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# Modularity in teacher professional development – building blocks for bridging everyday teaching practices and reform ideals centered around whole tasks

Michiel Dam and Fred Janssen

## ABSTRACT

Many reforms in past decades have come and gone without having the desired impact on teaching practices. Two shared ideals that reforms have had are offering challenging content by using whole tasks and tailoring student guidance to what students need for effective learning. In this article, we aim to bridge the reform-practice gap by taking a practicality perspective on how reform ideals are presented by exploring the concept of modularity. In this study modularity refers to how teachers can rearrange and adapt lesson-building blocks (e.g. explanation, checking homework or using a whole task) to change their teaching practices in line with reform ideals. We performed an explorative study (school-based PD programme) in which participants designed, enacted and reflected on authentic lessons using their student learning outcomes as input for subsequent lesson designs. Data were gathered about the use of building blocks and how teaching practices were developed in terms of using whole tasks and tailoring student guidance. Results show that participants made ongoing stepwise changes by building on what they already did successfully for both using whole tasks (e.g. change a task to recall into a whole task and shifting it to the lesson start) and tailoring student guidance.

## ARTICLE HISTORY

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## Introduction

Numerous reform initiatives in the past decades have had several shared ideals in common (Kennedy 2005, Paas *et al.* 2012). First, teachers should provide students with opportunities to learn challenging content and skills using authentic whole tasks in which students are actively engaged. In authentic whole tasks, students are expected to learn effectively because they use their own cognitive efforts for learning and new content and skills are productively related to prior knowledge and skills. Second, student guidance when using authentic whole tasks should be tailored to what students need so that the full range of students can learn effectively whereby both unguided discovery learning and fully guided discovery learning are mostly ineffective (Hmelo, Duncan and Chinn, 2007; Kirschner *et al.* 2006).

Many reform efforts around these two shared ideals have come and gone without having the desired impact on teaching practices (Hamilton *et al.* 2003, Janssen *et al.* 2013, Fullan 2015). Larry Cuban's statement about how we reform education 'again, again and again' is still as valid today as it was when he first expressed it (Cuban, 1990). How can it be that teachers who are so caring for their students and well-educated to provide high-quality education are seemingly so resistant to change? In considering the gap between reform ideals and everyday classroom practices, several authors have proposed hypotheses about the failure to change classroom practice. Teachers were supposed

to lack knowledge or guidance to change their teaching (e.g. Borko and Putnam 1996), teachers were supposed to hold beliefs and values that conflict with those of the reforms (e.g. Pajares 1992) and yet others proposed that the very teaching situation itself (the many interruptions by e.g. office personnel, messages, special-purpose classes, scheduled breaks or bureaucracy issues) prevents teachers from teaching the kind of practices that reformers aim for (e.g. Ingersoll and Smith 2003). However, a very different hypothesis has received little attention so far. This novel hypothesis is based on what most teachers say about reforms: the ways in which reform ideals are presented are implicitly unattainable within the work of teaching (Kennedy 2005, Janssen *et al.* 2013). For example, reform goals often specify that all students, regardless of ethnic or economic background should be challenged to develop their individual powers of mind. Can teachers actually do that with a particularly broad array of students? And how can this be done within existing teaching settings where teachers have so many goals, demands and challenges? And what approach can be taken to include these goals into these existing practices? The answers to these questions lead us to rethink the ways in which reform ideals are presented and implemented. In other words, there is a need to rephrase reform ideals by making them practical for use by teachers.

From practicality theory (Doyle and Ponder 1977), we know that teachers will only perceive new reform initiatives or innovations as practical when they comply to three demands. First, the innovation needs to contain instrumental content so that teachers know how a reform proposal will work out in the classroom. Second, the innovation needs to be congruent with how teachers regularly teach. Third, the innovation should have low cost in terms of the time and energy that teachers need to invest. In this study we explore how the concept of modularity can play an important role in making reform ideals practical. Modular design refers to a cost-effective and generative approach aimed at offering instrumental content for managing complexity in design during innovation (Campagnolo & Camuffo, 2010; Holland, J. H 2000). It involves decomposing complex designs into middle-level building blocks (modules) followed by recombining and adapting these building blocks in order to create innovative new designs (Janssen *et al.* 2013, Dam *et al.* 2020). The focus in the present study is on how we can use modularity to make the two ideals for contemporary innovations practical (reform ideal 1: provide students with opportunities to learn challenging content and skills using authentic whole tasks and reform ideal 2: tailor forms of guidance while using a whole task to what students need (reform ideal 2).

Insight into what constitutes effective teacher learning has shown that teachers are not to be regarded as the ones who simply execute pre-designed reform materials, but are to be considered as partners in the design and implementation processes of reform ideals. Also, effective teacher learning should productively connect teacher and student learning (Borko *et al.* 2010). In the present study, therefore, teachers work from their own professional expertise in the design and experimentation process by taking an inquiry approach to their own learning. Teachers were asked to cyclically design and redesign lessons for their own classes for which they used their students' learning outcomes as input for new developmental steps. We will first report on the design of a model consisting of modules (lesson building blocks) aimed at making the two reform ideals practical. Next, we will report on an explorative study done within the setting of a PD program in which teachers take a reflective approach and use this model to design, enact and reflect on lessons using their student learning outcomes as input for subsequent lesson design.

## 2. Theoretical framework

### 2.1 Reform ideal 1: Using an authentic whole learning task

It is commonly understood that teaching should be meaningful to students and incorporate students' existing conceptions. To address this, many reform initiatives in the past decades as well as more recent instructional theories have advocated using authentic whole learning tasks and addressing real-world problems as the driving force for learning (Kennedy 2005, Merrill 2007, Paas

*et al.* 2012). In authentic whole learning tasks (whole tasks), students are provided with opportunities to learn challenging content and skills and use their own cognitive efforts for learning. Whole tasks cover integrated knowledge and skills in a certain domain or even between domains and are the opposite of more atomistic designs where complex contents and tasks are usually reduced to simpler elements which can easily be transferred to learners through a combination of explanation and practice (Merrill 2007, Paas *et al.* 2012). When students productively use their cognitive and metacognitive skills within whole tasks they are challenged to acquire certain complex, higher-order cognitive skills. These cognitive skills (e.g. problem-solving, self-regulation, domain-specific reasoning) may vary according to the way in which whole tasks are elaborated into the learning process (see section 2.2).

Literature shows that using whole tasks can have a positive influence on skill acquisition, conceptual learning, motivation and the ability for transfer (e.g. Van Merriënboer and Kirschner 2007, Lim *et al.* 2009; Roll *et al.* 2012). For example, when comparing the use of whole tasks followed by instruction to direct instruction, Loibl and Rummel (2014) have shown that the use of whole tasks increases conceptual learning. The proposed mechanisms that account for this is that problem solving before instruction prepares students for a deeper understanding of the content during the subsequent instruction (Schwartz and Bransford 1998, Loibl and Rummel 2014) and the need to actively use prior knowledge about the domain (e.g. Kapur and Bielaczyc 2012). The solutions of students who were asked to solve complex problems in whole tasks before receiving instruction were often found to be of poor quality (Kapur, 2012; Loibl and Rummel 2014). However, even if this approach seemingly led to failure, students from groups that solved complex problems before instruction outperformed the control group that did receive instruction in the post-test consisting of complex whole tasks, suggesting a productivity in the failure. Kapur (2008) argued that delaying instruction helped students to discover how to structure complex whole tasks, thereby facilitating a transfer of problem-solving skills to new settings and new problems.

## 2.2 Reform ideal 2: Tailored student guidance when using whole tasks

The amount of guidance or structure when learning within whole tasks is a much debated topic in educational research. Too little guidance would leave students feel lost, unmotivated or would even hinder learning (Van Joolingen *et al.* 2005, Kirschner *et al.* 2006) and too much guidance takes away the joy of discovering something yourself and subsequent deep learning. Guidance can be operationalised in a variety of forms, such as scaffolding (e.g. question prompts, flowchart models), structuring the problem (e.g. highlighting relevant components), provision of tools, content support or ad hoc teacher or expert assistance (e.g. clarifying terms or explaining important solution components) (see Hmelo-Silver *et al.* 2007; Kapur, 2012, Puntambekar and Hübscher 2005).

Classifications of approaches to guidance when using whole tasks are often based on three more or less-fixed instructional models about how people learn (Bruner 1996; Bransford, 2005, Merrill *et al.* 2008). First, guidance can be based on *direct instruction* which regards students as learning from didactic exposure and the acquisition of propositional knowledge, presuming the learner's mind as blank slate that has to be filled with information. In direct instruction teachers are often in the lead, explaining new concepts or skills followed by further learning taking place via guided application and recall. A second approach regards students as imitative learners. In this *apprenticeship* model learning takes place through imitation and demonstration; teachers or experts demonstrate how to perform certain tasks and learners learn by imitation. This also implies a predominant teacher led starting phase, followed by phases in which teachers and students operate together. A third instructional approach sees students as rather independent thinkers and constructing knowledge using self-regulation (*discovery learning*). Discovery learning has been studied intensively, showing that both highly guided and unguided forms have undesired outcomes. Discovery learning emphasises the discovery aspect, that is, learners are supposed to reveal one or more underlying concepts or models by running real or paper-pen

experiments or solving complex problems. This can often not be done without offering guidance for learning activities that limit the problem-solving space and therefore the middle ground, guided discovery learning, seems to be advantageous (e.g. Van Joolingen *et al.* 2005, Kirschner *et al.* 2006). Unguided forms of discovery and problem-solving in whole task settings prior to instruction show that students often fail to find correct solutions (e.g. Kapur and Bielaczyc 2012). However, in the light of the previous findings by Kapur and Bielaczyc (2012) we also know that failure during discovery or problem-solving due to little or no guidance can lead to a better transfer of problem-solving skills. Thus, while literature on guided discovery learning shows certain benefits of guidance, we need to acknowledge that guidance might not be beneficial in every setting. Kapur (2010) even found some negative effects of high instructional guidance during problem-solving in whole tasks prior to instruction.

Another factor that should be taken into account while designing effective guidance is that the actual classroom setting always enables and limits certain forms of guidance. Teachers design lessons for specific classes that are part of certain schools having all sorts of dynamics, values and norms – what Doyle and others called the ecology of teaching (Doyle 2006, Daly *et al.* 2020). For example, the physical space in which teachers teach their class only allows certain choices for guidance (e.g. multimedia use, grouping, instrument use). Also, classes have a curriculum that prescribes what concepts and/or skills are expected to be known and studied within a certain domain, limiting the use of certain forms of guidance.

A final factor that influences the design of effective guidance when learning within whole tasks is that teachers should be able to cover the needs of the full range of students so they can learn effectively. The various forms of guidance as presented in this section already provide options. Teachers, however, should also be able to aim for differentiation between different classes, between groups of students within a class or even between individual students as most classes consist of students that have varied learning needs and cognitive abilities (Tomlinson and Tomlinson *et al.* 2003). For example, learners in German language teaching that already have a high speaking proficiency require less or different guidance compared to those having a low speaking proficiency within that same class. When using whole tasks, teachers should be able to tailor the amount of guidance to what their students need as a class or in more differentiated forms.

### 2.3 Making reform ideals practical

How can these two shared reform ideals of using authentic whole tasks (section 2.1) and tailoring student guidance when using whole tasks (section 2.2) be made practical for teachers? For that, we first need to understand the work of teaching. What we know from literature is that most teachers are passionate about their work and well-educated to provide high-quality education (Kennedy 2005). We also know that the very act of teaching puts constraints on what is possible and attainable in lessons. Classrooms are not just the places where teaching and learning take place (see e.g. Doyle 2006). Even if teachers strive for optimum solutions (e.g. student learning) they are often bounded by the elements of teaching which are influenced by three aspects that constitute design: goals, context and resources (Janssen *et al.* 2017). Teachers always have multiple simultaneously important *goals* to address such as promoting the classroom norm or maintaining momentum (Kennedy 2016a). Teachers also teach in a complex and crowded *classroom setting* which limits the number of possibilities (e.g. preferences, abilities, class history, and demands of external accountability measures) (Ball, 2015). Third, teachers also have limited *resources* to explore possible alternatives and their consequences as well as limited time to prepare lessons, e.g. Dutch secondary school teachers only have on average 15 minutes paid time to prepare a lesson (Bergen *et al.* 2009). Together, these design aspects frame a teachers' perspective on what he/she considers to be practical. Teachers only consider a reform initiative to be practical when it complies with three demands (Doyle and Ponder 1977; Janssen, 2015). First, the reform

initiative needs to contain instrumental content so that teachers know how a reform will work out in their classroom. Second, the reform initiative needs to be congruent with how teachers regularly teach. Third, the reform initiative should have low cost in terms of the time and energy that teachers need to invest.

Therefore, instead of aiming for one or more fixed and optimum solutions, a reform initiative should be presented in such a way that it is congruent to what is possible and attainable for teachers in their classrooms. It should also offer instrumental content that teachers can work with to make change happen in line with reform criteria. In this study, we propose and explore the use of modularity as an instrumental means to bridge this gap between abstract reform criteria and teachers' regular, day-to-day practices. Modularity refers to a modular approach which comprises the decomposition of a larger whole into middle-level modules or building blocks, followed by rearrangement of the modules to propose change. On the basis of earlier work on the decomposable nature of complex wholes (e.g. Simon 1996), Holland, J. H (2000) states that most innovations can be understood as the rearrangement of the smaller parts or building blocks that make up a certain structure. An example from the area of architecture is that buildings are made up of modules such as brick, steel, wood and glass that architects use to design and redesign many different types and forms of buildings and structures.

In order to propose innovation in a certain area one first needs to find the essential building blocks (Campagnolo & Camuffo, 2010; Holland, J. H 2000). Next, these building blocks can be rearranged and adapted to propose changes congruent to existing situations or practices. Following, suitable building blocks should offer the possibility to depict both desired and existing/regular situations and allow change by recombination and adaptation. Translated to the area of research in this study, being the main teaching and learning process in education, we propose a modular model that comprises building blocks that focus on the main instructional sequence happening in an authentic classroom. For the first reform ideal of using authentic whole tasks, this was translated into building blocks such as *checking homework*, *explanation*, *using a whole task*, *application* and *using a task to recall*. Within the building block of using a whole task, three phases can be distinguished: a *task preparation*, *task enactment* and *task reflection* phase. For the second reform ideal of tailoring the precise amount and form of guidance to what students need when using whole tasks, it is also important that teachers can depict both desired and existing approaches to guidance (see section 2.2). In a rough sketch, we therefore proposed that each of the building blocks of the model (e.g. *explanation*, *using a whole task*, *application*) can be guided by the teacher (teacher guidance), guided in a shared manner between teacher and students (shared guidance) and guided by students themselves (students guidance) (see Vermunt 1998, Dam *et al.* 2018, p. 2020). In Figure 1, we present the resulting model which is made up by two axes. On the vertical axis, we present a set of building blocks that together can form any instructional sequence. On the horizontal axis, we present the type of guidance to be executed by either the teacher, shared or students themselves.

The modular approach in this study further used the following heuristic to work with the building blocks (see Janssen *et al.* 2013, Dam *et al.* 2018): 1. Represent a teacher's regular practice for teaching a lesson as a series of building blocks. 2. Represent the desired teaching practice similarly to a series of building blocks. 3. Establish how, by recombination and/or adaptation of building blocks, a teacher's regular lesson can be redesigned to create the desired lesson.

In the present study, we explored the extent to which the two main reform ideals can be made practical by studying A. how teachers for all kinds of subjects use the model to propose change and B. how teaching practices develop over the course of a professional development (PD) programme when using the model. The PD program took an iterative approach and teachers were asked to measure and use their student learning outcomes as input for subsequent lesson design. In the PD

Guidance Instructional Sequence	Teacher	Shared	Student
Checking homework			
Explanation			
Task to recall			
Application			
Whole task preparation <sup>1</sup>			
Whole task enactment <sup>1</sup>			
Whole task reflection <sup>1</sup>			
Test			
Reflect			

Note. Building blocks for the instructional sequence relating to principle 1 (using whole tasks) shown vertically.

Building blocks for principle 2 (tailoring student guidance) shown horizontally.

<sup>1</sup> Within using a whole task, three phases can be distinguished: a *task preparation*, *task enactment* and *task reflection* phase.

**Figure 1.** Building block model.

program, teachers took a solution focused approach by focusing on successes rather than problems as these have shown to stimulate the formation of stronger intentions to change (Janssen *et al.* 2008, Dam *et al.* 2018). The research question for this study: *How do teachers' teaching practices develop within the setting of a PD program when using a modular model aimed at making two main reform ideals practical?*

### 3. Method

#### 3.1 Participants and research setting

This study has an explorative approach and took place at a large government-funded secondary school in the West of the Netherlands. The first author was asked by the school board to arrange professional development for teachers in all subjects and aim for active student engagement using whole tasks and offering differentiated forms of guidance so that all students were challenged to actively learn and effectively supported at their respective level. We sent an invite by email to all concerned school teachers (n = 45) and visited teacher team gatherings to explain the purpose and background of the programme. As a first response, 20 teachers agreed to participate out of which ultimately 11 teachers actually followed the PD programme. The other nine were impeded from participating due to school tasks such as substituting for colleagues having high levels of stress and burnout or being assigned extra mentoring tasks. The average number of students per class at government-funded Dutch secondary schools is 24 which resembles the class sizes in many other Western countries. Also, students in Dutch classes have approximately the same learning level. Teachers in the Netherlands, who work full time teach 24 lessons of 50 minutes each per week.

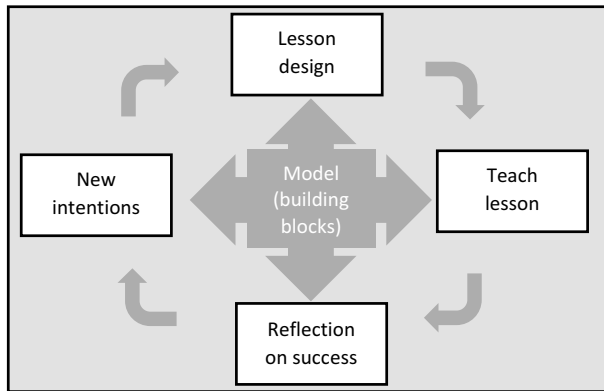


Figure 2. Survey of the reflective approach in the PD program.

### 3.2 Structure of the PD program

Participants followed a PD program in which they took an iterative reflective approach to their PD consisting of four phases (see Figure 2): Lesson design – Teach lesson – Reflection on success – New intentions. Participants designed, taught and reflected on a total of four lessons. The PD program comprised the following steps (see also Table 1,2):

*Step 1:* Participants were first interviewed using the MECI technique (Dam *et al.* 2018; elaborated below). In this MECI interview, participants expressed their regular instruction using the building blocks of the model (e.g. checking homework – explanation – application – test) and formulated an intention for change, e.g. 'I want to start my lesson with a whole task instead of me explaining everything at the start'.

*Step 2:* Participants used the model to design a lesson on the basis of this intention. Participants also designed a short student learning questionnaire (SLQ) aimed to determine the extent to which their students met the learning goals and set expectations for learning (e.g. I expect that 85% of the students will score sufficiently for this topic). Note that the outcomes of the SLQ were no research data in this study but rather served as input for reflection on the lessons by participants themselves (see Dam *et al.* 2020).

*Step 3:* Participants taught the designed lesson and administered the SLQ in the final part of the lesson.

*Step 4:* Participants reflected on problems and successes in their lessons for which they used their own observations as well as the outcomes of the SLQ compared to their expectations set beforehand (e.g. 'My lesson did not go as planned, SLQ scores were lower and they looked bored to me because ...'). This

Table 1. Survey of participants.

Participant	Age	Male/ Female	Teaching experience (years)	Grade Level <sup>a</sup>	Subject
Round 1					
Tess	61	F	36	GSE	Biology
Laura	34	F	12	PUE	French language
Angela	48	F	5	GSE	Dutch language
Alison	61	F	35	GSE	English language
Aliyah	42	F	17	LVE	Creative arts
Gael	38	M	11	PUE	Geography
Stella	43	F	21	PUE	History
Raegan	59	F	13	GSE	English language
Roland	38	M	14	PUE	Dutch language
Isabella	23	F	1	PUE	French language
Tiara	52	F	14	GSE	French language

Note. <sup>a</sup>PUE = Pre-university education, GSE = General secondary education, LVE = Lower vocational education

**Table 2.** Survey of the cyclic steps in the PD programme.

PD program	What participants do	Research data
Step 1: Starting interview (MECI <sup>a</sup> interview)		Regular instructional sequences Intentions for change Strength of intentions
Step 2: Lesson design	Participants design a lesson using the model. For the first lesson, they used their intention from the MECI interview as starting point Participants design SLQ to determine student learning	Instructional sequences of designed lessons
Step 3: Teach lesson	Participants teach the designed lesson and administer the SLQ in the final part of the lesson	
Step 4: Reflection on success	Participants reflect on the lesson using fixed reflection questions For this, they use their observations as well as the outcomes of the SLQ compared to their expectations set beforehand Think back to earlier successful experiences with the goal behaviour	Successes or problems (as an answer to the following question: Looking back on the lesson, did the lesson go as planned? What went well? For this, use your observations and compare the SLQ scores to your expectations. Explain why)
Step 5: New intentions <sup>b</sup>	Participants set new intentions for change using fixed questions This new intentions was used as input for subsequent lesson design.	Intentions for change Strength of intentions (as an answer to the following question: What next change to your lesson design could improve student learning in line with the goal situation? And: What is the strength of this new intention (on a 1–7 Likert scale, 1 = very low to 7 = very high).

<sup>a</sup>The MECI technique is an interview method that aims to stimulate strong intentions for change in the setting of educational reform (Dam *et al.* 2018). Used with permission. <sup>b</sup> Participants executed this cycle for a total number of four lessons

reflection was scaffolded by the researchers by presenting participants with questions in an online reflection format (see Table 2- right column – reflection on success). It's important to note here that our focus on these questions is on success and solutions rather than problems and failure. In educational settings, reflection is often considered a problem-solving method because the starting point for reflection is a difficult or problematic experience where the reflection strategy helps to formulate and analyse the deeper problem, considering alternative solutions of which one is tested out (Lee 2005). Regarding reflection as problem-solving, however, has shown to impede motivation for further change (Korthagen and Vasalos 2005, Janssen *et al.* 2008). In this study, we take a very opposite perspective and frame reflection along with Seligman and Csikszentmihalyi (2000) as focusing on solutions and positive experiences. In such an approach, attention is given to what went well in the lesson and what goals someone would like to achieve next, followed by a focus on previous successes with the goal situation and positive personal qualities that teachers can use to grow towards the goal situation (Janssen *et al.* 2008).

*Step 5:* Participants were asked to formulate a new intention which served as input for subsequent lesson design (see Table 2, right column- new intentions).

The PD programme comprised five meetings in total. To establish the goal situation, we presented the two reform ideals or characteristics into the following two sequences of building blocks of the model: A. *Whole task preparation – Whole task enactment – Whole task reflection*, and B. *Whole task preparation – Explanation – Whole task enactment – Whole task reflection*. In the first meeting we presented three short examples of whole tasks: 1. Students are given two sentences and must analyse together what the difference between them is. Then, in a group, they arrive at the difference between the two conjugation forms, without the teacher having to explain it (Dutch language). 2. Students are given the role of a journalist at the time of a tide of the 'scientific revolution' and write an article about it for a popular magazine at that time (History). 3. Students

are given the role of Argentine scientists that try to clone Lionel Messi (famous soccer player). What do you need in your lab and how can you clone him in order to win the world championship? (Biology)

To stimulate strong intentions for change in the first meeting of the PD programme, we administered a so-called motivating-for-educational-change-interview (MECI) which is a validated interview technique specifically designed to stimulate the formation of strong and specific intentions to change (Dam *et al.* 2018). In the MECI, participants were asked to describe their most regular instructional approach and translate that into the building blocks of the model (e.g. checking homework, explanation, using a task to recall, reflection) followed by answering solution-focused questions like: Did you ever have positive experiences with the goal situation? And: When you compare your regular instructional sequence to the two reform ideals represented in the goal situation, can you think of anything that could take your regular instruction one step towards the goal situation? This final question served to elicit a first intention for change after which we asked the strength of this intention (on a 1–7 Likert scale, 1 = very low to 7 = very high). In the second to fifth meeting participants followed the steps in the reflective circle as described above (see Figure 1 & Table 2). Participants attended joint meetings so that they could ask questions and share experiences. However, as they followed an individual trajectory they worked individually on a computer on the reflections. In the final meeting of the PD programme, participants evaluated the PD programme and member-checked their individual developmental paths.

### 3.3 Data gathering and analysis

We gathered two types of data (see Table 2, right column). First, from administering the MECI we gathered regular instructional sequences, intentions to change and the strength of these intentions (on a 1–7 Likert scale, 1 = very low to 7 = very high). As the MECI has a rather fixed protocol that focuses on these outcomes, we can present these data in a survey without the analysis needed. Next, we gathered all the answers given to the questions in the reflective phases of the second to fifth meeting as data. As these questions were presented to participants in an online reflection format, we obtained these data in digital format as written out answers to questions (see section 3.2). As such, we could easily classify the outcomes into phases in the reflective approach (see Table 2, right column). Reflections yielded the following types of data:

*Instructional sequences.* The questions ‘What was the design of your lesson in building blocks?’ and ‘What was the content of each building block and how did you teach that?’ yielded data in the form of instructional sequences presented as a sequence of building blocks (four instructional sequences representing four lessons per participants in total), content descriptions and teaching approach for each building block. We analysed these as follows: First, we compared the instructional sequence of the first lesson to that of the regular instruction (also represented in building blocks) to find in what way participants changed their regular instruction to make use of a whole task. Second, we focused our analysis on the building blocks of using a whole task in all lessons as this was the focus of our study. For this, we analysed if participants mentioned one or more of the building blocks that make up a whole task and analysed the content descriptions of these building blocks. How did they design the guidance for each of these phases of a whole task (being either teacher, shared or students)? This analysis was done by the first author, followed by the same analysis by the second author and we discussed issues until agreement was reached. An example of where discussion was needed: are classroom conversations during ‘whole task reflection’ more teacher guided or a shared guidance?

*Successes and problems.* For this, we analysed the answers to the question: ‘looking back on the lesson, did the lesson go as planned? What went well? Explain why’. This question resulted in answers pointing towards a problem (answers such as ‘no’ or ‘not really’) or success (answers such as ‘yes’ or ‘SLQ scores were higher’) and attending explanations. With these outcomes, we could list the total number of participants encountering either successes (S) or problems (P) during

enactment. In reflecting on the lesson, participants made statements about their observations and the outcomes of the SQL. We did not analyse these statements in depth, these only served as input for participants' new intentions.

*New intentions.* The next question in the online reflection format was: 'what next change to your lesson design could improve student learning?' This yielded four intentions for each participant in total. We analysed these written out intentions together with the instructional sequences by categorisation: Did participants choose to repeat the previous change, propose a change in the same direction or choose a completely different direction for change? And did participants maintain the previous change or not? The final question in the online reflection format was: 'What is the strength of this new intention (on a 1–7 Likert scale, 1 = very low to 7 = very high)?' We listed all the intentions and strengths of each participant and next, on the basis of the direction of the intentions of the changes (see third question) calculated the average strength for each developmental direction. With this, we could see how many participants chose certain developmental directions together with the average strengths for these intentions.

## 4. Results

### 4.1 Using a whole task

The total set of instructional sequences shows that all participants chose to make use of a whole task in all four lessons throughout the entire PD programme. Also, except for Isabella's first lesson, all the whole tasks lasted the entire lesson (50 minutes). Compared to participants' regular instructional sequences (see Table 3, left column), we see that six participants would normally start the lesson with an explanation phase and five participants would start the lesson with a task to recall knowledge from previous lessons (after checking homework). Interestingly, none of the participants made use of a whole task in their regular instructional sequence. In this section, we will first describe

**Table 3.** Survey of the MECI interview outcomes.

Participant	Regular instruction in lesson segments	Intention from motivational interview (MECI) (teacher quotes)	Strength (1–7)
Tess	Checking homework – Explanation – Application or Task to recall – Test	'I want to replace a task to recall with a whole task and start the lesson with that task so that students can discover things for themselves'	5
Laura	Checking homework – Explanation – Task to recall – Test	'I want to rework a task to recall into a whole task and start the lesson having students find things out for themselves'	4
Angela	Checking homework – Explanation – Task to recall – Test – Reflection	'I want to start with a whole task instead of explanation'	6
Alison	Task to recall – Test – Explain – Application – Reflection	'I want to start with a whole task instead of a task to recall'	7
Aliyah	Checking homework – Explanation – Task to recall	'I don't want to explain all the lesson content but rather have students discover and find solutions for themselves using a whole task'	4
Gael	Explanation – Task to recall – Reflection	'I want to start with a whole task and have students work more independently'	6
Stella	Checking homework – Explanation – Task to recall – Test – Reflection	'I want to start with a whole task instead of explanation'	6
Raegan	Checking homework – Task to recall – Explanation – Application	'I want to start with a whole task instead of a task to recall'	6
Roland	Checking homework – Task to recall – Explanation – Application	'I want to rework the task to recall into a whole task'	6
Isabella	Checking homework – Explanation – Application – Reflection	'I want to turn checking homework into a whole task'	6
Tiara	Task to recall – Explanation – Application – Reflection	'I want to start with a whole task and not explain everything myself'	7

*Note.* These intentions serve as input for the first lesson design.

the results from the MECI interview and how participants made changes away from their regular sequence and next, present the results about how participants developed throughout the PD program as a whole.

Results from the MECI interview that was administered during the first meeting show that participants start off their PD by introducing a whole task into their teaching practice in multiple ways (see Table 2, right column). Five participants (Tess, Laura, Alison, Raegan and Roland) want to rework their existing ‘task to recall’ that they regularly start with into a whole task and start with that whole task. Four other participants (Aliyah, Angela, Stella and Tiara) express that they do not want to explain everything themselves and instead use a whole task to start the lesson with. One participant wants to rework the phase of ‘checking homework’ into a whole task (Isabella). Most participants express the strength of their intentions to be rather high (see Table 3), indicating a strong willingness to change. Aliyah and Laura scored the lowest (both a 4 on a 1–7 Likert Scale).

Next, as the PD programme progressed, participants kept using a whole task (see Table 4). Surprisingly, all participants used a whole task in all of their lessons. Participant Gael (Geography), for example, introduced a whole task into his teaching by having his students make a folder containing fun facts about the Netherlands to present a welcome for refugees. Throughout the PD programme, he kept using whole tasks having different forms of guidance to stimulate active learning. In the next section, we elaborate on how all participants started experimenting with other forms of guidance for the different phases of using a whole task (preparation, enactment, reflection).

#### 4.2 Tailoring student guidance when using whole tasks

We distinguished three phases within the use of a whole task: a *task preparation*, *task enactment* and *task reflection* phase. In the phase of task preparation, all participants showed to use a teacher guidance in their first lesson (see Table 4). During the PD program, some participants were shown to start using more shared and student guidance during the phase of task preparation. For example, in her first lesson Tess (Biology teacher) designed a task in which all students had to do a short hands-on practical for demonstrating human stereoscopic view using the dots method (in biology). However, in her third lesson Tess wanted her students to choose between three tasks (shared

Table 4. Survey of whole task designs during the PD.

Guidance	Lesson phase design	lesson	lesson	lesson	lesson
		1 n = 10	2 n = 11	3 n = 10	4 n = 11
	Task preparation				
Teacher	Teacher designs task	10*	10	9	7
Shared	Teacher designs multiple tasks and lets students choose		1	1	2
Student	Students design one or multiple tasks for other students				2
	Task enactment				
Teacher	Teacher first demonstrates how to solve the task	1			
	Classroom conversation	1			
	Students mimic how experts solve the problem – plus guiding questions	1			
	Students mimic how experts solve the problem – without guiding questions		1		
	Teacher offers smaller assignments on paper	5	3	1	1
	Teacher offers multiple learning routes, students choose		1	1	
	Purposive student matching: good students help other students			2	1
	Teacher offers criteria for answer and adaptive support on paper			1	
students	Teacher offers criteria for answer and oral help upon request	2	6	5	9
	Task reflection				
Teacher	Teacher presents answers or checks answers	7	5	3	2
Shared	Classroom conversation	1	5	6	7
Student	Compare to correct answers individually	1			
	Check each other's work and present feedback to other groups	1	1	1	2

\*Participant Isabella started her trajectory by designing a smaller task (checking homework) in her first lesson. All other tasks, both from Isabella and other participants were bigger tasks that lasted the entire lesson (50 minutes).

regulation) to improve student autonomy. Another example is Raegan (English language teacher), who designed a whole task herself in the first lesson (to have students write a letter to the English embassy). However, during the PD programme Raegan shifted towards having her students design tasks for other students (students create an online quiz for other student groups about the essay they read).

In the task enactment phase, there is a more dispersed approach to guidance. In total, we noticed participants to use a variety of eight forms of guidance in the enactment phase. On the one side of the spectrum there are participants such as Aliyah (creative arts teacher) who start the enactment phase of the whole task in the first lesson by having a teacher-led form of guidance (e.g. she wants her students to get information from two expert videos about gouging based on several questions that drive the quest for this procedural information). On the very opposite side of the spectrum, several participants start their development by only presenting students with criteria for the answer and offering oral help upon request (student guidance). Between these two forms, five participants chose to offer smaller assignments on paper in their first lesson. During the PD programme, we noticed an increase in the variety of guidance resulting in multiple forms of shared guidance (see Table 4). Interestingly, participants also moved towards more differentiated guidance. Laura (French language), for example, designed a task in which students had to practice speaking French using verbs that take the verb 'être' as auxiliary verb (e.g. partir, sortir, venir) in preparation for the oral examination. As a specific form of guidance, Laura wanted good students to help other students who indicated they desired help. Other participants designed more differentiated guidance by having students choose from multiple learning routes. Over the course of the PD programme, we can see a decrease in the forms of teacher and shared guidance and an increase in student guidance (nine participants choose to use student guidance in their final lesson versus two in the first, see Table 4). Interestingly, we expected teachers to have an inclination towards explanation before having students work for themselves (based on participants' regular instructional sequences) but none of the participants explained content during whole task enactment.

In the phase of task reflection, most participants start by presenting or checking the answers themselves (teacher guidance, seven out of 10 participants). Over the course of the PD program, however, this approach disappears and is replaced by most participants having a classroom conversation (shared regulation, in the fourth lesson implemented by seven out of 10 participants). We also noticed two forms of student regulation to appear in the phase of task reflection: 1. Students checking answers individually and 2. Students checking each other's work and presenting feedback to other groups.

### **4.3 Development of teaching practices**

In the PD program, participants developed their teaching practices in a step-by-step manner. Once they taught a lesson, participants reflected upon that lesson using their own observations as well as the outcomes of the SLQ compared to their expectations set beforehand. For example, Isabella introduced a whole task in her first lesson by changing a homework assignment into a whole task (learn how to read a clock in French) and offered students smaller assignments on paper for discussion. In her reflection, she mentioned that 'students were actively engaged with the content, although they made more noise than usual'. The outcomes of the SLQ that she administered showed that students adequately understood how to read a clock in French (only 3 out of 22 students scored insufficiently) which she considered to be a success compared to her expectation. Based on her observations, she wanted her students to work together more efficiently and with less help from her. Isabella mentioned that she once had a successful experience with efficient student cooperation in a project where students used the jigsaw method to create a poster. Isabelle therefore changed the enactment phase of her second lesson to a more open format, only offering criteria for the answer and oral help upon request. In her third lesson, she again changed the guidance of the enactment phase so that good students can help other students during the enactment phase and so on.

Some participants encountered problems in their lessons such as students that found content too difficult or participants not having enough time for everything they planned. For example, Aliyah (Creative Arts teacher) designed a whole task (her third lesson) around how to make a drawing from a 1-point perspective. She had students make up an instructional video about how to draw such a 1-point perspective for other student groups (offer criteria for answer and oral help upon request). In her observations, she mentioned that students were very active during the lesson. She also was surprised by the great variety of both the method of making the video as well as the content. The SLQ showed sufficient learning. However, some student videos did not explain the skill correctly, and she considered this to be a problem. In her fourth lesson, she therefore chose to repeat the instructional sequence and form of guidance (strength of the intention = 6) with better content criteria.

Considering the way in which participants change their teaching practice, we can see some differences among participants. For although all participants systematically apply the first reform ideal in line with the goal situation (using an authentic whole task) and most are shown to apply ideal 2 (tailoring student guidance) in a variety of forms, there are some exceptions. For example, participants Gael and Isabella show to make a first change to their teaching practice and keep this the same throughout the PD programme by repeating the approach for other topics. Other participants (Tess, Angela, Alison, and Aliyah) predominantly make changes to the phase of task preparation where other participants do not. Also, there is one participant (Tiara) that shows a 'reverse' development in comparison to others. Tiara started off with having a rather student guided enactment and reflection phase, but found that task to be too 'open' for students. Therefore, she designed her next tasks to be more and more teacher guided. Finally, there are three participants (Isabella, Roland and Laura) who focus their designs on differentiated teaching by designing guidance to be either 'Teacher provides multiple learning routes' or 'Purposive student matching: good students help other students'.

In Table 5 we present a survey of participants' development routes. What we found is that most participants keep the changes they made to their teaching practice when designing new lessons. Only one participant does not maintain the change in lesson 2. However, she still wants to make a change in a new direction. Second, we also found that participants did not stop developing during the PD programme. Rather, they continued in their development route and were mostly successful in their attempts to make changes (see Table 5, second column). Even as participants experienced that their SLQ outcomes were not as expected or when they encountered difficulty in class (problem), many still tried out new directions to make their lessons successful. After lessons two and four, half of the participants wanted to repeat the approach using a similar whole task and form of guidance for another topic. As some participants expressed: 'I want to see whether my new

**Table 5.** Survey of the PD directions after experiencing success or problems.

Lesson	Total participants encountering Success (S) or problem (P)	Maintains the changes, intentional change in new direction		Maintains the changes, intentional change in same direction		Maintains the changes, wants to repeat the approach		Does not maintain the changes, intentional change in new direction		Stops developing
		n	strength	n	strength	n	strength	n	Strength	
Lesson 1	9	Success	8	5.9 (av)	–	1	5	–	–	–
	1	Problem	1	6						
Lesson 2	9	Success	4	5.8 (av)	–	4	6.5 (av)	1	7	–
	2 <sup>a</sup>	Problem				1	6			
Lesson 3	6	Success	3	6.3 (av)	1	6	2	6 (av)	–	–
	4	Problem	2	6 (av)			2	6.5 (av)		
Lesson 4 <sup>b</sup>	8	Success	1	3	3	5.3 (av)	5	6 (av)	–	–
	3	Problem			1	5	1	7		

<sup>a</sup>Participant Stella did not design a third lesson and therefore, we cannot include the reflection on the problem she encountered in the analysis. <sup>b</sup>Based on the intentions for future changes

approach also works for other, more difficult topic'. The average strengths of the intentions (on a 1–7 Likert scale, 1 = very low to 7 = very high) show that participants mostly had strong intentions to change (see [Table 5](#)).

## 5. Conclusion and discussion

In this study we have focussed on how two important, but rather abstract reform ideals (using whole tasks and tailoring guidance when using whole tasks) can be made practical for use within teachers' day-to-day, busy and complex work. Knowing that the setting of a classroom and the very work of teaching puts constraints on what is attainable in educational reform, we followed insights from practicality theory (Doyle and Ponder 1977) to make these ideals practical. Practicality theory prescribes that reform content needs to be instrumental, connected to what teachers already do (congruent) and has little cost in terms of teachers' time and energy. Following this, we propose the concept of modularity (the use of modules or building blocks to rearrange existing situations into innovation) and designed a modular model aimed at assisting teachers in making changes. Next, we studied if and how teachers for all kinds of subjects change their regular instructional approaches in line with the two reform ideals in practical terms.

From the results, it becomes clear that participants were indeed able to change their regular instructional sequence towards using a whole task (reform ideal 1). All participants chose to design a first lesson starting with a whole task for which they turned a task to recall into a whole task or turned the explanation phase into a whole task. This contrasts with their regular instructional sequences, where not one participant would start with a whole task (see [Table 3](#)). We think that this first change towards using a whole task in the first lesson away from their regular instructional sequences can predominantly be explained by use of the MECI (motivational starting interview) in which participants were asked to think back to earlier successful experiences and made aware of their personal strength that pointed them to both their willingness as their capability to change (Dam *et al.* 2018). Next, during the PD programme, all participants designed all four lessons containing a whole task to start and none of the participants wanted to explain content first. Considering the second reform ideal (tailoring guidance when using a whole task) we saw an increase in the variety of forms that participants used. Also, during the course of the PD program, participants' use of shared and teacher forms of guidance decreased and the use of student guidance increased (e.g. students design tasks for each other, teacher offers criteria for answer and oral help upon request). Some participants (Isabella, Roland and Laura) saw a need for differentiation between students or groups of students within one class and designed guidance accordingly (e.g. by having good students helping other students). From the PD routes, we can conclude that even after problems, participants continued developing. This persistence in professional development contrasts with findings in other research, where motivation to proceed in development was low once problems were encountered (e.g. Borko *et al.* 2010).

One of the limitations is that the approach that we took was studied in a Dutch setting in which teachers in secondary education, e.g. have a relatively high degree of autonomy and teach many classes to crowded classrooms each week. The exact results are therefore not directly transferable to other settings. However, precisely because the design of the approach is such that individuals in a particular setting go through an individual learning trajectory, the approach could also work for many other settings and domains. How the professional development develops depends on the intentions of the participants and the available building blocks in the domain in which successful experiences determine the growth and route. The approach itself also explicitly takes into account the situation that the individual is in, e.g. in the form of available time and resources and goals, which allows us regard the approach itself as situated. Another limitation is that it would be interesting to study the influence of the facilitator and school management on how teachers develop

as in the present study these were supportive to the PD programme. A third limitation is that we did not videotape the lessons but rather took teachers' written reflections into account. Comparing video's with lesson plans and reflections could possibly reveal unnoticed issues during enactment.

Coming back to the literature, we can discuss the ways in which the present study relates to known characteristics of high-quality teacher PD (see Guskey 2002, Borko *et al.* 2010). Educational research is currently at a stage in time in which we have developed relatively specific theories for *student* learning, yet ideas and theories about *teacher* learning are less specific. Therefore, it is important to contribute to more specific theory formation about teacher learning and, even more specifically, about how teachers can incorporate new educational ideas into their ongoing systems of everyday practice (Kennedy 2016b). In the design of our study we incorporated the set of characteristics of high-quality teacher PD as previously formulated by Borko *et al.* (2010). Reflecting on how these characteristics played out in the PD programme we are consistent in that we, e.g. focused the PD programme on *connecting teacher and student learning* by having participants gather student data in their lessons and reflect on these learning outcomes to formulate new intentions. We also based the PD programme at the actual school where the participants worked and participants exchanged ideas within a group (*school based* and *collaborative*).

On the basis of this study we can, however, also explicitly add to, and provide further insight into two of the PD characteristics: 1. PD content is situated in practice; addresses problems of practice; 2. Active teacher learning; teacher inquiry. We fully agree that PD should be situated in practice and address problems of practice and that teachers should learn actively by inquiry and experimentation. However, the ways in which reform ideals are presented in the light of that practice are often implicitly not practical for teachers which results in a gap between reform ideals and practices. Current approaches to teacher PD have often chosen to close this gap by either providing teachers with rather abstract fixed instructional models or providing concrete core practices. Most fixed ID models for using whole tasks and tailoring guidance to what students need in whole task learning (see e.g. Van Merriënboer and Kirschner 2007) can hardly be used in practice as these are too complex for use in day-to-day practices where teachers need instrumental content that connects to their existing practices. A second approach to bridge the reform-practice gap are so-called core practices. Core practices are stated to be several concrete parts of ambitious practice that are desired by teacher educators and reformers. These core practices are trained in isolation before eventual enactment in more complex teaching practices (Ball and Forzani 2009). However, a known challenge for using core practices in teacher PD is that there is a 'skill versus will' dilemma which speaks about the need for teachers to develop a will to enact core practices besides developing the necessary skill (Lampert 2012). Also, as teachers learn certain core parts of a more ambitious practice in isolation and outside of their authentic school setting (e.g. how to elicit student ideas) they encounter problems when they ultimately recompose multiple-core practices in the design and enactment of complete lessons and in their actual authentic school setting (Janssen *et al.* 2015). What both approach share is that they strive for an approach that optimises student learning, but they do not explicitly consider the practicality of the approach for teachers. It is implicitly assumed that a teacher seeks only the most optimal solution for students appropriate to learning goals that have been formulated. Simon (1996) has called such an approach 'Olympic rational' to indicate that it is not actually feasible for many people in complex situations, which is what teachers find themselves in. Instead, he, and his followers make a case for bounded rationality. This explicitly assumes that people in complex situations strive for several goals at the same time and that the available time and resources are limited (Wimsatt 2007, Gigerenzer and Gaissmaier 2011). We must take this into account if we also want to make approaches usable in practice for teachers. Modularity is a very common strategy that can be used to deal with this complexity. Instead of innovation from scratch, for which time and resources are often lacking and which, moreover, often do not match several goals at the same time, innovation takes place through recombination and adaptation of existing building blocks (Campagnolo & Camuffo, 2009; Holland, J. H 2000).

Working from bounded rationality also has implications for the second characteristic of effective PD, being active teacher learning and teacher inquiry. Most existing research about how teachers learn actively in the setting of educational reform is done from a reformers' perspective that takes little account of teachers' complex classroom ecology. Such research focuses on how teachers can best be trained to actively use materials and practices associated with the reform according to their design (Davis and Krajcik 2005, Remillard 2008). A second prominent perspective emphasises teachers' professional expertise and autonomy without guidance (teachers' perspective). In turn, this may lead to creative adaptation of a reform with the risk of losing the essence. In the present study a novel, success-oriented perspective to active teacher learning was introduced which is not so much grounded in a teachers' or reformers' perspective. It has a strong focus on both the essence and goals of a reform initiative as well as teachers' everyday teaching practices, yet takes teachers' complex classroom settings with its practical requirements and teachers' professional autonomy very seriously. This novel perspective sees teachers themselves as professionals who are immersed in inquiry, questioning and experimentation centred around and enacted in their own teaching practices using modules (lesson building blocks) as the main objective of experimentation. As teachers are often already familiar with the lesson-building blocks and feel that they do not have to discard everything they value (Fullan 2015) this specifically relates to the congruency criterion of practicality. Furthermore, this study also shows that active teacher learning should be done in a success-oriented way. Most teacher learning uses a deficiency approach, in which teachers are expected to remedy their shortcomings, but the success-oriented approach used in this research has an opposite focus. By explicitly using earlier successful experiences, attention was given to particular strengths of individual teachers (what they already do and are good at) and their intentions to change that they already have or have yet to develop. In this study, this success-oriented approach resulted in strong intentions (high scores for strengths) to change and keep changing throughout the PD.

### Short biographical note

**Michiel Dam** works as an assistant professor of science education at Leiden University. His research focuses on teacher learning and the interplay between what teachers and students learn in the setting of educational innovation.

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