was communicated. One instance occurred in a lesson where a fifth segment was recorded (thus a lesson of consisting of more than 127,5 minutes), the other three segments occurred during one single lesson, indicating that no learning goals were communicated that lesson.

Table 1: Scores on Purpose divided over start, middle and closure of the lessons

Score	First segment	Middle segment(s)	Last segment	Total
1	1	1	2	4
2	103	140	115	358
3	21	6	8	35
4	2	2	2	6
Total	127	149	127	403

Learning goals per teacher

If we look at the different teachers and see in what way the scores were divided, we can see that the majority of teachers scores a mean value at or close to 2,00 (Mean 2,11; SD 0,38). Of all 31 teachers, 16 scored only on the low end (score 1 or 2), the other 15 teachers scored both at the high and the low end (scores ranging from 1 to 4). These teachers, who scored distinctly higher than 2,00 on average, communicated their goals more explicitly and in more detail. On rare occasions, this was done through utterances like: "at the end of the lesson you are expected to be able to (…)" or "yesterday we dealt with functions with one unknown, today we will continue and you will learn how to handle functions with two unknows or variables". The scores on the high end require that the learning goals are in some way connected to a learning outcome, which could for instance be through exit tickets where students were to write what they had learned during the lesson.

Summary

We set out to answer the research question "To what extent and in what detail are learning goals communicated across lessons and classrooms in Swedish 7th grade mathematics?" and found that learning goals are typically implicitly stated and addressed in a vague way. Half of the teachers, express their learning goals more explicitly and, on rare occasions, learning goals are revisited by the teacher at the end of the lesson.

Discussion

The present study aimed to contribute to previous literature about learning goals through analysing how the purpose of the lesson is communicated in class, in specific in 35 mathematics classes in Sweden. The results showed that learning goals in lower secondary mathematics instruction are often implicitly stated, which is in line with the findings of Hemmi and colleagues (2019). Also, in a study including LISA data from all Nordic countries, similar results were found with a large number of segments scoring a '2' (Selling & Klette, 2021). Their study also examined if the goals were focusing on content or competencies and found that most often content was addressed. If competency goals were included, these addressed procedures rather than conceptual knowledge.

A lack of clarity and detail can lead to a difficulty for students to perceive coherence within a lesson (Vaughn & Bos, 2010). In the present study, we found that even when instructions indicate some kind of coherence (e.g., when teachers say "Today we will continue from where we ended yesterday") the connection between previous lessons and the current one might nevertheless be unclear. Also, the outcome of a lesson might be unclear for students, as no guidance is given regarding to what they are supposed to learn during the lesson. As there were few deliberately planned closures of lessons, learning goals and learning outcomes were very seldom reflected upon.

In light of the goal-oriented curriculum in Sweden, where it is considered to be important for students to understand what they are expected to accomplish for a specific grade (Swedish National Agency for Education, 2011), implicit goals in class do not offer students such an awareness (English & Steffy, 2001; Hattie, 2009). A critical note to our choice of method (video observations) is that a phenomenon like communicating learning goals might be observable elsewhere, and not only through the teachers' communication captured on the video-recordings. For instance, detailed plans that explain what students are expected to do are often available for students on digital platforms, and in such plans, learning goals might be more explicitly stated. Furthermore, when giving feedback to students, teachers might indicate more explicitly what an expected learning outcome might be, related to detailed learning goals (Hattie, 2009). PLATO includes feedback as an element, and the analysis of that element might reveal some more insights on the communication of learning goals. The implicitness and vagueness of the orally communicated learning goals do not have to imply that students are not aware of the more detailed ones. During the observations we saw that students were constantly working on their tasks (measured in the PLATO-element 'time management and behaviour management, for more details, see Tengberg et al., 2021). Students ask relevant questions and teachers replied accordingly, seemingly in line with specific learning goals.

In sum, we argue that since communication of learning goals influences the students' learning achievement (Hattie, 2009; Boden et al., 2019; Locke & Latham, 2002, Reed, 2012), the results of this study could suggest that the students in half of the classrooms (with teachers scoring at the high end) might be affected in a positive way, whereas the other half of the students (with teachers only scoring on the low end) might obtain lower results. The next step will thus be to link teachers' instruction to student achievement as our data enables us to do so.

Acknowledgement

This research was supported by The Swedish Research Council (Grant Number 2017-03544).

References

Baker, S., Gersten, R., & Lee, D. (2002). A synthesis of empirical research on teaching mathematics to low-achieving students. *The Elementary School Journal, 103*(1), 51–73.

Banilower, E., Cohen, K., Pasley, J., & Weiss, I. (2010). *Effective science instruction: What does research tell us? (2nd ed.).* RMC Research Corporation, Center on Instruction.

Boden, K. K., Zepeda, C. D., & Nokes-Malach, T. J. (2020). Achievement goals and conceptual learning: An examination of teacher talk. *Journal of Educational Psychology, 112*(6), 1221–1242.

Boesen, J., Helenius, O., Bergqvist, E., Bergqvist, T., Lithner, J., Palm, T., & Palmberg, B. (2014). Developing mathematical competence: From the intended to the enacted curriculum. *The Journal of Mathematical Behavior*, *33*, 72–87. https://doi.org/10.1016/j.jmathb.2013.10.001

Borko, H., Carlson, J., Mangram, C., Anderson, R., Fong, A., Million, S., Mozenter, S., & Villa, A. M. (2017). The role of video-based discussion in model for preparing professional development leaders. *International Journal of STEM Education*, *4*(29), 1–15.

Cohen, J., & Goldhaber, D. (2016). Building a more complete understanding of teacher evaluation using classroom observations. *Educational Researcher*, *45*(6), 378–387.

Cor, K. (2011, April). *The measurement properties of the PLATO rubric* [Paper presentation]. Annual meeting of the American Educational Research Association, New Orleans, LA, United States.

English, F. W., & Steffy, B. E. (2001). *Deep curriculum alignment: Creating a level playing field for all children on high-stakes tests of educational accountability*. Scarecrow Press.

Fauskanger, J., Mosvold, R., Valenta, A., & Bjuland, R. (2018). Good mathematics teaching as constructed in Norwegian teachers' discourses. In E. Norén, H. Palmér, & A. Cooke (Eds.), *Nordic research in mathematics education – papers of NORMA17* (pp. 239–248). Swedish Society for Research in Mathematics Education.

Grossman, P. (2015). *Protocol for Language Arts Teaching observations (PLATO 5.0)*. Stanford University. http://platorubric.stanford.edu/index.html

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Hemmi, K., Krzywacki, H., & Liljekvist, Y. (2019). Challenging traditional classroom practices: Swedish teachers' interplay with Finnish curriculum materials. *Journal of Curriculum Studies, 51*(3), 342–361.

Ho, A. D., & Kane, T. J. (2013). *The reliability of classroom observations by school personnel*. Bill & Melinda Gates Foundation.

Kane, T. J., & Staiger, D. O. (2012). *Gathering feedback for teaching: Combining high-quality observations with student surveys and achievement gains*. Bill & Melinda Gates Foundation.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist*, *57*(9), 705–717.

Ramböll (2016). *Slututvärdering: utvärderingen av Matematiklyftet 2013–2016* [Final evaluation: evaluation of the Boost for mathematics 2013–2016]. https://www.skolverket.se/publikationer?id=3705

Reed, D. K. (2012) Clearly Communicating the Learning Objective Matters! *Middle School Journal, 43*(5), 16–24.

Selling, A., & Klette, K. (2021) *Teacher enactment of goals in Nordic mathematics classrooms*. Manuscript in preparation.

Swedish National Agency for Education (2011) *Curriculum for the compulsory school, preschool class and the recreation centre.* *https://www.skolverket.se/publikationer?id=3984*

Swedish Research Council (2017) *Good research practice.* https://www.vr.se/download/18.5639980c162791bbfe697882/1555334908942/Good-Research-Practice_VR_2017.pdf

Swedish Schools Inspectorate (2009). *Undervisningen i matematik – utbildningens innehåll och ändamålsenlighet.* Kvalitetsgranskning, Rapport 2009:5.

Spinath, B., & Steinmayr, R. (2012). The roles of competence beliefs and goal orientations for change in intrinsic motivation. *Journal of Educational Psychology, 104*(4), 1135–1148.

Tengberg, M., van Bommel, J., Nilsberth, M., Walkert, M., & Nissen, A. (2021). The Quality of Instruction in Swedish Lower Secondary Language Arts and Mathematics. *Scandinavian Journal of Educational Research.* Advance online publication. https://doi.org/10.1080/00313831.2021.1910564

Vaughn, S., & Bos, C. (Eds.). (2010). *Strategies for teaching students with learning and behavior problems (7th ed.).* Allyn & Bacon.

Österholm, M., Bergqvist, T., Liljekvist, Y., & van Bommel, J. (2016). *Utvärdering av Matematiklyftets resultat: slutrapport*. Umeå Universitet.

Österholm, M., Bergqvist, T., Liljekvist, Y., & van Bommel, J. (2021). The Boost for Mathematics Evaluation Report. *Working papers in mathematics education*, 2021:1