LEARN TO THINK: DEVELOPING A CROSS-CURRICULAR TEACHING METHOD TO ENHANCE CRITICAL THINKING IN THE FIRST STAGE OF SECUNDARY EDUCATION

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ABSTRACT

Especially in times of fake news and populism, critical thinking is a key skill for students to master. In the ongoing "Redeneerling"-project[1], a cross-curricular teaching method is developed aiming to stimulate the critical thinking skills of students through dialogue, focusing on argumentation skills, recognition of logical fallacies, and analysis of sources. Following the principles of education-design research, the "Redeneerling"-teaching method is developed and evaluated in different cycles in cooperation with interdisciplinary Teacher Design Teams. The goal of this practical research project is to formulate the design principles of the cross-disciplinary critical thinking approach. In addition, we aim to identify the teacher's attitude towards the teaching method. Interviews and observations allow us to discuss how some critical thinking skills are easier implemented into specific school subjects than others. The discussion includes the role of visualization and vocabulary necessary to link these skills across different subjects. Preliminary findings show how teachers appreciate the approach as it helps them to stimulate argumentation and reflection among students.

[1] The term 'Redeneerling' is a creative compound of the Dutch words for reasoning (*redeneren*) and pupil (*leerling*).

INTRODUCTION

In a so-called 'post-truth'-era (Peters, 2018), critical thinking is crucial to properly handle and interpret the constant flow of information. Therefore, critical thinking has been labelled as an indispensable 21st century skill (Saavedra and Opfer, 2012). However, tackling critical thinking and reasoning skills across subjects is challenging (Mulnix, 2012). As critical thinking is a broad concept, we focus on *(a) argumentation skills, (b) recognition of logical fallacies and nuance, and (c) source analysis*. The challenge is to help teachers focus on these skills in their classes. The use of *dialogue* where both teachers and students engage in a shared inquiry encourages students to use reasoning skills (Alexander, 2006; Hemberger, Kuhn, Matos, & Shi, 2017; Kuhn & Crowell, 2011; Resnick, Asterhan, & Clarke, 2018). However, having a dialogue with equal input from teachers and students can be challenging for the teacher. To overcome this challenge a teaching method is developed to be used in the first grade of secondary education (grades 7-8). The aim is to provide teachers with tools to stimulate critical thinking in students.

THEORETICAL BACKGROUND

What is critical thinking?

Critical thinking as an umbrella concept for three kinds of reasoning

Although the importance of critical thinking is broadly emphasized (Davies & Barnett, 2015), the concept appears to be rather fluid and covers different meanings. More specifically, different pedagogical perspectives can be identified on what critical thinking entails: the philosophical-logical, psychological, and critical pedagogical perspective (see Davies & Barnett, 2015; Rombout, 2021). Based upon insights by these different perspectives, a useful conceptualization of critical thinking in three domains has been constructed (Rombout, 2021, see also Barnett, 1997). The first domain, *critical thinking as critical reasoning (or logical thinking)*, refers to skills that lead to a well-considered judgement of what is true and reliable, such as identifying logical fallacies. The second domain, *critical thinking as critical judgement and action*, covers the judgment of what is the right thing to do and act upon this judgement. This domain concerns moral, ethical, and political judgment. The third domain, *critical thinking as critical self-reflection*, refers to questioning one's reasoning.

Focus upon three categories of critical reasoning

In this project, we focus upon the domain of critical reasoning (logical thinking). In other words, we aim to learn students to reason independently, to carefully gather reliable information, and evaluate and analyze the arguments. In this domain, we focus on three categories of logical thinking: (a) *argumentation skills*, (b) *recognition of logical fallacies and nuance*, and (c) *source analysis*. Within each of

these three categories, we focus upon two particular skills. To build and analyze arguments (a), students learn to identify, correctly use, and understand the implications of "if-then" arguments and the conjunctions "thus, because, but, and unless" (De Maeyer, 2016). With regard to recognizing logical fallacies and to nuance (b), students learn to recognize and identify vague terms and false dilemmas. To provide students with tools for source analyses (c), they learn about the authority argument and learn to pose the question 'what wins the source?'.

Critical thinking: a skill as well as an attitude

We want to note that critical thinking is interpreted as a skill as well as an attitude[2]. The goal, thus, is to stimulate reasoning in the classroom and strengthen a positive attitude towards critical thinking, in students and teachers. In other words, the aim is that students find critical thinking important (*attitude*), as well as they are able to think critically and identify misconceptions in the specific lesson contents (*skill*). Therefore, teachers need to assess critical thinking as an important skill to master for students (*attitude*), as well as understand reasoning skills (*skill*). Teachers need to be able to couple the knowledge on reasoning with their own lesson content (cfr. Pedagogical content knowledge). We content that deploying on both critical thinking as a skill and attitude has a reinforcing effect.

A cross-curricular approach and the need for teacher teamwork

Developing complex skills such as reasoning requires long-term, regular stimulation (Hattie, 2008; Timperley, Wilson, Barrar, & Fung, 2007; Torff, 2019). Multiple opportunities for students need to be provided to work with key concepts in different contexts. A cross-disciplinary approach encourages students to make the transfer from one subject to another, as well as from school to everyday life (Halpern, 1998). However, such an approach asks for a meticulous collaboration of teachers. The complexity and expectations of the teaching profession call for teamwork (Struyve, 2019). Indeed, a shift has occurred from the teaching profession as characterized by isolation and individuality towards a team effort (Louis, Marks, & Kruse, 1996). Teachers are expected to build bridges between the classroom and the world as well as to be more of a didactic expert rather than a subject expert (Sassenus, Boderé, Van Gasse, and Van Petegem, 2018). Professional learning communities can act as an instrumental resource, with teachers sharing expertise, knowledge, and teaching materials (Struyve, 2019).

Teaching critical thinking through dialogue and systematic explication

According to educational research, effective instruction on reasoning meets the conditions of explicitly and reflectivity (e.g., Khishfe & Abd-El-Khalick, 2002;

[2] Thus, we do not focus on critical thinking as an act, which is a vision that underlies the second domain of critical thinking ('critical thinking as critical judgement and action').

Abell, Martini & George, 2001). Explicit instruction on central concepts and strategies regarding critical reasoning in combination with practicing is a proven method (Abrami et al., 2015). Students learn and use reasoning skills better and faster when awareness of the skill is sparked (Sun, Slusarz, & Terry, 2005). When a teacher helps to make a skill explicit, the student will more quickly master complex skills, such as reasoning skills.

Dialogue has been identified as an important means to enhance critical thinking (Davies & Barnett, 2015) and reasoning skills specifically (Kuhn & Crowell, 2011). Various forms of dialogue can be distinguished, ranging from the exploration of prior knowledge (Balck, Temmerman, Robberecht, Sermeus & De Schrijver, 2018) to philosophizing (Gellens, Deweerdt, & Enckels, 2018). In all these forms, a dialogue is successful if students listen to each other and the teacher, analyze arguments, recognize fallacies, and articulate and substantiate their own thoughts. Although the use of dialogue is not always anchored in the teaching practice, most teachers have a positive cognitive attitude and high willingness to experiment with didactic methods to stimulate the learning in their students (Bodere et al., 2019).

RESEARCH QUESTIONS

The following research questions guide our study:

RQ1: Which *design principles* must the teaching method meet in order to stimulate critical thinking skills in students by engaging in dialogue?
RQ2: What is the *attitude* of teachers about the teaching method and what are the *contextual factors* that facilitate or hinder successful implementation in classrooms?

RESEARCH DESIGN

Educational design research

The project deploys an *educational design research* (EDR) *methodology* to develop a cross-disciplinary teaching method and materials. In consecutive cycles, the didactic material will be developed, tested, evaluated and adjusted (Plomp & Nieveen, 2007). The feasibility and usability of the material are evaluated and theoretical implications are explored. To create the teaching method, *interdisciplinary Teaching Design Teams* (iTDTs) are established (Crow & Pounder, 2000; Handelzalts, 2009) to stimulate cooperation. The result is a *Redeneerling*-method, containing detailed example learning material and a manual for developing new material. This project specifically develops a cross-disciplinary teaching method in which dialogue is key in different courses throughout the

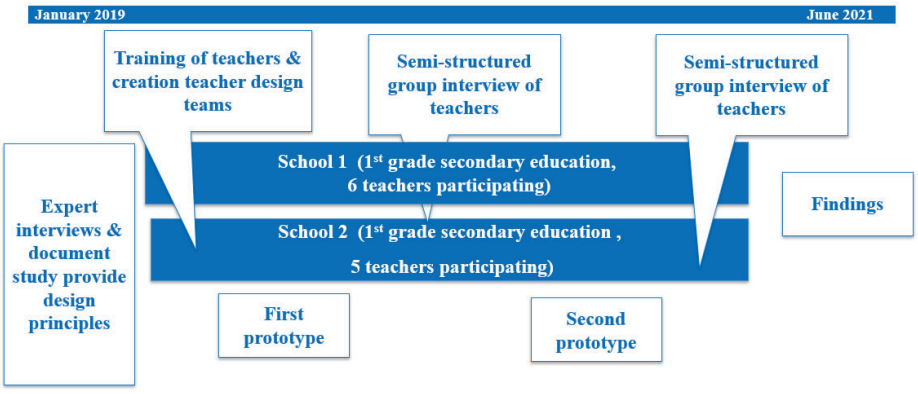
academic year. The method also describes conditions for a successful implementation. The timing and method of the project are illustrated in figure 1.

Intervention and multimethod design

The research uses a qualitative approach to answer the research questions. Expert interviews and document study are used to answer **RQ1**. Semi-structured (group) interviews (Brenner, 2006) with teachers are used to answer **RQ2**. (Interviews were aimed to assess the clarity, readability, usability and feasibility of the method, as well as the perceived impact in later cycles. Insights into the strengths and weaknesses of each version of the Redeneerling-method lead to the development of a new version of the method. The interviews were guided by a topic list and mainly conducted in an online teams-environment. Notes of the interviews were coded and analyzed using qualitative content analysis (Elo & Kyngäs, 2008).

This project is implemented during a *one-year-intervention* in two Brussels secondary schools with an ethnically diverse population. Students from the first stage of SE (grades 7-8) receive the intervention in different school subjects. Teachers and students received information about and training on critical thinking skills. We organized a training for the teacher design teams. The goals were to exchange experiences with regard to teaching critical thinking (explore), learn about critical thinking and reasoning fallacies (educate), discuss and develop learning material for critical thinking (develop learning material), and provide feedback to each other's material (teacher feedback). The goal is to get teachers to see opportunities in their own course material (e.g., Akerson, Abd-El-Khalick,& Lederman, 2000). As indicated above, the research culminates in a manual for teachers to develop new material, some detailed example material as well as implementation guidelines.

Figure 1. Methodology and timing



RESULTS

The research yielded some general insights on the cross-curricular approach and the use of dialogue. Teacher interviews suggest that explicit and cross-curricular attention help students to develop critical thinking skills. The research confirmed that the use of *dialogue* encourages students to use reasoning skills. However, having a dialogue with equal input from teachers and students can be challenging. Teachers find it difficult not to explain everything. The willingness of teachers to give pupils the responsibility for their learning process is associated with fear of letting go of control (see also Boderé., 2019).

With regard to the design principles *(***RQ1***),* our research suggests that the teaching method must meet a number of conditions. First, the application of a cross-disciplinary approach to teaching critical thinking skills helps teachers to cooperate and allows students to be continuously exposed to similar reasoning strategies in different subjects. Second, student mistakes in the classroom provide opportunities to focus on critical thinking. Teachers can respond to reasoning mistakes students make in the classroom and purposefully elicit confusion about arguments, providing a chance to help students reflect about their arguments. Third, a thorough training of teachers is necessary, in order to refresh their understanding of the reasoning and dialogue skills. Fourth, questioning student responses allow students to reflect and address their reasoning skills. Fifth, similar vocabulary and visual support to illustrate the different reasoning skills need to be used across different subjects. Unity facilitates students' understanding (e.g., the recurrent use of key signalling words such as 'but' or 'unless'). Graphical visualisations were appreciated by teachers to support the learning of critical skills
With regard to the attitudes of teachers (**RQ2)**, teachers showed enthusiasm and motivation to implement the method and showed appreciation for the cross-disciplinary approach. However, creating the optimal context is crucial to also translate the enthusiasm into actions. This is expressed in two ways. First, support from the principal in the form of practical assistance (e.g., adjust timetables) act as a stimulator. Second, hands-on guidance in the development of the lessons from the researchers seems necessary.

DISCUSSION

Critical thinking is an essential skill and attitude in the 21st century (Saavedra and Opfer, 2012). New attainment targets, with a focus on cross-curricular goals, from the Flemish government (Vlaamse Regering, 2018) makes this research project timely. Although teachers are already committed to work on critical thinking, questions can be raised about how to implement these skills in their existing lessons. How could a teacher educate, stimulate, and strengthen critical thinking in his/her

students? This research shows that focusing on a cross-curricular, dialogue-based approach to critical thinking appears promising.

During the research process, we gradually adapted and fine-tuned the didactic approach to best suit the level and subject matter to students in the first stage of secondary education. The input and creativity of the teachers were essential in this process, which again shows the benefits of working with an Educational Design Research method in collaboration with teachers. Overall, working with interdisciplinary teacher design teams allows to develop adequate learning material. The developed materials and teaching method can guide and support teachers across the region in their adaptation to the new curriculum. The cross-curricular approach facilitates the transfer from one subject to another, as well as to everyday life. Training critical thinking together with the course content is also a time-efficient strategy.
However, this approach asks for a meticulous collaboration of teachers, which is also often not well established in Flanders in comparison with other countries that participated in the TALIS studies (De Wilde, 2016; OECD, 2014). Flemish teachers spent less time on teamwork and dialogue with colleagues than their European counterparts. Interdisciplinary learning communities is not yet an embedded practice in the work force, although this research showed how teacher diversity is an added value in developing teaching material. However, the teacher design teams substantially relied on the support from the researchers. Questions can be raised upon what support and conditions are necessary for a good learning community to function independently. Guidance from the principal to facilitate teamwork and structural anchoring of teamwork in the teacher's timetable would help to create an optimal context for learning communities (see also Boderé et al., 2019). In addition, as this research project relies heavily on the active involvement of teachers, the corona lockdown substantially influences the effective implementation of the teaching method in the school context. The pandemic shifted the focus of teachers and led to reduced cooperation. The usefulness of collaboration must be made clear in order to motivate teachers (Struyve, 2019), especially because professional learning communities could stimulate the collaborative (subgroup) culture in schools that positively affects teacher well-being and efficacy (Meredith et al., 2017).

Another question that can be raised is about the generalisability of critical thinking skills (e.g., McPeck, 2017). Does critical thinking consist of general principles which can be applied across courses, or is subject knowledge required for critical thinking? In other words, is critical thinking a generic skills that students can use across different courses or is it a domain-specific skill and is subject knowledge a precondition for critical thinking (Ten Dam and Volman, 2004)? Key is, however, that critical thinking in both cases needs to be infused in different courses and coupled with existing knowledge. Anyway, a shared language of critical thinking in a school is paramount in order to make connections across courses (Rombout, 2021). When students learn how critical thinking is infused across courses, critical thinking

can become a disposition - a natural recurrent tendency for students to think critically.

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