

AN ANALYTIC DESCRIPTION OF PROJECTEXPERT

An instructional reading program for ninth grade vocational students

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Abstract

A significant number of ninth-grade students still struggles with proficiently comprehending texts. Moreover, their increasingly lowering motivation to read is alarming. Various educational interventions designed to enhance reading comprehension and/or motivation are available in the scientific field. However, a detailed description of its underlying principles is frequently lacking. This detailed description could provide genuine opportunities for replication, theory building, and dissemination into practice. Therefore, the main goal of the present study is to offer an analytic, rigorous, and detailed description of an instructional program aimed at fostering ninth-grade vocational students' reading comprehension, strategy use, and autonomous reading motivation, named ProjectExpert. The context, theoretical and/or empirical grounding, macro and micro-level design principles will be outlined, based on the framework of Bouwer and De Smedt (2018). ProjectExpert entails four design principles: (1) Text reading is goal-directed. (2) The instruction is embedded in a motivating learning environment rooted in the fulfilment of students' basic psychological needs. (3) By means of explicit strategy instruction students are taught to use a repertoire of cognitive and metacognitive reading comprehension strategies. (4) Students practice reading and applying reading strategies in heterogeneous pairs. Moreover, during the design, a stepwise procedure was adopted to guarantee the feasibility and usability of the design principles for this particular group of teachers and students. This stepwise procedure and the implications for the design of ProjectExpert are described in detail. Finally, the relational structure of the design principles and challenges related to implementing them into practice are discussed.

Keywords: design principles, reading comprehension, reading strategy use, reading motivation, self-determination theory, vocational education

1

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Educational interventions aimed at enhancing students' reading comprehension are widespread in the scientific field. Nonetheless, a detailed description concerning the translation of its empirical and theoretical grounding into instructional practices is frequently lacking in scientific articles. In the related field of writing research, a recent call of Rijlaarsdam, Janssen, Rietdijk, and Van Weijen (2018) explicitly advocates for rigorously and systematically describing design principles of interventions. These principles refer to the basic components of an intervention, grounded in empirical and theoretical findings. Failing to describe these principles thwarts replication, theory building, and communication about effective instruction. Additionally, it hampers dissemination and implementation into practice (Bouwer & De Smedt, 2018; Rijlaarsdam et al., 2018; Schrijvers et al., 2019; Vansteelandt et al., 2019). In the field of reading research, a similar call seems imperative. Already in 1997, this call has been proposed by Guthrie and Alao (1997). They strived for the identification of a set of design principles underlying interventions, instead of describing individual or isolated principles. As to reading comprehension interventions, components or activities are commonly referred to in scientific articles. However, this cannot be considered a thorough and systematic description of design principles underpinning educational interventions. An exception is encountered for Concept Oriented Reading Instruction (Guthrie et al., 2007; Guthrie & Alao, 1997), for which a set of theoretical and resulting instructional principles is described. In line with Guthrie et al. (1997, 2007) and responding to the call of Rijlaarsdam et al. (2018), the main goal of the present article is to analytically and systematically describe the set of design principles underlying the ProjectExpert reading intervention. ProjectExpert consists of a set of instructional and learning activities and accompanying instructional materials that are designed to enhance ninth-grade vocational students' reading comprehension, strategy use, and autonomous reading motivation.

The design of an educational intervention can be evaluated based on multiple criteria: theoretically sound (i.e., adhering to specific design principles), practically sound (i.e., feasible for teachers to implement and usable for students), and/or empirically sound (i.e., evolutions in the desired student or teacher outcomes) (McMaster et al., 2019; Nieveen, 1999; Schrijvers et al., 2019). This paper foremost focusses on the first criterion by analytically describing ProjectExpert's design principles, concentrating on the detailed translation of the theoretical and empirical grounding into concrete teaching and learning activities and instructional materials. Moreover, the construct validity (i.e., the extent to which the principles are consistently linked) is addressed in the Discussion (Nieveen, 1999; Schrijvers et al., 2019). In addition, the present paper aims to provide insight into the stepwise procedure that has been adopted during the design of ProjectExpert and the corresponding teacher professional development program to guarantee the feasibility and usability (i.e., guarantee if the design is practically sound) of these design principles and the related instructional activities and materials. An extended evaluation of the extent to which the intervention is practically, and moreover empirically sound (McMaster et al.,

2019), is addressed in a separate manuscript (Van Ammel, Aesaert & Van Keer, 2021).

The stepwise procedure to guarantee the feasibility and usability included the following steps. (1) Before the onset of the design of ProjectExpert and in view of getting specifically acquainted with vocational education, the teaching approach used, and the challenges of the target group, the main researcher conducted classroom observations in six ninth-grade vocational classes from various fields of study (e.g., nutrition and care, central heating, office management). During the observations, notes were made regarding the teaching and learning activities, the applied instructional materials, student engagement and motivation, classroom management, and student grouping. (2) Second, after deciding on the design principles, these were presented to a group of reading research experts. The group discussion focused on the value of each of the proposed design principles in view of enhancing students' reading comprehension, strategy use, and autonomous reading motivation. Furthermore, the feasibility and usability of each of the principles was reviewed and discussed. (3) Third, two focus groups with in total 12 ninth-grade vocational teachers were set up to scrutinize the feasibility to implement the designed activities and accompanying instructional materials in daily practice. More in particular, a selection of the instructional and learning activities and materials were presented to the teachers. They shared their opinions extensively in group discussions. (4) Fourth, in search for interesting text topics for the target group under study, eighty students and four teachers participated in a short explorative study. More specifically, students and teachers were orally queried about themes or text topics that would encourage vocational students to read, which resulted in a comprehensive list of possible themes and topics. Afterwards, 19 students from three different classes rated their level of interest in these listed topics in an online questionnaire. For each topic they could indicate whether they found the topic 'interesting' or 'not interesting'. (5) Fifth, after writing the ProjectExpert-texts, a short survey was set up in five ninth-grade vocational classes wherein 53 students rated their level of interest for the texts (*not interesting at all - not interesting - interesting - very interesting*) and the perceived level of difficulty (*too easy - appropriate difficulty - too difficult*). (6) Finally, after finishing the design of ProjectExpert, five ninth-grade vocational teachers participated in an online interview to gain deeper insight into their opinions regarding the feasibility and usability of ProjectExpert. These teachers first participated in a 2-hour training session clarifying the theoretical and empirical background of ProjectExpert and the developed instructional and learning activities and accompanying materials. Furthermore, they had access to the comprehensive teacher manual.

The entire stepwise procedure that aims to guarantee the feasibility and usability of ProjectExpert impacted the design and resulted in several adjustments to this intervention and the corresponding teacher professional development program. The impact on the design and the adjustments are explained in detail within the following sections, in boxes entitled 'Feasibility and usability'. As a whole, this provides insight

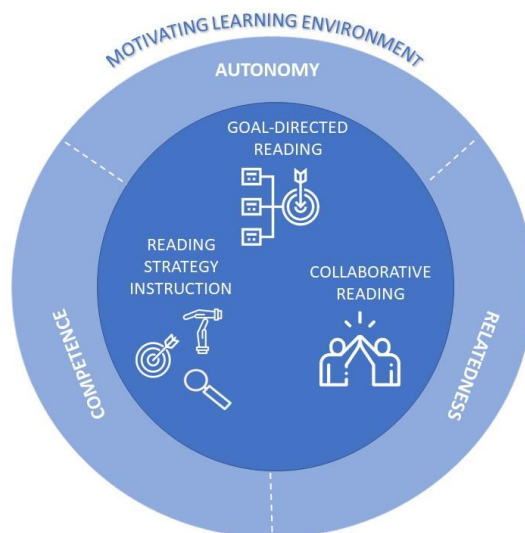
into how these various steps aimed to guarantee the feasibility and usability of ProjectExpert.

1. ANALYTIC DESCRIPTION OF PROJECTEXPERT

1.1 Overview of ProjectExpert

At the start of the design process, the following design as presented in Figure 1 was put forward. This design represents the fundamental teaching practices with regard to goal-directed reading, reading strategy instruction, and collaborative reading. These practices foremost aim at enhancing students' reading comprehension, strategy use and autonomous motivation. The entire instruction is embedded in a motivating learning environment aiming at the fulfillment of students' basic psychological needs (i.e., autonomy, competence, relatedness) (Ryan & Deci, 2020). The central teaching practices of ProjectExpert (i.e., goal-directed reading, reading strategy instruction, and collaborative reading) simultaneously aim to fulfill these needs (goal-directed reading aims at fulfilling the need for autonomy, reading strategy instruction aims at fulfilling the need for competence, and collaborative reading aims at fulfilling the need for relatedness). Throughout the design process, that is described further on in detail, this hypothesized structure was investigated in light of construct validity (Nieveen, 1999). In the Discussion, a reinterpretation of this proposed relational structure of the design principles (as presented in Figure 1) will be presented.

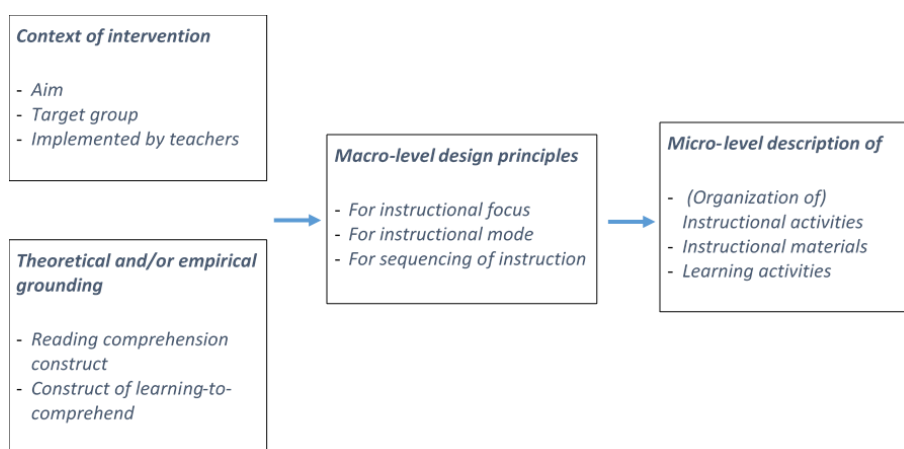
Figure 1. Preliminary overview of the design principles of ProjectExpert



1.2 Framework

The analytic description of ProjectExpert is rooted in the comprehensive framework of Bouwer and De Smedt (2018, p.122) (Figure 2), consisting of four components: context of the intervention, theoretical and/or empirical grounding, macro-level design principles, and micro-level design principles.

Figure 2. Framework of Bouwer and De Smedt (2018, p.122)



ProjectExpert is designed to be implemented in a specific *context*. The characteristics and constraints of this context (e.g., aim of the intervention; teacher, class, or school characteristics; cognitive or motivational student attributes) will subsequently affect the choice of design principles (Bouwer & De Smedt, 2018). Although the design principles are attributed to this specific context, they can be inspiring for the broader field of reading comprehension research and practice. Additionally, a *theoretical and/or empirical grounding* is required to explain the expected relationships between the teaching and learning activities on the one hand and between the learning activities and the desired learning outcomes on the other hand (Pearson et al., 2020). Based on the context of the intervention and the theoretical and empirical grounding, the next step of an analytic description is the construction of design principles, which define the key ingredients of an intervention (Bouwer & De Smedt, 2018; Guthrie & Alao, 1997; Rijlaarsdam et al., 2018). Bouwer and De Smedt (2018) define design principles as: “the building blocks of an instructional intervention, prescribing the key characteristics that underlie the instructional activities and learning activities within a particular instructional practice or program” (p.117) and distinguish macro- and micro-level design principles. *Macro-level design principles* characterize the focus of instruction (what are we going to teach?), the mode of instruction (how are we going to teach?), and the sequence of instruction at the program level (Koster &

Bouwer, 2018). *Micro-level design principles* are operationalized into concrete instructional teaching activities, instructional materials and learning activities. The instructional activities refer to the instructional actions of the teacher or the person delivering the intervention. Combined with well-chosen instructional materials, these instructional activities trigger specific learning activities, which are cognitive or metacognitive activities performed by the students (Bouwer & De Smedt, 2018).

1.3 Context

1.3.1 Aim

According to the latest PISA-2018 results, 17% of the Flemish fifteen-year old students perform below the basic proficiency level for reading literacy (De Meyer et al., 2020). Teaching them how to deliberately use a rich repertoire of reading comprehension strategies during reading is a promising avenue in light of enhancing their comprehension of texts (Duke et al., 2011; Rogiers et al., 2020). Moreover, students' autonomous reading motivation tends to decline when students enter adolescence (e.g., De Smedt et al., 2020) and their reading enjoyment is found strikingly low in Flanders (i.e., the Dutch speaking part of Belgium) in the last PISA cycle (De Meyer et al., 2020). Consequently, the aim of ProjectExpert is to foster students' reading comprehension, strategy use and motivation.

1.3.2 Target group

ProjectExpert is designed for ninth-grade vocational-track students in Flanders. The vocational track aims to prepare students for inflow into the labor market and primarily has a focus on teaching practical skills (OECD, 2017). The focus of ProjectExpert is on this group of vocational students since a large proportion of them are performing below the basic proficiency level for reading literacy (De Meyer et al., 2020). Furthermore, also reading self-concept, intrinsic reading motivation, autonomous reading motivation, interest, enjoyment, reading strategy knowledge, reported reading strategy use, and recreational reading frequency are demonstrated to be lower for students in the vocational track (Kozminsky & Kozminsky, 2001; Mol & Jolles, 2014; OECD, 2019; Retelsdorf et al., 2011, 2012; Schaffner et al., 2016; Van Ammel et al., 2021).

1.3.3 Implemented by teachers

ProjectExpert is designed to be implemented by teachers teaching the course 'Project General Subjects'. In Flanders, this is a cross-domain course specifically developed for the context of vocational education. It contributes to multiple learning goals: functional language skills, functional mathematical skills, functional information processing and acquisition, organizational skills, time- and space awareness

and social and ethical awareness, resilience and responsibility (Vlaams Ministerie van Onderwijs en Vorming, 2015). Consequently, stimulating students' reading comprehension is only one of the goals. Moreover, the idea behind 'Project General Subjects' is that learning contents should be approached in a functional manner (i.e., stressing functional language skills).

'Project General Subjects' teachers are generally trained as content-area teachers. According to Greenleaf and Valencia (2017) these teachers tend to neglect texts in their instruction. Additionally, they do not necessarily have knowledge and/or experience regarding language and reading instruction and generally believe that they are not capable to teach reading comprehension (Ness, 2016), especially to struggling readers (Cantrell et al., 2009). These teacher characteristics may impact the quality of their reading instruction (Hall, 2005). High-quality professional development seems therefore recommended (Fogarty et al., 2014). In view of implementing ProjectExpert, teachers' professional development consists of multiple constituents: a group-based two-and-a-half-hour training session, an extensive teacher manual, an observation of one lesson during implementation followed by individual feedback, regular contact with the main researcher via mail or phone, and the opportunity to participate in an online learning community.

Feasibility and usability

Based on the online teacher interviews (step 6 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), insight was provided into teachers' opinion regarding the usability and feasibility of ProjectExpert. In general, they perceived the instructional and learning activities usable and feasible to implement. Especially the comprehensive teacher manual was rated as valuable in light of implementing the intervention. Yet, some critical remarks were made as well. Teachers for example raised concerns about their ability to model reading strategy use, the abilities of their students to actively engage in collaborative reading, and the organizational requirements related to providing students with self-chosen texts. In view of tackling this, these remarks have been explicitly taken into account and discussed during the teacher professional development, by for example providing a modelling example, by explicitly focusing on the rationale behind the instructional practices (and the collaborative reading in particular), and by adding practical suggestions (e.g., use a binder with tabs to organize the texts efficiently).

1.4 Theoretical and empirical grounding

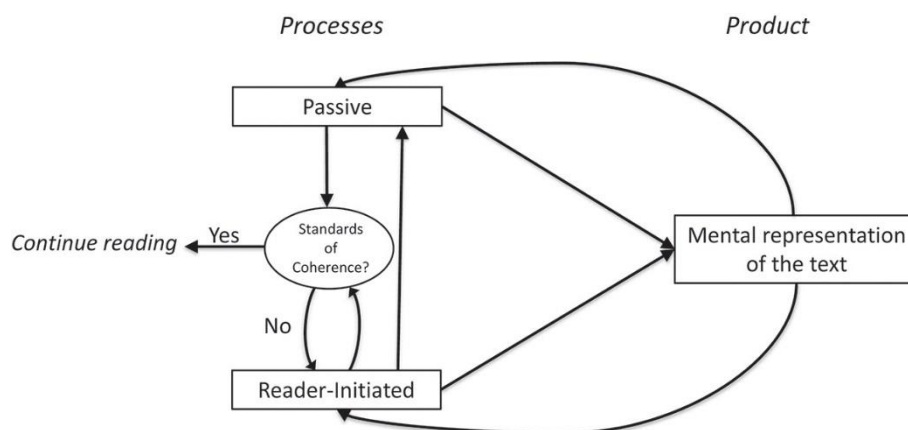
The theoretical and empirical grounding of ProjectExpert is situated within two main domains: (1) the construct of reading comprehension and (2) the approach regarding learning-to-comprehend. The first domain focusses on the construct of reading comprehension proposed by van den Broek and Helder (2017) and elaborates on certain aspects related to its central concept 'standards of coherence': (1a) reading as a goal-directed activity, (1b) reading motivation and how to promote it, and (1c) reading

strategy use. The second domain focusses on strategy instruction as the approach regarding learning-to-comprehend and elaborates on (2a) specific instructional practices in reading strategy instruction and (2b) reading as a collaborative activity.

1.5 Construct of reading comprehension

Reading comprehension refers to the ability to gain meaning from what is read (McNamara & Magliano, 2009). According to the influential framework of Kintsch (1988) readers engage in the construction of a coherent representation of the text or a *situation model*. The situation model is based on a relational structure between information in the text and readers' background knowledge. This relational structure is constructed via inferring relations between current segments of the text and other information (i.e., other text segments or background knowledge). Van den Broek and Helder (2017) elaborate on Kintsch's framework. To build this coherent situation model, readers engage in a combination of passive and reader-initiated processes. *Passive processes* are associative processes, for example the automatic activation of background knowledge. On the other hand, *reader-initiated processes* are active, requiring control and attentional resources (e.g., rereading or note-taking). The extent to which readers engage in these reader-initiated, active processes is determined by their *standards of coherence*. This refers to "criteria that a reader has for what constitutes adequate comprehension" (van den Broek & Helder, 2017, p. 364). When passive processes are sufficient to adhere to a reader's standards of coherence, the reader will not engage in demanding, reader-initiated processes. However, when these are not sufficient to achieve their standards of coherence, reader-initiated processes will be adopted. The combination of passive and reader-initiated processes results in updating the mental representation of the text, see Figure 3.

Figure 3. Framework of reading comprehension, van den Broek & Helder (2017, p. 363, Figure 1)



The *standards of coherence* have several properties. (1) They can differ based on the type of coherence (e.g., causal, referential, logical) and the strength of the coherence. (2) The standards of coherence can vary based on individual and developmental differences. (3) There are furthermore differences related to readers' goals for reading, their motivation to read, and the presence of distractors or physical factors (e.g., fatigue). (4) Attention-allocation and reading strategies can be used to attain the standards of coherence. These processes can be taught and can become more automatized (similar to the passive processes) (van den Broek & Helder, 2017). The standards of coherence thus take a central position in the construct of reading comprehension. Since they can vary between individuals, ensuring that readers read to proficient standards of coherence is key. In ProjectExpert, this is operationalized via providing goals for reading and taking into account students' *reading motivation*. Furthermore, to attain the standards of coherence, *reading strategies* can be adopted. We will subsequently elaborate on each of these topics.

1.5.1 *Goal-directed reading*

First, *providing a goal for reading* impacts students' standards of coherence during reading (van den Broek & Helder, 2017). Readers should be offered challenging and concrete reading assignments, concurrently providing a goal for reading. Textual information can for example provoke reactions that can be shared among students. Talking about and reflecting on the text will furthermore strengthen students' comprehension, and create possibilities to relate to real-life situations (Greenleaf & Valencia, 2017). Additionally, texts and assignments should align with students' natural use of texts, outside of school (Pearson et al., 2020). Textual information can for example be related to personal lives, or can be useful to participate in our society. By this means, text reading will be perceived as valuable and functional (Alvermann, 2002).

1.5.2 *Reading motivation*

Next to the reading goal, students' standards of coherence are determined by their motivation to read (van den Broek & Helder, 2017). Moreover, reading motivation itself is a desirable outcome in light of for example enhancing students' recreational reading frequency (De Naeghel et al., 2012). *Reading motivation* is a multifaceted construct. Given that numerous definitions, conceptualizations, and frameworks are used in the reading motivation research, it is essential to consciously select and describe the theory educational interventions depart from (Conradi et al., 2014). In ProjectExpert, Self-Determination Theory (SDT) is adopted as the underlying framework (Ryan & Deci, 2020). This framework offers a unequivocal way of distinguishing qualitatively different aspects of reading motivation (De Naeghel et al., 2016; Ryan & Deci, 2020). SDT focusses on the reasons for reading and differentiates between

autonomous and controlled reading motivation. The traditional distinction between intrinsic and extrinsic motivation is herein rethought, by reconsidering different aspects of extrinsic motivation. Autonomous reading motivation reflects reading for the enjoyment of reading itself (i.e., intrinsic regulation) or reading for the relevance readers attach to reading (i.e., identified regulation). Controlled reading motivation refers to reading because of feelings of internal pressure (i.e., introjected regulation) or external pressure (i.e., external regulation). Students' reading motivation can consequently be situated on a continuum from more controlled to more autonomous forms of motivation. Autonomous motivation is related to higher reading engagement, higher rates of recreational reading and more proficient reading comprehension (De Naeghel et al., 2012). Taking the above into account, fostering students' autonomous reading motivation is, next to enhancing their reading comprehension, one of ProjectExpert's goals. SDT additionally offers a theory regarding how to foster autonomous motivation (i.e., cognitive evaluation theory). In this subtheory SDT states that the fulfillment of three basic psychological needs will result in higher autonomous motivation (Ryan & Deci, 2020). First, the need for autonomy refers to a feeling of ownership in one's actions. Second, the need for competence entails feelings of mastery and a sense that one can succeed. Finally, the need for relatedness refers to a sense of being related to significant others. To nurture these innate psychological needs, teachers should adopt a need-supportive teaching style characterized by autonomy-supportive, structured, and caring teacher behavior.

1.5.3 Reading strategies

Reading strategies can be used as vehicles to attain standards of coherence (van den Broek & Helder, 2017). *Reading strategies* are defined as "deliberate, goal-directed attempts to control and modify the reader's efforts to decode text, understand words, and construct meanings of text" (Afflerbach et al., 2008, p. 368). Consequently, they refer to the active, reader-initiated processes that a reader undertakes when the passive processes are not sufficient to achieve their standard of coherence (van den Broek & Helder, 2017). Proficient readers are for example actively searching for clues and drawing inferences, while reading a text (Afflerbach et al., 2020; Pearson & Cervetti, 2017). However, when reading strategy use is fully developed and internalized, this becomes more automatized, similar to the passive processes in the framework of van den Broek and Helder (2017).

Which strategies to teach. Students need a rich repertoire of reading comprehension strategies to be able to attain their standards of coherence and understand a text (Rogiers et al., 2020; van den Broek & Helder, 2017). Numerous strategies are found to be successful in terms of enhancing reading comprehension. However, teaching an extensive number of strategies in a short period of time has been proven to be ineffective. Therefore a selection of strategies needs to be made (Pressley, 2000; Souvignier & Moklesgerami, 2006). The selected reading strategies need to support students in becoming active, problem-solving readers (Boardman et al.,

2018; Duke et al., 2011; Magnusson et al., 2019), who are engaging in the construction of a coherent representation of the text as referred to by van den Broek and Helder (2017). The strategies should furthermore encompass the entire reading process (i.e., before, during, and after reading) (Pressley & Harris, 2006). In this way, a reading plan is provided for students (Souvignier & Moklesgerami, 2006). Finally, the selection of strategies needs to take into account the feasibility (Greenleaf & Valencia, 2017; Guthrie et al., 2007), particularly for the specific group of vocational students who generally struggle to use reading strategies (De Meyer et al., 2020).

1.6 Approach regarding learning-to-comprehend

Students who can accurately read words, are not automatically skillful comprehenders. They need instruction about how to approach a text in order to be able to understand the content (Edmonds et al., 2009). In this regard, *explicit reading strategy instruction* is crucial, wherein students are taught declarative (i.e., knowing what), procedural (i.e., knowing how) and conditional (i.e., knowing when and why) strategy knowledge (Duke et al., 2011; Edmonds et al., 2009). This instruction includes multiple steps: mapping current use of the reading comprehension strategy, emphasizing the value of reading comprehension strategy use, modelling reading strategy use, instructing about reading strategy use, guided practice, and finally reflecting about reading strategy use (Duke et al., 2011). Throughout this stepwise process, the *gradual-release-of-responsibility* framework is taken into account in ProjectExpert. More specifically, the strategies are modelled at first. Afterwards students can collaboratively practice to apply the strategies with the aid of several scaffolds (i.e., teacher feedback, strategy card) (Duke et al., 2011; Fisher & Frey, 2014). Following this approach, it is assumed that students' capabilities to regulate their own reading process gradually improve (Souvignier & Moklesgerami, 2006).

As to the *collaborative practice*, positive effects of collaborative practices on students' reading comprehension are found in several meta-analyses and review studies (e.g., Alzahrani & Leko, 2018; Baye et al., 2019; Reichrath et al., 2010; Slavin et al., 2008), especially reading in heterogeneous pairs is promising (Murphy et al., 2017; Topping et al., 2017). During individual reading, readers both need to act (i.e., read) and monitor their acting, which are both cognitively demanding activities. Via text-based discussions, these comprehension processes can become tangible. In other words, the activities 'acting' and 'monitoring the acting' can then be externalized in two persons. Especially for struggling readers, being able to externalize these practices seems beneficial (Boardman et al., 2015). Students then act as models for each other. Moreover, these tangible activities will eventually be internalized by students and incorporated during individual reading (Pressley et al., 1992; Souvignier & Moklesgerami, 2006). In sum, reading in heterogeneous pairs creates opportunities to enrich (high-level) text comprehension (Van Keer, 2004). On the other hand, including collaborative practices results in higher overall motivation (Monteiro, 2013; Ryan & Deci, 2020; van Steensel et al., 2016) and motivation to use complex reading

strategies via the opportunity to share questions, concerns, and information (Guthrie et al., 2007; Pressley et al., 1992).

1.7 Macro-level design principles

The *instructional focus* (what to teach) of ProjectExpert is multiple. Generally, enhancing students' reading comprehension, autonomous reading motivation and reading strategy use is targeted. As to fostering autonomous reading motivation, fulfilling students' basic psychological needs is aimed at. As to reading strategy use, three groups of strategies were selected: looking ahead (i.e., previewing text, predicting and activating prior knowledge), taking a time-out (i.e., monitoring comprehension and fixing comprehension problems), and looking back (i.e., reflecting on the product and process of reading, and creating text-based affective reactions).

Regarding the *instructional mode* (how to teach), four principles are incorporated to achieve ProjectExpert's aims. (1) In light of fostering students' reading comprehension, strategy use and autonomous motivation, goal-directed reading is a promising avenue (van den Broek & Helder, 2017). (2) In light of fostering students' autonomous reading motivation, the creation of a motivating learning environment is explicitly aimed at by pursuing a need-supportive learning environment (Ryan & Deci, 2020). (3) In light of fostering reading strategy use, reading strategies are taught using explicit instruction, within a gradual-release-of-responsibility framework (Duke et al., 2011; Fisher & Frey, 2014). (4) This results in students collaboratively practicing reading by using a repertoire of reading strategies (Duke et al., 2011; Fisher & Frey, 2014). This collaboration among students moreover enhances their reading motivation (Ryan & Deci, 2020).

Feasibility and usability

Initially, three design principles were selected: reading strategy instruction, reading motivation promotion, and collaborative reading. After presenting the three principles to a group of reading experts (step 2 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), they concluded that these were highly valuable and feasible to implement. For example, they emphasized the value of explicit reading strategy instruction for stimulating students' reading strategy use and collaborative reading to practice using the reading strategies. In addition, they stressed the value of goal-directed reading in order to provide students with a reading goal and strengthen for example their motivation to use reading comprehension strategies. Moreover, they made some suggestions regarding how this principle could be adopted while keeping in mind the feasibility (e.g., via a deliberate choice of text). Accordingly, this principle was added to ProjectExpert.

As to the *instructional sequence*, the instruction is time-based. ProjectExpert entails twelve 50-minute lessons, to be implemented within a period of six weeks. As to fostering reading motivation, striving for fulfilling all three psychological needs (i.e.,

autonomy, competence, relatedness) simultaneously is required (Ryan & Deci, 2020). As to reading strategy instruction, in lessons one until six, the series of strategies are subsequently taught, based on their difficulty (looking ahead—looking back—taking a time-out). Yet, teaching each strategy separately is not sufficient to transform students into active, problem-solving readers. Students need integrated practice to learn how to use the selected repertoire of strategies while reading a text (Rogiers et al., 2020; Vaughn et al., 2011). Therefore, most of the instructional time in ProjectExpert-lesson seven until twelve is devoted to practicing the use of several strategies simultaneously and flexibly (Rogiers et al., 2020).

1.8 *Micro-level design principles*

1.8.1 *Goal-directed reading*

Goal-directed reading is operationalized as functional reading. To ensure that reading is functional, students are offered a deliberate choice of texts, and the opportunity to react on or create text-related posts in an online learning environment.

Deliberate choice of texts. The texts incorporated in ProjectExpert were written to be inciting to find out answers to a relevant problem, question, prevailing misconception, or fake news (Greenleaf & Valencia, 2017). Students will read the texts for example to find out answers to problems (e.g., How can you find a student job?) or questions (e.g., Was there ever cocaine in Coca-Cola?). Hereby the texts build on students' own experiences (e.g., online in search of love), knowledge and questions (e.g., will robots take over all our work?) and/or the information in the texts can be useful in their daily lives (e.g., searching for a student job) (Guthrie, Wigfield, & You, 2012). In other words, students read texts they will need to understand to participate in our information society and that are connected to their home or community. In general, this deliberate choice of texts results in having a purpose to read and to apply reading strategies (Alvermann, 2002).

Reacting on or creating posts. The main goal of reading in ProjectExpert is to use text content to react on or create posts on the online learning environment Padlet. Posts can relate to students' own opinions regarding the text topic and can entail content-related questions, associations with their personal world of experience, examples of implementation, affective reactions, opinions of other people, related newspaper articles, or visual examples of text information. Students can react on posts that are related to the topic they have just read about. Additionally, it is possible to create new posts. The rationale behind incorporating Padlet in ProjectExpert is multifaceted. First, engaging in reacting on or creating posts broadens and deepens their comprehension of the text content. Students can apply the information to new situations, analyze by drawing connections among ideas, evaluate a stand or decision, or create new posts. Furthermore, these possibilities are not exclusively language-based. Hereby students who are not confident about their language skills are also stimulated to participate. Moreover, reacting on or creating posts generates

opportunities to make connections to real-life situations, which is beneficial in light of enhancing their autonomous motivation (Greenleaf & Valencia, 2017; Guthrie et al., 2007; Ryan & Deci, 2020). In addition, students can also react on posts created by other students, who are not necessarily in their class or even school. This strengthens feelings of relatedness (Ryan & Deci, 2020). Finally, reading posts about other topics can provoke their interest in these other text topics.

Table 1. Overview of principle 1: Goal-directed reading

Design principle 1: Goal-directed reading	(Organization of) instructional teaching activities	Learning activities
To enhance students' reading comprehension, reading strategy use, and autonomous reading motivation, ensure that text reading is goal-directed via a deliberate choice of texts and offering the opportunity to react on or create posts concerning textual information using an online learning environment (Afflerbach et al., 2020; Goldman et al., 2016; Greenleaf & Valencia, 2017; Guthrie et al., 2012; Ryan & Deci, 2020).	<p>Ensure that text reading is goal-directed</p> <p>... via offering texts that are</p> <ul style="list-style-type: none"> ● inciting to find out answers to a relevant question, problem, or prevailing misconception or fake news ● connected to youngsters' interests and world of experience <p>... via offering the opportunity to react on or create posts concerning textual information using an online learning environment (Padlet)</p> <ul style="list-style-type: none"> ● Inform students about the goal of reading (i.e., using text content to react on or create posts on Padlet) ● Instruct students about the use of Padlet <ul style="list-style-type: none"> • How to gain access to the correct Padlet • How to interpret the Padlet • How to react on or create posts ● Engage students in a class discussion about the use of Padlet and agree upon rules of use ● Provide opportunities to engage with Padlet <ul style="list-style-type: none"> • 5 minutes at the end of each lesson • Observe students during the use of Padlet and react on violating rules of use 	<p>Read texts while...</p> <ul style="list-style-type: none"> ● trying to find out answers to a relevant question, problem, or prevailing misconception or fake news ● identifying themselves with the text theme <p>React on or create posts:</p> <ul style="list-style-type: none"> ● Understand and keep in mind the goal of reading texts ● During instruction about Padlet <ul style="list-style-type: none"> • Listen and try to understand how to use Padlet ● Engage in class discussion about rules of use and agree with these rules ● During use of Padlet <ul style="list-style-type: none"> • Surf to correct Padlet • Adhere to rules of use ● React on or create posts <ul style="list-style-type: none"> • Answer content questions • Reflect on text content • Create affective reactions about text reading

Feasibility and usability

During the focus groups (step 3 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), teachers raised some concerns about the use of Padlet. They feared that students would react inappropriately on the posts. Therefore, clear guidelines for students about 'appropriate reactions on Padlet' are included in the first lesson. Moreover, they pointed to the infrastructure needed to engage with Padlet: schools might for example not have a stable WIFI-connection. For that reason, offline alternatives for Padlet are included in the teacher manual.

1.8.2 Reading motivation

Autonomy support. First, students can *choose* the texts they want to read, based upon their personal interest (Patall et al., 2013; Su & Reeve, 2011; Taboada & Klauda, 2020). This is proven to be a driving force for reading comprehension growth (Retelsdorf et al., 2011; Soemer & Schiefele, 2019). Additionally, students rate providing choice as one of the most influential factors in order to stimulate their reading motivation (Hughes-Hassel & Rodge, 2007; Pitcher et al., 2007). In total, a battery of 74 texts is available, categorized in three main themes (i.e., 'fact or fiction?', 'working as a student' and 'technology in the future') and fifteen subthemes.

Feasibility and usability

As to the themes and text subjects that have been selected, we originally came up with four themes: 'fact or fiction?', 'social media', 'technology in the future', and 'your own boss'. The teachers in the focus groups (step 3 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert) were enthusiastic about the first three proposed themes. However, they agreed that the proposed theme 'your own boss' was not appropriate for this group of students. Therefore, this has been altered to 'working as a student'. During the short explorative study (step 4 in the stepwise procedure), these four themes and at least two related text topics per theme were presented to students and teachers during oral conversations. They judged all the proposed themes and text topics as interesting, and provided suggestions for other themes (i.e., 'music' and 'health'). Later on, for each theme at least two text topics were presented to 19 ninth-grade vocational students in an online questionnaire. They rated the text topics as 'not interesting' or 'interesting'. Based on these results, the three themes with the most interesting text topics were selected and texts were written. Finally, during a survey (step 5 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), the texts were presented to a group of 53 students. They rated their level of interest in the texts and the perceived difficulty. Each student read two texts. 64% of the texts were rated as interesting and only 9% were rated as too difficult. Based on this entire process wherein students and teachers were highly involved, we concluded that the texts were interesting and had an appropriated level of difficulty.

Table 2. Overview of principle 2: Reading motivation promotion

Design principle 2: Reading motivation promotion	(Organization of) instructional teaching activities	Learning activities
To enhance students' reading comprehension, reading strategy use, and autonomous reading motivation, reinforce the fulfillment of students' basic psychological needs (i.e., autonomy, relatedness and competence) (Chen et al., 2015; Guthrie & Davis, 2003; Jang et al., 2009; Ryan & Deci, 2020; Su & Reeve, 2011).	<p>Reinforce the fulfillment of students' basic psychological needs</p> <ul style="list-style-type: none"> ● Autonomy: <ul style="list-style-type: none"> • Give students the opportunity to select the texts they will read <ul style="list-style-type: none"> • Provide multiple interesting texts • Let students get acquainted with the different text topics • Assist students in choosing texts • Engage in a class discussion about the value of reading starting from cartoons, obviously useful texts (e.g., contracts), or peer reflections about reading • Engage in goal-directed reading, cf. design principle 1 ● Relatedness: <ul style="list-style-type: none"> • Let students read in pairs, cf. design principle 4 • Read aloud to students • Strive for a constructive student-teacher relationship ● Competence: <ul style="list-style-type: none"> • Teach reading strategies, cf. design principle 3 • Provide texts with an appropriate level of difficulty • Strengthen positive self-evaluation by giving positive feedback to students concerning their reading strategy use and reading comprehension • Provide consistency in rules and guidelines (e.g., collaboration rules, roles, lesson structure) 	<p>Autonomy</p> <ul style="list-style-type: none"> ● Get acquainted with different text topics ● Select texts to read based on own interests ● Actively participate in class discussion about the value of reading ● Acknowledge the value of reading ● Engage in goal-directed reading, cf. design principle 1 <p>Relatedness</p> <ul style="list-style-type: none"> ● Read in pairs, cf. design principle 4 ● Listen to teacher when teacher reads aloud ● Enjoy the reading-aloud moment ● Endorse constructive student-teacher relationship <p>Competence</p> <ul style="list-style-type: none"> ● Practice use of reading strategies, cf. design principle 3 ● Read texts with an appropriate level of difficulty ● Be aware of self-perceptions about reading ● Accept teachers' feedback about reading strategy use or reading comprehension ● Adhere to rules and guidelines

Second, the *value of reading* is explicitly emphasized (Su & Reeve, 2011; Taboada & Klauda, 2020), mainly to tap into students' identified regulation (Jang, 2008; Ryan & Deci, 2020). In ProjectExpert, this is operationalized by using texts students will encounter in their daily life (e.g., job contract, medicinal product package leaflet), by highlighting the advantages of being a proficient reader in a for the students accessible way (e.g., via cartoons), and via class discussions based on videoclips of peer reactions about the value of reading. Third, students engage in *goal-directed*

reading, which is illustrated in design principle 1. In this way, reading is close to students' personal lives and interests and the value of reading is repeatedly emphasized (Guthrie & Davis, 2003; Ryan & Deci, 2020).

Relatedness support. First, the principle of *paired reading* will be described in design principle 4. This taps into student-to-student relationships, which are a central part of relatedness support (Ryan & Deci, 2020). Second, teachers engage in short *read alouds*. This practice connects teachers and students during a brief moment that is focused on reading (Gilson et al., 2018; Mello, 2001). Research among middle school students has confirmed that students positively value read alouds of their teachers. Additionally, during reading aloud, teachers act as role models in displaying their love for reading (Albright & Ariail, 2005; Gilson et al., 2018). Third, a *constructive student-teacher relationship* is aimed at. Students' feelings of relatedness are enhanced when their learning takes place within a respectful and caring relationship with their teacher (Ryan & Deci, 2020). Especially for this group of students, striving for a trusting teachers-student relationship is of pivotal importance (Learned, 2016). As to ProjectExpert, this was targeted during the teachers' professionalization training session.

Competence support. Competence support is especially important for vocational students, who generally report having lower feelings of competence (Wolters et al., 2014). First, by providing students with a *repertoire of reading strategies*, their competence in comprehending texts can grow, see design principle 3. Second, *text difficulty is adjusted* for this particular group of students (Ryan & Deci, 2020; van Steensel et al., 2016; Wigfield et al., 2016). Consequently, students read texts that are not too difficult for them, which enhances feelings of competence. Additionally, reading texts with an appropriate level of difficulty enhances students' interest and engagement (Fulmer & Tulis, 2013).

Feasibility and usability

During the focus groups (step 3 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), the teachers stressed the importance of aligning text difficulty with students' capabilities. They were especially concerned about the limited vocabulary of their students. Therefore, all the ProjectExpert-texts were screened for difficult words using a list of easy-to-comprehend Dutch words (exclusively including words that 95% of Dutch-speaking people understand). Using this list, some of the difficult words were replaced by synonyms that are easier to comprehend. Furthermore, all texts have been checked by the Dutch center of educational measurement CITO in this respect.

Feelings of competence are moreover strengthened by *positive teacher feedback* regarding reading strategy use and reading comprehension (Guthrie et al., 2007). This is targeted during guided practice, when teachers are asked to observe students and provide feedback, and during the reflection phase at the end of each lesson. Moreover, during the final lesson, positive feedback is one of the lesson goals. Finally,

consistency is provided in *rules and guidelines*, for example in rules of use for Padlet, collaboration rules or the structuring of paired reading by providing roles (see design principles 1 and 4). Students need these clear expectations and guidelines to benefit from a motivating learning environment (Ryan & Deci, 2020; Vansteenkiste et al., 2012).

1.8.3 Reading strategy instruction

Active view on reading. Reading is a highly active process. Students need to be able to use active processes (i.e., focus their attention and use reading strategies) to attain their standards of coherence (van den Broek & Helder, 2017). To highlight the value of this active view on reading, the ‘top-class sport metaphor’ is adopted in ProjectExpert. Readers are like top athletes. A high level of engagement is needed to comprehend texts, just as a high level of energy is needed when practicing a sport. Moreover, to become a top athlete, intensive and varied training is crucial. Likewise in reading, ample, diverse, and adequate practice with multiple texts and reading strategies is essential (Duke et al., 2011). This metaphor is included throughout the twelve ProjectExpert-lessons. Strategies are for example renamed into ‘tactics’ and students are taught metacognitive reading strategies that enable them to become an active reader (van den Broek et al., 2017), referred to as ‘taking a time-out’.

Looking ahead. Before reading, students are taught to preview the text (Duke et al., 2011) in line with the strategy ‘previewing’ in Collaborative Strategic Reading (CSR) (Vaughn et al., 2011). They *preview titles, subtitles, and pictures*. Afterwards, students make educated *predictions*. These predictions can aid students during the monitoring of their comprehension. When the predictions are not confirmed, students will deliberately check their understanding of the text content (Palincsar & Brown, 1984). Second, students engage in *activating their prior knowledge* (Duke et al., 2011; Vaughn et al., 2011). This knowledge will be useful to generate inferences and create a coherent representation of the text (van den Broek & Helder, 2017).

Taking a time-out.

Feasibility and usability

During the focus groups (step 3 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), the teachers expressed their concerns about the abilities of their students to assess their needs to monitor text comprehension. As a result, the time-out symbol has been added to the texts to scaffold this task and indicate possible comprehension problems.

The complex task of monitoring comprehension is scaffolded by indicating possible comprehension problems in the text, via the symbol displayed in Table 3. Students take pauses (a time-out) when encountering the symbol in a text (see Figure 4). This practice is similar to the checkpoints of Fogarty et al. (2014). After a while, when

students are aware of their need to monitor their comprehension, texts can be presented to students without these symbols.

Table 3. Overview of principle 3: Reading strategy instruction

Design principle 3: Reading strategy instruction	(Organization of) instructional teaching activities	Learning activities
To enhance students' reading comprehension, reading strategy use, and autonomous reading motivation, explicitly teach a repertoire of cognitive and metacognitive reading strategies and install an active view on reading so students can engage in active, strategic reading (Boardman et al., 2018; Duke et al., 2011; Edmonds et al., 2009; Pressley, 2000; Souvignier & Moklesgerami, 2006).	<p>Install an active view on reading</p> <ul style="list-style-type: none"> ● Introduce the top-class sport metaphor ● Refer to the top-class sport metaphor, for example when <ul style="list-style-type: none"> • emphasizing the value of reading strategy use • introducing the roles of player and coach <p>Teach cognitive and metacognitive strategies</p> <ul style="list-style-type: none"> ● Looking ahead: previewing text, activating prior knowledge, and making predictions ● Time-out: monitoring text comprehension (taking pauses, brief oral summarizing) ● Time-out: fixing text comprehension problems on <ul style="list-style-type: none"> • word level (i.e., by using word familiarity, text context or (online) dictionary) • sentence/paragraph level (i.e., by careful rereading or looking ahead in text) ● Looking back: reflecting on <ul style="list-style-type: none"> • product of reading (via oral summarizing) • process of reading • affective text-based reactions <p>Engage in explicit strategy instruction, focusing on teaching declarative, procedural, and conditional strategy knowledge</p> <ul style="list-style-type: none"> ● Map students' current reading strategy use ● Emphasize value of reading strategy use ● Model reading strategy use (video + teacher modelling), while involving students ● Instruct the use of the strategy card ● Coach and facilitate during guided practice ● Strategy card as scaffold ● Observe and give feedback to students ● Adjust support based on students' needs ● Reflect on students' reading strategy use 	<p>Engage in active, strategic reading</p> <ul style="list-style-type: none"> ● Perceive reading as an active process, in line with the top-class sport metaphor ● Think about strategies already in use ● Understand the value of using reading strategies ● During modelling <ul style="list-style-type: none"> • Watch video • Observe teacher • Listen and try to understand why and what teacher is doing • Help teacher by giving suggestions ● During guided practice <ul style="list-style-type: none"> • Practice reading strategy use in pairs • Use strategy card when necessary • Listen to teachers' feedback and adopt feedback ● During reflection <ul style="list-style-type: none"> • Reflect on own reading strategy use • Listen to and accept teachers' feedback

Second, when comprehension problems are detected, *several strategies are offered to fix understanding* in line with the work of Vaughn et al. (2011) and Van Keer (2004). These are categorized into strategies for fixing problems on word level, and strategies for fixing problems on sentence/paragraph level, see Table 3.

Looking back. After reading a text, students are taught to reflect on their reading (Pressley, 2000). This reflection focusses on the product of reading, the process of reading, and affective text-based reactions. Regarding the product of reading, students produce a short oral summary by engaging in retelling (Duke et al., 2011). As to the reading process, students reflect on the reading strategies they used and how these strategies were useful to improve their text comprehension (Edmonds et al., 2009; Souvignier & Moklesgerami, 2006). This strengthens the value they attach to reading strategy use and accordingly increases the likelihood they will apply the reading strategies during future reading (Berkeley et al., 2011). Finally, students create affective text-based reactions, thereby for example making connections to their personal experiences (Guthrie et al., 2007; Kim et al., 2017).

Figure 4. Example text, with time-out symbols

Lynch's eyes were so painful and swollen that she visited an ophthalmologist. He examined her and discovered the problem. He saw that black dots had formed under her eyelid. Those buns were made up of caked-up mascara. They damaged her eyeball and therefore had to be removed. It was the very first time the ophthalmologist saw anything like this.

Luckily Lynch had gotten to the ophthalmologist on time. The doctor was able to perform surgery just in time to save her eyes. It took about an hour and a half before all the dots were removed. If Lynch had waited any longer, she could have gone blind.

Note. The first time-out symbol indicates a time-out related to potentially difficult words. The second time-out symbol indicates a time-out related to potential difficulties with sentences or paragraphs.

Reading strategy instruction. Each strategy is separately taught via a predefined pattern of steps. This pattern of steps operationalizes teachers' explicit strategy instruction, and focuses on teaching declarative, procedural, and conditional strategy knowledge (Duke et al., 2011; Pearson et al., 2020).

(1) The first step is *mapping students' current use of the reading comprehension strategy*. Students are asked how, when, and why they currently use the strategy. Teachers can utilize this information to adjust their instruction during further steps of the instructional pattern (De Smedt & Van Keer, 2018). (2) Second, the *value of using the reading comprehension strategy* is explicitly addressed. This will motivate

students to use the strategy during and after initial instruction (Pressley & Harris, 2006). (3) The third step is *modelling* (Duke et al., 2011). Via modelling, the mental processes of an expert reader become visible (Palincsar & Brown, 1984). In ProjectExpert, this is enacted via pre-recorded video and teacher modelling.

Feasibility and usability

During the focus groups (step 3 in the stepwise procedure to guarantee the feasibility and usability of ProjectExpert), the teachers indicated that an additional modelling video would be valuable to teach students how to use the strategies. In this way, the content is offered to students via multiple formats (i.e., teacher and video modelling).

(4) Fourth, the *use of the tactic card is instructed* (see Appendix A). In agreement with for example Vaughn et al. (2011) and Van Keer (2004) this card presents an overview of the different strategies and steps that are included in each tactic. Presenting the tactics on a comprehensible card in a logical order (i.e., before, during, and after reading) fosters internalization of strategy use (Souvignier & Moklesgerami, 2006). Students can furthermore use this card as a scaffold during guided practice. (5) Fifth, during *guided practice*, students read texts and practice the use of reading strategies in pairs, while the teacher observes the students and adjusts instruction based on students' needs (Duke et al., 2011; Duke & Cartwright, 2019). Teachers can therefore reinstall previous steps of this instructional pattern, comparable to practices in for example CSR and reciprocal teaching (Palincsar & Brown, 1984; Vaughn et al., 2011). (6) The last step is *reflection about strategy use* which can reinforce students' comprehension of and willingness to use the strategy (Duke et al., 2011; Palincsar & Brown, 1984).

1.8.4 Peer collaboration

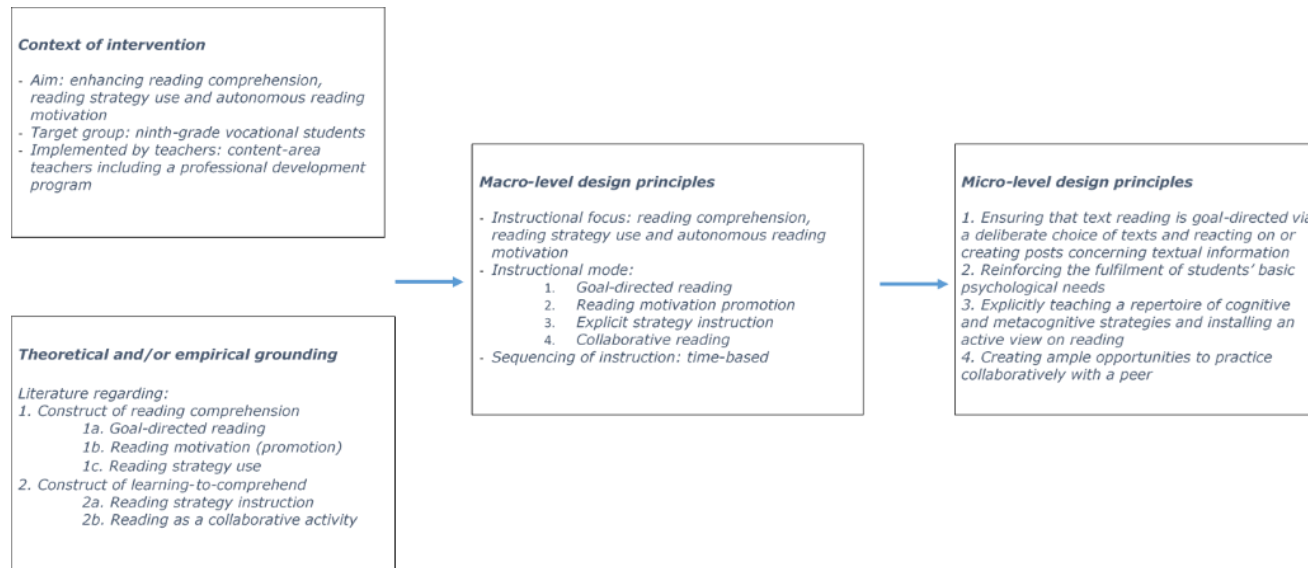
In ProjectExpert, students collaborate in pairs. The teacher creates *heterogeneous pairs*, based on students' reading proficiency. Moreover, matching students' personalities is taken into account when creating groups. By this means, cooperating in pairs will contribute to a higher autonomous reading motivation (Ryan & Deci, 2020). To structure collaboration, two roles are assigned. These are named 'player' and 'coach'. Role responsibilities (see Table 4) are comparable to the roles of tutor and tutee from Van Keer and Verhaeghe (2003). The role of the 'player' can be compared to the role of tutee, while the 'coach' serves as the tutor. Role allocation is alternated lesson per lesson so students can practice both roles (Fuchs et al., 1999; Van Keer, 2004).

An overview of the context, theoretical and empirical grounding, and macro- and micro-level design principles is presented in Figure 5.

Table 4. Overview of principle 4: Peer collaboration

Design principle 4: Peer collaboration	(Organization of) instructional teaching activities	Learning activities
To enhance students' reading comprehension, reading strategy use, and autonomous reading motivation create ample opportunities to practice collaboratively with a peer (Baye et al., 2019; Fisher & Frey, 2014; Reichrath et al., 2010; Ryan & Deci, 2020; Topping et al., 2017; Van Keer & Verhaeghe, 2003; Vaughn et al., 2011).	<p>Create ample opportunities to practice reading texts and using reading strategies</p> <ul style="list-style-type: none"> • Every lesson at least 20 minutes are spent on reading texts in pairs <p>Create engagement for collaborative reading</p> <ul style="list-style-type: none"> • Group students in heterogenous pairs, taking into account <ul style="list-style-type: none"> • reading proficiency • matching personalities • Discuss the importance and added value of reading in pairs • Engage students in a discussion to agree upon collaboration rules • Structure collaboration by providing roles (i.e., 'player' and 'coach') • Notify students that they should alternate roles and keep track by using the role distribution sheet • Model collaboration: demonstrate the responsibilities of each role • Observe students during paired reading and give feedback about the implementation of roles 	<p>Practice collaboratively with a peer</p> <ul style="list-style-type: none"> • Agree on working with peer • Understand value of reading in pairs • Participate in discussion on collaboration rules and adhere to rules • Practice reading with peer, by fulfilling role as a 'player' or 'coach': <ul style="list-style-type: none"> 'Player': <ul style="list-style-type: none"> • Reads aloud • Uses reading strategies, together with 'coach' 'Coach': <ul style="list-style-type: none"> • Reads in silence • Reads tactic card and keeps track of reading strategy use • Uses reading strategies, together with player • Make sure roles are alternated by using the role distribution sheet • Listen to and accept teachers' feedback about implementation of roles

Figure 5. Overview of context, theoretical and/or empirical grounding, macro- and micro-level design principles, based on the framework of Bouwer and De Smedt (2018, p.122)



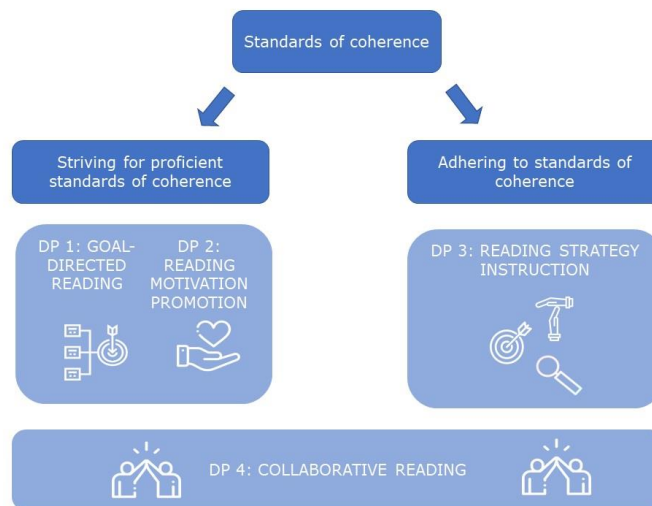
2. DISCUSSION

Referring back to the criteria to evaluate an educational intervention (McMaster et al., 2019; Nieveen, 1999; Schrijvers et al., 2019), this study foremost focused on evaluating whether the design of the reading intervention ProjectExpert is theoretically sound, by providing a detailed description of the context, theoretical and/or empirical grounding, and related macro- and micro-level design principles. Moreover, this paper provided first insights into whether the design of the intervention is practically sound, via taking into account the feasibility and the usability of the design principles. In this Discussion, first the construct validity (i.e., relational structure of the design principles) will be addressed based on the presented detailed description. Second, elaborating on the feasibility and usability, the challenges related to implementing ProjectExpert into authentic classroom settings will be considered.

2.1 Theoretically sound: Construct validity of ProjectExpert

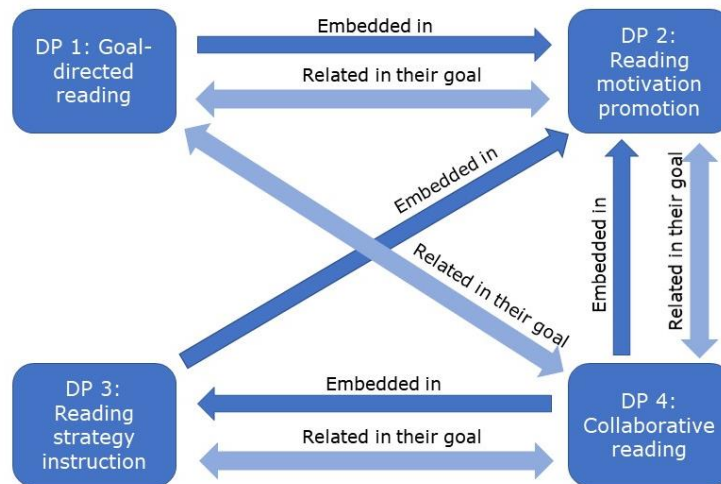
According to Nieveen (1999), all of the components of an intervention should be consistently related, referring to the construct validity of an intervention. As to ProjectExpert, we originally departed from a design focusing on engaging in goal-directed reading (i.e., design principle 1), teaching students a repertoire of reading comprehension strategies (i.e., design principle 3) and collaborative reading (i.e., design principle 4), all embedded in a motivating need-supportive learning environment (i.e., design principle 2) (see Figure 1). The usability and feasibility data confirmed the key value of reading motivation promotion for this group of students, corroborating its overarching position in our relational structure. Nonetheless, throughout the design process, we were urged to adjust this hypothesized structure. Departing from the central value of striving for and adhering to proficient standards of coherence (van den Broek & Helder, 2017), additional relationships between the design principles (DP) came to the fore (see Figure 6).

Figure 6. Revised relational structure of the ProjectExpert reading intervention



In this revised relational structure, goal-directed reading (i.e., design principle 1) and reading motivation promotion (i.e., design principle 2) both strive for ensuring that readers read to proficient standards of coherence. Reading strategy instruction (i.e., design principle 3) is adopted in view of ensuring that students are able to adhere to their standards of coherence. Collaborative reading (i.e., design principle 4) is both related to ensuring that readers read to proficient standards of coherence, and are able to adhere to their standards of coherence (van den Broek & Helder, 2017). After finishing the design of ProjectExpert, the hypothesized relational structure consequently included additional relationships. An overview of the changes made to the relational structure is presented in Figure 7. At first, design principles 1, 3 and 4 were embedded in design principle 2 (presented in light blue). After revising this relational structure, design principles 1, 2 and 4 are additionally related as to their mutual goal (i.e., striving for proficient standards of coherence). The same accounts for design principles 3 and 4 (i.e., enabling students to adhere to their standards of coherence) (presented in dark blue).

Figure 7. Overview of relationships between the design principles.



Note. Dark blue: presented in original relational structure - light blue: added in revised relational structure

In sum, although we discuss these design principles separately, the four design principles are mutually related in multiple ways. Fostering students' reading comprehension, strategy use and autonomous motivation is a complex and challenging endeavor, requiring a combination of multiple instructional practices. In view of sustainable changes in students' reading outcomes, this study corroborates previous calls for combining a multitude of both cognitively and motivationally-oriented instructional principles in reading interventions (Baye et al., 2019; Duke et al., 2011; Edmonds et al., 2009).

2.2 Practically sound: Implementing ProjectExpert into authentic classroom settings

Notwithstanding our attempts to guarantee the feasibility and usability of ProjectExpert, implementing a theory-based intervention in authentic classrooms is highly challenging. The implementation is more specifically complicated by multiple characteristics of the teachers, students, and the educational context (Okkinga et al., 2018), which we will elaborate on underneath.

Considering *teacher characteristics*, the meta-analysis on the effectiveness of strategy-interventions by Okkinga et al. (2018) points to larger effect sizes when interventions are implemented by researchers in controlled settings, in comparison with teachers in authentic classroom settings. This might be explained by the demanding nature of explicit strategy instruction and guiding a whole class of students during paired reading (Brevik, 2017). Particularly content-area teachers (who teach reading comprehension in the Flemish vocational track) might not feel capable to engage in these complex tasks (Ness, 2016). Furthermore, an important pitfall regarding reading strategy instruction is that it might result in a mechanic, isolated instruction wherein teaching reading strategies instead of fostering reading proficiency through strategy instruction is considered the end goal of instruction (Brevik, 2019). This risk increases in particular given that this kind of isolated instruction might be more in line with teachers' typical reading comprehension instruction (Af-flerbach et al., 2020). To respond to these abovementioned challenges, high-quality professional development for teachers is to be recommended (Elleman & Oslund, 2019; Fogarty et al., 2014).

Regarding *student characteristics*, the group of vocational-track students is characterized by a large amount of individual differences (e.g., educational background, language skills, cognitive skills). Furthermore, students' standards of coherence are highly individual. These standards of coherence are fundamental in the framework of van den Broek and Helder (2017) that was adopted in ProjectExpert as the underlying construct of reading comprehension. The extent to which readers use active, reader-initiated processes (e.g., reading strategies) depends on whether they are able to achieve their standards of coherence. It is thus crucial to ensure that students read to proficient standards of coherence. Yet, the standards of coherence during reading remain highly individual and invisible for teachers. In an authentic classroom context, it is consequently challenging for teachers to monitor whether students adopt proficient standards of coherence during paired reading. Furthermore, next to the reading goal and reading motivation (incorporated into ProjectExpert), other student characteristics likewise impact their standards of coherence (e.g., distractors or fatigue). These might consequently impact students' use of reading comprehension strategies in classrooms as well (van den Broek & Helder, 2017). In conclusion, a one-size-fits-all solution for stimulating these students' reading comprehension seems implausible (Alvermann, 2002). Differentiating instruction is a promising teaching practice to deal with these varied and diverse students' needs (Duke & Cartwright, 2019). However, this is challenging for teachers and difficult to include optimally in a relatively short reading comprehension intervention.

As to *characteristics of the context*, classroom time that can be devoted to fostering students' reading comprehension is limited. Especially in vocational education, teaching students to comprehend texts is only one of the multiple theoretical and practical educational goals (Vlaams Ministerie van Onderwijs en Vorming, 2015). However, there is not a quick-fix for teaching students how to understand texts (Alvermann, 2002). Reading comprehension requires the orchestration of numerous

skills, takes a great deal of time, effort and practice (van den Broek et al., 2017) and becoming a strategic reader is a long-term process (Souvignier & Moklesgerami, 2006). On the other hand, becoming an engaged and autonomously motivated reader requires a sustained motivation-enhancing reading and learning environment (Ryan & Deci, 2020) as well. Implementing the twelve ProjectExpert lessons can be a promising starting point. Yet, teaching reading comprehension needs to be incorporated across all domains and subjects and ideally during students' entire educational career (Greenleaf & Valencia, 2017).

3. CONCLUSION

Via adopting the comprehensive framework of Bouwer and De Smedt (2018), this study provides a detailed, rigorous, and analytic description of the reading intervention ProjectExpert. Four design principles are put forward: goal-directed reading, reading motivation promotion, reading strategy instruction, and collaborative reading. In addition to this analytic description, the complex and multiple relationships between the design principles are highlighted. Furthermore, based on a stepwise procedure, the extent to which the intervention will be feasible for teachers to implement, and usable for students is strengthened. Nonetheless, potential challenges related to implementing ProjectExpert are discussed. This study points to the complex relationships between various design principles of reading interventions, and the inherent challenges related to implementing theoretically- and empirically-based reading interventions. Based on these insights, this study could guide the implementation, dissemination, evaluation, and replication of ProjectExpert in particular, and reading interventions in general.

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APPENDIX A

Tactic card

(available for students, translated from Dutch)

BEFORE reading**Looking ahead**

- 1 Inspect the title, subtitle(s) and picture(s)
- 2 What can this text be about?
Why do you think so?
- 3 What does this remind you of?
What do you already know about this?

DURING reading**Time-out**

- 1 Take a pause
Describe briefly what the text is about
- 2

<p><u>Problems with <i>difficult words</i>?</u> Do you recognise a part of the word?</p> <p>Search for the meaning</p> <ul style="list-style-type: none"> - in the text - by inspecting the pictures - in an (online) dictionary 	<p><u>Problems with <i>sentences or parts of the text</i>?</u> Slowly and carefully reread that part and</p> <ul style="list-style-type: none"> - think about what you already know about the text - think about titles, subtitle(s) and picture(s) <p>Read a little further to solve your problem</p>
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- 3 Problem not solved? Ask each other or the teacher for help





AFTER reading



Looking back

1 Describe briefly what the text is about

2 Which tactics did you use?

-  Inspecting title, subtitle(s) and picture(s)
-  Taking pauses during reading
-  Searching for the meaning of difficult words
-  Rereading difficult parts of the text

...

How did using this tactic(s) improve your comprehension?

3 What did you think of the text? (e.g. interesting, difficult, long, fun ...)