

Assessing the Impact of Teacher Design Teams on the Professional Development of Vocational Education Teachers

A Focus on Attitudes, Beliefs and Instructional Practices in the Context of an Interdisciplinary Course

Tina Gryson, Katrien Strubbe, Tony Valcke & Ruben Vanderlinde

Abstract Vocational students in European secondary education face a high dropout rate. Research shows that although general subjects are essential for preparing students for their future lives, increasing the time allocated to these subjects in the curriculum also leads to higher dropout rates (e.g., Hall, 2016; Hermann et al., 2013). The professional development of general subject teachers through active and long-term initiatives can improve their attitudes, beliefs, and instructional practices (Merchie et al., 2016). These changes can enhance vocational students' engagement and motivation, thereby reducing early school dropout (e.g. Van Houtte & Demanet, 2016). This study explores the influence of Teacher Design Teams (TDTs) on teachers' attitudes, beliefs, and instructional practices in general subjects for vocational secondary education. Throughout two school years, three TDTs have been investigated in the context of an interdisciplinary course. Data collection involved conducting interviews with nine teachers and collecting the designed curriculum materials. These data were analysed using thematic analysis. The results show that the teachers improved their instructional practices and particularly their digital skills. Teachers' attitudes and beliefs also developed after the implementation of TDTs. The designed curriculum materials exhibited diversity with varying levels of consistency across the different components.

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Title *Assessing the Impact of Teacher Design Teams on the Professional Development of Vocational Education Teachers. A Focus on Attitudes, Beliefs and Instructional Practices in the Context of an Interdisciplinary Course*

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1 Introduction

Vocational secondary education is organised in various ways in Europe. Despite these different approaches, it is striking that vocational secondary education in most European countries deals with a large student dropout rate (Cerdeña-Navarro et al., 2017). Research indicates a correlation between the dropout rate in vocational secondary education and the allocation of hours to general subjects. For instance, Hermann and Horn (2023) showed that a decrease in the time allocated to general subjects within the curriculum of vocational students, as executed through an educational reform in Hungary, was followed by a reduction in the dropout rate. Equally, Hall (2016) demonstrated that an educational reform in Sweden, which increased the focus on general subjects for vocational students, coincided with a rise in the dropout rate. Nevertheless, it is important to include general subjects in secondary vocational education. Hermann et al. (2013) demonstrated that reducing the hours dedicated to general subjects in the curriculum is associated with a decrease in student achievement among vocational students. To put differently, a lack of general skills and knowledge makes students less prepared for their future daily, social and professional life in which, for example, new information must be constantly understood and deployed, and communication skills are necessary (Placklé et al., 2020; Räisänen & Rökköläinen, 2009). Furthermore, vocational students who graduate with insufficient general education may find themselves at a disadvantage in the labour market. A lack of general skills hinders their ability to adapt to the constantly evolving demands of the job market and accelerates the obsolescence of their professional skills (Hanushek et al., 2011; Hermann et al., 2019).

While the importance of incorporating general subjects into vocational secondary education is undeniable, it is shown that the presence of these subjects in the curriculum influences the dropout rates (Hermann et al., 2013). Research frequently explains dropout rates by focusing on determinants on the student level such as socioeconomic status, school career and achievements. However, research also shows that several factors on the teacher level such as encouraging student engagement and motivation, eliminating feelings of futility and teacher behaviour can prevent students from dropping out (Cerdeña-Navarro et al., 2017; Quin, 2017; Van Praag et al., 2015). Research of Van Houtte & Demanet (2016) and van Uden, Ritze and Pieters (2014), for instance, shows the impact of teacher beliefs and attitudes on students' learning outcomes and study motivation in vocational education. Van Houtte and Demanet (2016) conducted research on the role of teachers in students' intentions to drop out of secondary education, revealing that vocational students who experience positive beliefs about teachability are less inclined to drop out. Also, teachers' self-efficacy beliefs have an indirect impact on vocational stu-

dents' study engagement which can prevent them from dropping out (van Uden, Ritze, & Pieters, 2014). In addition to teachers' beliefs and attitudes, teachers' instructional practices and classroom behaviour are beneficial for vocational students' motivation. In this context, Placklé et al. (2014) designed a model for powerful learning environments in vocational education with a focus on general subjects to encourage student motivation and engagement. In this model, authentic and challenging learning tasks, adaptive learning support and a focus on 21st century competencies are the key design principles for vocational teachers to create powerful learning environments.

Professional development (PD) for teachers of general subjects can ensure that vocational students have significantly lower risk of dropping out. There are different approaches to foster teachers' PD, ranging from short-term activities outside school to long-term initiatives at school. Merchie et al. (2016) indicate the effectiveness of long-term PD initiatives with collaborative participation at school. Professional learning communities (PLC's) meet these characteristics as teachers in a PLC share and discuss their daily teaching practice on a systematic and long-term basis (Valckx et al., 2019). PLC's enable teachers to develop professionally and enhance their classroom practice ultimately resulting in improved student learning outcomes. In this context, a Teacher Design Team (TDT) as a specific type of a PLC, appears promising due to its focus on the collaborative design of curriculum materials (Binkhorst et al., 2015). TDTs allow teachers to professionalise while designing useful curriculum materials for their students at the same time. This research project investigates the PD of general subject teachers in vocational secondary education through their participation in TDTs. More specifically, the PD of vocational teachers' attitudes, beliefs and instructional practices are examined.

2 Research context: Project Integrated General Subjects in Flanders

This research was implemented in the context of the course Project Integrated General Subjects (PGS) in Flemish secondary vocational education. Flemish secondary education is characterised by a cascade system. This means that most students start their school career in the socially highest valued academic track and 'drop down' to 'lower' tracks. This cascade system leads to a heterogeneous student composition in the 'lowest' vocational track (Van Praag et al., 2015). Van Praag et al. (2015) indicate that this diversity among students leads to a lack of motivation for general subjects, which may seem repetitive and insufficiently challenging for those who dropped down from a more academic track. Consequently, these students may exhibit disruptive behaviour, affecting the learning environment for others who genuinely need to focus to comprehend the subject matter. This cascading effect poses a challenge for PGS teachers to provide differentiated instruction and to actively engage students in their classes (Van Praag et al., 2015).

General subjects in Flemish vocational secondary education are clustered in the course PGS. PGS aims to teach general subjects in a meaningful and motivating way using thematic and project-based teaching to enable vocational students to become self-reliant and resilient in their social and professional life (Placklé et al., 2020). However, national assessment research in 2013 and 2021 shows that PGS does not achieve these objectives (Janssens & Willem, 2022). More than half of the examined vocational stu-

dents do not meet the basic level for maths, listening and reading. A follow up study to the 2013 assessment research examined possible explanations for the disappointing results (Sierens et al., 2017). An essential explanation is that PGS teachers often lack a wide range of knowledge and specific experience when instructing vocational students. Almost all Flemish teachers are allowed to teach PGS without any requirements concerning preliminary education or training. The results of the 2013 assessment research indicate that 78 % of the PGS teachers lack specialised training for the course (Van Nijlen et al., 2014). However, teaching PGS poses significant challenges for educators, given its open-ended attainment targets and curriculum requirements. Consequently, PGS teachers are expected to develop their own curriculum materials to meet these demands.

3 Theoretical framework

3.1 Teacher Design Teams

Handelzalts (2009) describes a TDT as *'a group of at least two teachers, from the same or related subjects, working together regularly, with the goal to (re)design and enact (a part of) their common curriculum'* (p. 7). TDTs thus are used to design curriculum materials collaboratively. These collaborative design activities are valuable for teachers' PD (Voogt et al., 2015). Binkhorst et al. (2015) describe PD of the participating teachers as an outcome of a TDT, as are the designed curriculum materials. According to the integrated descriptive framework for TDTs by Binkhorst et al. (2015), the quality of both outcomes is determined by input and process factors. Input factors of a TDT refer to the teachers and their characteristics (e.g. motivation to participate) and to the context (the school) and its characteristics (e.g. support of school leader). The process factors involve everything that occurs during a TDT meeting, such as a clear goal alignment and beneficial interactions in the TDT. The process factors are identified by Binkhorst et al. (2015) as most defining for the quality of PD and designed curriculum materials. Especially the support of a coach is emphasised as an important process factor.

In a TDT, a coach can be either internal or external (Compen & Schelfhout, 2020). An internal coach is mostly a peer teacher who is internal to the school and participates as a team member. An external coach is a subject matter or didactical expert and external to the school, and as such has a more neutral role towards the team. Research by Compen and Schelfhout (2020) found that both coaches have positive effects on a TDT, however these positive effects are reflected in different aspects of a TDT. The coaching activities and team learning beliefs and behaviours were experienced more positively by teachers in TDTs with an internal coach, while teachers who participated in TDTs with an external coach reported higher levels of team effectiveness and higher quality of created materials. Binkhorst et al. (2022) highlight the complex and difficult role of a coach in a TDT and suggest the need to split up roles. One coach should provide expert knowledge and the other should monitor the progress of the TDT. Besides the support of a coach, the support of the school leader is important. The successful implementation of the newly developed curriculum materials requires a combination of both practical (e.g. schedul-

ing TDT in teaching assignment) and emotional support (e.g. interacting with the TDT) from the school leader (Handelzalts, 2009; Voogt et al., 2016).

TDTs can be organised in two ways: firstly, as school-based TDTs with teachers from the same school and secondly, as networked TDTs with teachers from different schools. Research on school-based TDTs has shown that they enable the implementation of a school reform in a school-wide manner (Handelzalts, 2009). The designed curriculum materials are also better aligned to the specific student population of a school. Additionally, these TDTs can increase the internal curriculum consistency, more specifically consistency between the intended and the implemented curriculum and between all components of the curriculum materials (Albashiry et al., 2015). Networked TDTs have the added advantage of exceeding the expertise of teachers in one school by sharing knowledge and skills across schools. This is why researchers are increasingly highlighting the need for networked TDTs as they can generate a higher level of PD (Binkhorst et al., 2022). PD through TDTs occurs through the direct exchange of knowledge and skills among teachers, but TDTs can also contribute to the development of teachers' attitudes and beliefs (Voogt et al., 2015).

3.2 Teachers' professional development

Teachers' PD can be defined as a process of continuous learning to improve teachers' skills and knowledge for the enhancement of student performance (Darling-Hammond et al., 2009). It is a crucial aspect of in-service teachers' growth and improvement. Research of Avalos (2011) emphasises the value of teacher collaboration, such as TDTs, for PD initiatives. Merchie et al. (2016) developed an extended evaluative framework for mapping the effects of PD initiatives. According to this framework, PD can enhance teacher quality (including knowledge, skills, attitudes, and beliefs) and teacher behaviour (including instructional strategies and practices, and interaction patterns). The PD of teachers also benefits students, as the framework suggests that both socio-emotional outcomes and knowledge and skills improve.

3.2.1 Professional development of attitudes and beliefs

Research of Vossen et al. (2019) indicates the importance of investing in teachers' attitudes and beliefs for their PD, which are part of the teacher quality in the framework proposed by Merchie et al. (2016). This research will focus on attitudes and beliefs towards the course PGS, self-efficacy beliefs and beliefs about the teachability of vocational students.

Self-efficacy relates to the mental process where individuals form beliefs about their own capability to attain desired results, which affects their thoughts, emotions, actions, and motivation (Bandura, 1978). Dellinger et al. (2008) describe self-efficacy beliefs in an educational context as '*a teacher's individual beliefs in their capabilities to perform specific teaching tasks at a specified level of quality in a specified situation*' (p. 752). Research shows that teachers' self-efficacy beliefs have a significant influence on both teacher behaviour and student achievement (Geijsel et al., 2009). Van Uden, Ritze and Pieters (2014) show, for instance, the indirect impact of teachers' self-efficacy beliefs on study engagement of vocational students.

According to Kornblau (1982), teachability can be described as teachers' assumptions about their students' abilities to achieve learning objectives. Research shows that teachers expect less from students in less academically oriented tracks and, consequently, teachers will adapt their instruction based on their perception of the students' abilities (Stevens & Vermeersch, 2010). To put differently, teachers in technical or vocational education have lower teachability expectations towards their students. Positive teacher beliefs about the teachability of the students can be beneficial, especially for vocational students, who therefore tend to drop out less (Van Houtte & Demanet, 2016).

3.2.2 Consistency of curriculum materials

When designing curriculum materials, maintaining consistency between all curriculum components is a major challenge (Handelzalts, Nieveen, van den Akker, 2019). This study will focus on the influence of teachers' PD on their instructional practices, including the skills to design curriculum materials. This is examined by analysing the designed curriculum materials using the curricular spider web of van den Akker (2003). This spider web illustrates the complexity of curriculum materials and is used as a tool for analysing curriculum consistency using ten components. Central is 'the rationale' component (Why do students learn?). The other nine components are: aims and objectives (the specific learning outcomes and goals), content (the subject matter and topics), learning activities (teaching methods and student activities), teacher role (their responsibilities, interaction and support), materials and resources (curriculum materials and (digital) tools), grouping (individual or organisation of collaboration), location (learning environment), time (time allocation), and assessment (evaluation method). These nine components must relate to the rationale and to each other. If one of the components changes, the other components should also be revised. To investigate the curriculum consistency of the designed materials, the parameters based on van den Akker's (2003) curricular spider web were used in this study.

4 Method

4.1 Research aim and questions

The aim of this study is to investigate how TDTs influence the PD of general subject teachers in vocational secondary education. Accordingly, two research questions emerge in this study. The first research question focuses on teachers' PD of attitudes and beliefs. More concretely, three attitudes and beliefs will be examined: attitudes and beliefs towards PGS, beliefs concerning teachability and self-efficacy beliefs. The second research question focuses on teachers' PD of instructional practices. This involves the examination of teachers' PD in classroom practices and in design skills by analysing the consistency of the designed curriculum materials.

Research Question 1 (RQ1): How do TDTs affect vocational teachers' attitudes and beliefs?

- RQ1A: How do TDTs influence vocational teachers' attitudes and beliefs regarding PGS?
- RQ1B: How do TDTs influence vocational teachers' beliefs about the teachability of vocational students?
- RQ1C: How do TDTs influence vocational teachers' self-efficacy beliefs?

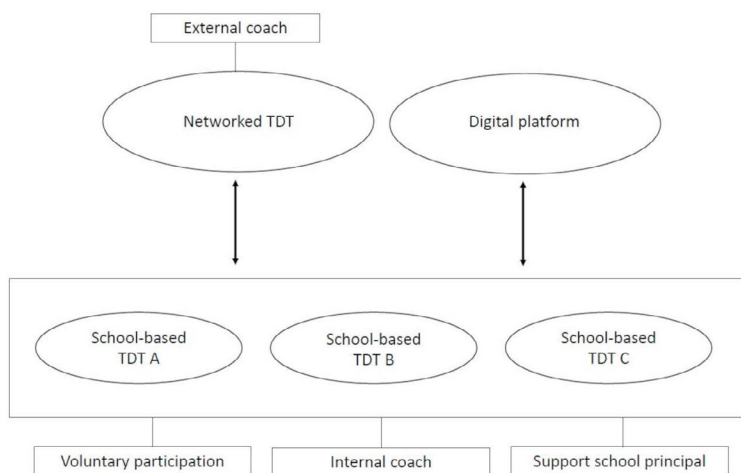
Research Question 2 (RQ2): How do TDTs affect vocational teachers' instructional practices?

- RQ2A: How do TDTs influence vocational teachers' classroom practices?
- RQ2B: How do TDTs influence vocational teachers' design skills?

4.2 Implementing Teacher Design Teams

To study the PD of vocational teachers in TDTs, a TDT programme for implementation in secondary schools was designed based on a preliminary study (Authors, 2024). In this preliminary study, focus groups with inspectorates, educational counsellors, teacher educators and teachers were conducted to examine the necessary conditions for TDTs with vocational teachers, more specifically PGS teachers.

Figure 1: Main conditions TDT programme



The main conditions of the TDT programme that was implemented in the participating schools are presented in figure 1. Each school and its participating teachers design curriculum materials in a school-based TDT which enables focusing on the school's student population during the design process. The members of the school-based TDT meet frequently at school and a long-term and voluntary participation of teachers was key. To guarantee the autonomy of the school-based TDTs, an internal coach provided sup-

port and guidance. The teacher who assumed the role of internal coach received training to develop the necessary coaching skills. To enhance process monitoring, each school-based TDT made a report during each meeting, using a pre-established template. These reports clearly documented the steps and agreements made during the meetings which secured continuation of the TDT when members of the team changed. The school leader was also encouraged to be involved in the school-based TDT process. To obtain knowledge and input from beyond the school-based TDTs, four meetings per school year were organised in a networked TDT with the internal coach-teachers. The networked TDT focused on exchanging knowledge, introducing new knowledge by experts, and providing feedback on each other's designed curriculum materials. A digital platform fosters collaboration outside these meetings by enabling teachers to review progress and materials from each school-based TDT.

4.3 Participants and Teacher Design Teams

This study examines teachers in three TDTs in three different schools over two school years. Participant selection was done through a public participation invitation on social media groups for PGS. PGS teachers were directly addressed instead of school leaders because preliminary research (Authors, 2024) emphasised the importance of teachers' voluntary participation. After the teachers volunteered to participate, the school leader was informed about the research and asked for their consent.

Three schools and ten teachers participated during the research period of two school years. In each school, one TDT was implemented. The background characteristics of the teachers are presented in Table 1.

Table 1: Demographics of the participants at the start of the TDT programme

TDT	Teacher	Gender	Education	Years of experience as teacher (in PGS)
A	Miranda (coach)	Female	Master's degree in psychology	14 (12)
	Vanessa	Female	Bachelor's degree in economy	14 (14)
	Vic	Male	Bachelor's degree in secondary education (PGS and physical education)	2 (2)
	Alex	Male	Master's degree in history	14 (14)
B	Sarah (coach)	Female	Bachelor's degree in secondary education (PGS and Roman Catholic religion)	6 (4)
	Peggy	Female	Bachelor's degree in secondary education (beauty studies)	27 (1)
	Noah	Male	Bachelor's degree in secondary education (woodworking and physical education)	13 (1)
C	Yves (coach)	Male	Master's degree in history	15 (15)
	Clara	Female	Bachelor's degree in secondary education (French, history and geography)	32 (20)
	Kevin	Male	Bachelor's degree in primary education	20 (17)

As shown in Table 1, each teacher is part of a school-based TDT which takes place within a secondary school. To reflect this context, the main characteristics of these TDTs and secondary schools are described in Table 2.

Table 2: Description of the school-based TDTs

TDT	Description
A	TDT A took place at a large, urban public school with multiple campuses. Students can enrol in the second and third grade and choose a field of study in the art, technical or vocational track. In school year 2021–2022, there were 1071 students enrolled at the school, of whom 382 were in the vocational track. TDT A consists of four participating teachers of the eight PGS teachers at school. The TDT struggled with teacher turnover in the second school year. Vanessa quit teaching in January 2022 but was not replaced in the TDT. In March 2022, Miranda began working as special educational needs coordinator at another school. However, Miranda continued to work as the coach of the TDT. TDT A had six meetings in the first school year and four meetings in the second school year.
B	TDT B took place at a small, rural public school with two campuses. Students can enrol in the three grades and choose a field of study in the general, technical or vocational track. In school year 2021–2022, there were 241 students enrolled at the school, of whom 79 were in the vocational track. TDT B consists of the PGS teacher and the two vocational subject teachers of the second grade. This composition was chosen because the school wants to design the course PGS-vocational subjects as part of the reform. In this course, the general subject matter of PGS will be linked to students' vocational field. Close cooperation between PGS teachers and vocational subject teachers is aimed at both design and classroom practice. TDT B had regular meetings, usually every two weeks, but these were often short meetings during lunch breaks, for example. The school's technical education coordinator also regularly participated in the TDT meetings to support teachers in their design process.
C	TDT C took place at a small, rural public school. Students can enrol in the three grades and choose a field of study in the technical or vocational track. In school year 2021–2022, there were 207 students enrolled at the school, of whom 88 were in the vocational track. TDT C consists of three participating teachers from the four PGS teachers at school. TDT C had three meetings in the first school year and four meetings in the second school year.

4.4 Data collection

During two school years (2020–2021 and 2021–2022), the TDT programme was implemented in three Flemish secondary schools. Each school year, an interview was conducted with each participating teacher. One teacher (Kevin) did not want to participate in all interview moments and is therefore excluded in this study. This implies that data were collected and analysed from nine teachers. Based on the yearly interviews, a picture of the initial and post-intervention perceptions was obtained. The first interviews occurred during the second trimester of the 2020–2021 school year¹, while the second interviews were conducted towards the end of the 2021–2022 school year. The interviews in the school year 2020–2021 were conducted and recorded online with Microsoft Teams because of the Covid-19 restrictions. In the school year 2021–2022, teachers could choose for an online or face-to-face interview as both show similar results (Abrams et al., 2014).

1 Due to Covid-19 measures, both the implementation of the TDTs and the scheduling of interviews were postponed. As a result, the interviews were conducted during the second trimester of the 2020–2021 school year.

The duration of the first interviews for all teachers lasted between 40 and 60 minutes. The second interview lasted longer between 60 and 80 minutes. The informed consent that was acquired in advance was approved by all participants.

The interviews were conducted using a semi-structured questionnaire. In the first interview, indirect questions were asked to capture teachers' attitudes, beliefs, and classroom practices. These questions were repeated in the second interview. The repetition of identical questions during the second interview facilitates the comparison of responses across both interviews, thus providing insight into the teachers' PD. Implicit attitudes and beliefs, which rely on spontaneous, unconscious mental associations, can be addressed with indirect questions (Ajzen & Dasgupta, 2015). An example question is: "Teachers sometimes say it is difficult to teach vocational students. What is your perspective on this statement?". The teachers were also directly questioned during the second interview about changes in beliefs and acquired skills due to the TDT. "What competencies did you acquire through your participation in the TDT?" is an example of a direct question.

The designed curriculum materials were also collected for analysis after the two school years. In accordance with their students' needs, the TDTs were given the autonomy to decide which curriculum materials they needed to develop.

4.5 Data analysis

The interviews were recorded and transcribed verbatim. The data were anonymised. The thematic analysis following the method of Braun and Clarke (2006) was applied by the main researcher to analyse the data. Since 2019, Braun and Clarke have termed their analysis method 'reflexive thematic analysis' to highlight the researcher's interpretative role in the analysis (Braun & Clarke, 2021). The researcher's subjectivity, rather than being a threat, is considered a valuable resource, with reflexivity playing a crucial role. Throughout the analysis process, the main researcher engaged in active reflection, both individually through memo writing and collaboratively by sharing intermediate findings with the other researchers and collectively reflecting on them. This reflexive engagement ensured that the interpretation of the data was thorough.

The data underwent a systematic and iterative coding process, with both deductive and inductive approaches (Fereday & Muir-Cochrane, 2006). Initially, the predefined research questions guided the creation of themes, with a specific focus on the PD of self-efficacy beliefs, teachability beliefs, beliefs about PGS, and classroom practices. During the different phases of coding the data, an inductive approach was adopted to allow for the emergence of additional (sub-)themes. This was conducted in accordance with the six steps of thematic analysis: (1) familiarising with the data, (2) generating initial codes, (3) constructing themes, (4) reviewing potential themes, (5) defining and naming themes and (6) producing the report (Braun & Clarke, 2006). The analysis involved a continuous iterative process, frequently moving back and forward between the different steps. Transcribing and repeatedly reading the transcripts created familiarity with the research material. This was followed by the iterative process of data analysis. The data analysis started at respondent level, focusing on each individual teacher as the unit of analysis. To capture the PD of the vocational teachers, the first and second interview of each teacher

were coded separately. This process began with open coding, followed by merging the codes. Based on this, themes and sub-themes were established. This included codes that had positive and negative teacher perceptions within the sub-themes. Positively marked codes indicated constructive aspects of PD, such as improved teaching strategies or increased confidence, while negatively marked codes highlighted challenges or areas of struggle. This distinction was crucial for understanding the nuances of each teacher's development over time. Table 3 presents several examples of codes and (sub-)themes utilised in this study. By comparing the coded data from the first and second interviews, including similar and different codes, we identified changes and developments in each teacher's PD. Subsequently, each theme was compared across respondents, which was done using cross-case analysis (Borman et al., 2006). Themes were compared across the respondents to identify broader trends and variations in PD, which made the determination of similarities and differences possible across the cases.

Table 3: Examples of (sub-)themes, codes and quotes from the data

Theme	Sub-theme	Code	Quote
Attitudes and beliefs PGS	Integrated approach	Unclear approach (negative perception)	"Yes, an integrated approach with themes, projects,... but after all these years, it is often unclear how to properly address it."
Beliefs about teachability	Feasibility attainment targets	Too high expectations reform (negative perception)	"Now with the reform, I don't believe students can still meet all the attainment targets."
Self-efficacy beliefs	Content knowledge	Sufficient (positive perception)	"I'm not saying I know everything by heart, but I certainly have enough basic knowledge to teach this course."
Classroom practices	Digital skills	Implemented in classroom practice	"Since I learned to make these exercises online, I now use them in my class, and it's a real advantage."

The data analysis of the designed curriculum materials was guided by the curricular spider web of van den Akker (2003) and consequently focused on their consistency. A deductive theory-based approach was applied by the main researcher. Individual reflexivity was pursued in this analysis through memo writing, while regular meetings at which the analyses were discussed and double-checked, enabled the research team's collective reflexivity. The rationale, which served as the central component of the curricular spider web, provided the foundation for this analysis and was proposed by the participating teachers themselves. The remaining nine components of the spider's web were assessed for their consistency with the rationale of the curriculum materials provided by the teachers of the TDTs. These nine components are aims and objectives, content, learning activities, teacher role, materials and resources, grouping, location, time, and

assessment. By using the curricular spider web model and these specific components, the data analysis aimed to provide a holistic and detailed analysis of the designed curriculum materials, ensuring comprehensive alignment with the rationale. To assess this alignment, all relevant aspects of the curriculum materials were coded and linked to the nine components of the curricular spider web. This approach facilitated an assessment of the presence and representation of these components within the curriculum materials. For each component, an assessment was conducted to determine whether the various aspects of the curriculum materials were consistent with the a-priori established rationale.

5 Results

This section presents the results for the teachers' PD according to the two main research questions and sub-questions. First, teachers' PD of the examined attitudes and beliefs is described. These results were considered at the individual level and where possible comparisons are made across teachers and TDTs. Next, the PD of teachers' instructional practices will be discussed. Due to the large differences between the designed teaching materials, the analysis here was limited to studying the results at TDT level without making comparisons.

5.1 Attitudes and beliefs

5.1.1 Attitudes and beliefs towards PGS

A key characteristic of PGS is the interdisciplinary character of the course. To enable an effective integration of subjects, it is important that teachers have a positive attitude towards it. Accordingly, PD in teachers' attitudes and beliefs towards PGS may be beneficial. Upon examining teachers' initial attitudes, it becomes apparent that they exhibit positive attitudes towards integrated approach of PGS. After the TDT programme, Miranda even emphasises the importance of an integrated approach for vocational students and she also sees the value for students in other tracks.

I think I became more convinced of how important PGS is within vocational education... I am convinced that PGS can be a huge asset in ALL fields of study [...] if we replace philosophical subjects with a sort of PGS [...] then I think you can offer enormous added value if you can link all subjects together. (Miranda, TDT A)

Contrastingly, Miranda quit her job as a PGS teacher during the second school year. She indicates the lack of support and clear vision for PGS. All teachers reinforce each other with the idea that PGS is not feasible for a single teacher and that a clear vision on PGS never is provided by the school or the government. This results in negative attitudes towards the course among other teachers. Yves, Alex and Noah consider moving away from the integrated course PGS and teach the general subjects separately. Sarah also sees advantages in splitting PGS into two courses with science-mathematics and the other gen-

eral subjects. Clara is neutral, stating that it matters little to her, as long as a clear vision on PGS is finally established in the schools. Vanessa clarifies the problem by stating that the course has to be taught by three teachers. All teachers also mention that co-teaching would be a relief in PGS. However, they regret they never experienced any possibility of collaboration in classroom practice at their school. It causes a lot of frustration among them. The following quote attests to this general feeling.

It is still not possible to collaborate during PGS classes. Regrettably, the class schedule did not suit again this year, and despite our efforts, the school leader refuses to make adjustments. (Peggy, TDT B)

The teachers have a clear belief in working together for PGS and assess collaboration in TDTs as positive. While the TDTs were already a good opportunity for teachers to experience more cooperation for PGS, there is a clear need for structural cooperation, determined at school or government level. Teachers have a general sense that either at the societal level or at the school level PGS is not taken seriously. This feeling is prevalent among teachers after the TDT programme.

Concluding, the attitudes and beliefs towards PGS and its integrated approach are not uniformly positively developed. After teachers' participation in the TDTs, attitudes towards the integrated approach became rather negative as the current format is not feasible for a single PGS teacher. Teachers became more aware of the need for a clear vision and support for PGS with more need for enabling collaboration. As such, there is a PD in attitudes towards PGS in terms of having more conviction in the need for more cooperation, both in the preparation of lessons and during actual classes.

5.1.2 Beliefs about the teachability of vocational students

In the PD regarding the beliefs about the teachability of vocational students, a rather negative development is emerging. Looking at the initial beliefs about the teachability of vocational students, four of the nine teachers have positive teachability beliefs, but negative beliefs at the second interview. More specific, Vanessa, Vic, Sarah and Peggy were first convinced that all attainment targets are feasible for all students. The second interviews show that an ongoing reform² and the additional demands of PGS weaken the belief that vocational students can master the subject matter.

The teachers indicate that learning about the experiences with the reform of other teachers in the TDT, decreased their belief in the ability of the students to achieve the attainment targets. Among the other five teachers, teachability beliefs remained constant. It can be noticed that both before and after the TDT programme, four of the five teachers already assumed that the attainment targets are not achievable for all vocational students. Only Clara retains the positive belief that the attainment targets are achievable for all vocational students.

2 A Flemish reform is ongoing and will be completed in the school year 2025–2026. This reform implies revised attainment targets for the general subjects in vocational education and caused uncertainty about the continued existence of PGS as an integrated course. The participating schools chose to continue PGS as an integrated course.

To conclude, it appears that collaborating in the TDTs during the educational reform may have contributed to the development of negative beliefs regarding the teachability of vocational students.

5.1.3 Self-efficacy beliefs

In general, little has changed among teachers in terms of self-efficacy beliefs. The teachers still perceive teaching PGS as challenging. However, there are some changes noticeable in the way teachers perceive their self-efficacy. As an example, Yves indicates that he is more confident in terms of teaching digital competencies to his students but mentions more struggles with implementing real-life elements in his lessons. Additionally, some teachers mention the reform as a reason to doubt their own ability as PGS teachers. PGS is getting more demanding with the reform and teachers are uncertain how this will change their teaching profession. Sarah, for example, indicates that she is afraid that her economic knowledge will not be sufficient, but stresses that the TDT makes her more confident to ask support from a subject teacher if her own knowledge falls short.

Learning to collaborate and learn from each other [...] I am more often talking about the content of the lessons. [...] That's something I would never have done before, because as a teacher you tend to be on your own little island. But now, I also feel much more comfortable asking Jeffrey (teacher of economics) more questions. (Sarah, TDT B)

Additionally, the teachers involved in this study demonstrated a heightened inclination to actively seek assistance from their colleagues when confronted with limited knowledge on specific subject matters. Moreover, more curriculum materials are exchanged based on the strengths of fellow teachers. To conclude, self-efficacy beliefs developed slightly, but there was a more substantial development in how the teachers perceive their deficiencies. By moving towards greater collaboration, the teachers no longer see their deficiencies as a real disadvantage.

5.2 Instructional practices

5.2.1 Classroom practices

The teachers in TDT A, TDT B and the coach-teacher in TDT C reported having developed new competencies in terms of digital skills, which is in this study a major outcome in terms of classroom practice. All teachers in TDT A who worked on a remediation website reported having acquired some digital skills. Miranda and Vic indicate that they already have used the obtained digital skills in their own classroom practices. Vanessa and Alex state they have not yet implemented this in their classes but realised the importance. Alex indicates that this is a major change for him as before the TDT he did not see the value of implementing digital tools.

Google Classroom is also a tool that I didn't use and that I do notice by using it a lot, it does add value in class. It is also something positive, by using it, I do

see the added value. [...] Other teachers told me for a long time: you must use it. But I always thought it was too difficult. (Alex, TDT A)

In the case of the teachers in TDT C, Yves mentions that he learned digital skills during the networked TDT. This does not appear to have trickled down to the other teachers in the school-based TDT, as Clara does not indicate anything about digital skills. The following statement may explain this:

We have developed an aligned curriculum for ICT. I am basic as far as Excel is concerned. So, I did agree with Yves that he gives the deepening of Excel and I will deal more with Word. (Clara, TDT C)

This quote shows that the teachers in TDT C had agreed to divide the design tasks according to everyone's strengths. This obstructs the exchange of knowledge among teachers. The same occurs in TDT B where Sarah says she learned many digital skills from the networked TDT and the technical advisor coordinator. Even though Peggy says she realised the importance of implementing digital elements in lessons, she hands over the digital work to Sarah. So, by working together in the TDT, she saw the importance of digital integration, but did not develop digital skills personally. Noah, on the other hand, indicated he learned many digital skills thanks to the TDT as he developed materials with Sarah's help. Now he applies his newly acquired digital knowledge in his own lessons.

Yes, to give an example, Google Classroom. It was all Greek to me at first, but now I can post some things on it. I notice that it's very convenient and I can improve the classes for the students. [...] So, I have certainly learned a lot digitally from the TDT. (Noah, TDT B)

The teachers in TDT A also focused on engaging students in the creation of curriculum materials. Students created videos to explain subject matter which were posted on the remediation website. Teachers here were very positive about engaging students and indicated they would like to use this more in their classes. Finally, among the teachers of TDT B, there was a clear exchange of classroom practices. Sarah learned a lot from Peggy and Noah about vocational subject matter and how to implement this in her classes, while Peggy and Noah learned about PGS and its didactics. This knowledge was integrated into their own vocational subjects.

5.2.2 Designing curriculum materials

A notable result regarding the curriculum materials is the variety of products designed. During the design process, the focus was not exclusively on curriculum materials immediately usable in classroom practice. The teachers in TDT A developed a website for remediation exercises and those in TDT B designed two PGS projects linked to the students' professional learning subjects. Finally, the teachers in TDT C developed an aligned curriculum across grades for digital competencies. Unlike to the curriculum materials in TDT A and TDT C, curriculum materials of TDT B are immediately usable in classroom practice.

When looking at the consistency of curriculum materials using the curricular spider web of van den Akker (2003), these curriculum materials generally showed a lot of consistency on the various components. However, not each TDT managed to develop consistent curriculum materials for each component of the curricular spider web, as shown in table 4. In the table, a tick mark indicates that the component from the curricular spider web aligns with the rationale of the designed curriculum material. A hyphen means that the component does not align with the rationale or that this component is absent in the currently designed curriculum material.

Table 4: Consistency of the nine components of the curricular spider web with the rationale

	TDT A	TDT B		TDT C
	Website for remediation	Project hair care	Project woodwork	Aligned curriculum ICT
Aims and objectives	X	X	X	X
Content	X	X	X	X
Learning activities	X	X	X	-
Teacher role	-	X	X	-
Materials/resources	X	X	X	-
Grouping	X	X	X	-
Location	X	X	X	-
Time	X	X	X	-
Assessment	-	X	-	-

TDT A developed a remediation website for PGS attainment targets, but it remained incomplete after two school years due to its ambitious scope. Nevertheless, analysis by the curricular spider web was possible as the final website design was clear. The website's rationale is to give struggling students remediation opportunities. This website aligns all various components of the curricular spider web with this rationale except for the assessment and the role of the teacher. This can be explained by the fact that the exercises students make are automatically corrected. The remediation website was designed with the intention of being accessible both in the classroom and at home. In the classroom setting, despite the automatic correction feature, the teacher is able to assume the teacher role and conduct assessment accurately. However, once the exercises are completed at home, the teacher loses visibility into the students' process and results. So, although the teacher offers the remediation to the student, the teacher has no knowledge of the problems the student may be still facing. The rationale of the PGS projects designed by teachers in TDT B is to link the general subjects to the lesson content of the vocational subjects

(hair care and woodworking). In these PGS projects, the different components appear to be consistent with the rationale. The designed curriculum materials are specifically tailored to introduce students to the fields of hair care and woodwork. However, regarding the woodworking project, there is no alignment with the assessment component as it has not been clearly elaborated or conducted. Finally, the rationale of the aligned curriculum across grades for digital competencies of TDT C is to ensure that students acquire clear and constructive learning outcomes in digital skills over the years. Although the aim of the aligned curriculum is to create more consistency over years, it is only a work document at present. When examining it with the parameters of the curricular spider web, not much consistency can be found because of several gaps. Only the aims and objectives and the content are clearly consistent with the rationale.

6 Conclusion and Discussion

This study investigated the professional development (PD) of general subject teachers in vocational education. The rationale for focusing on general subject teachers in this study stems from the correlation between increased dropout rates among vocational students and the higher number of general subject hours in their curriculum (Hall, 2016; Hermann & Horn, 2023). Accordingly, this study occurred in the context of Project Integrated General Subjects (PGS), a course in Flemish vocational secondary education which integrates the general subjects. This research focused on the PD of attitudes and beliefs towards PGS, self-efficacy beliefs and teachability beliefs and on the PD of instructional practices with a specific focus on classroom practices and curriculum materials. The demanding character of PGS led teachers to question its integrated approach. However, it appears that collaboration in TDTs for PGS was highly valued, potentially reinforcing teachers' conviction that increased collaboration, both in preparation and during lessons, could enhance the feasibility of PGS. During the second year of the TDT programme, four teachers' beliefs about teachability became negative, probably influenced by the ongoing educational reform which makes PGS more demanding. This caused many doubts among teachers and they appeared to reinforce each other's doubts through their participation in the TDTs. Regarding self-efficacy beliefs, a few teachers exhibited more positive beliefs towards content and didactic knowledge. For most teachers, self-efficacy beliefs remained unchanged, but the TDT helped them view deficiencies as easy to overcome since they were more likely to seek assistance from fellow teachers. Notably, most teachers improved their digital skills and knowledge through the TDT, although some still had to fully implement these skills in their classes. Nonetheless, the value of acquiring digital competencies was acknowledged. Additionally, it is notable that the varied designed curriculum materials were not all focused on immediate classroom use. The designed curriculum materials showed varying degrees of consistency according to the curricular spider web.

The results show a difference in the PD of classroom practices between the TDTs. Teachers in TDT B and TDT C report having learned less compared to the teachers in TDT A, these teachers divided the work instead of truly collaborating on curriculum design as

was done in TDT A. This highlights the importance of the collaborative activities carried out within the TDTs for teachers' PD, as depicted by Binkhorst et al. (2015).

This study assumed that certain attitudes and beliefs would either change positively or remain unchanged. However, some attitudes and beliefs exhibited a negative development among certain teachers during this two-year study. Although the positive results of TDTs for the PD of general subject teachers in vocational education were rather limited, it is crucial to consider the external factors beyond our control that influenced the research. The study took place during two school years deeply affected by the Covid-19 pandemic, forcing teachers to switch to emergency remote teaching and causing significant additional stress (Anderson et al., 2021). Concurrently, a major national educational reform was ongoing, raising uncertainties about the continuation of PGS as an integrated course. Tikkanen et al. (2020) show that education reforms lead to additional stress among teachers. These two events affected the important process factors of the TDTs. Binkhorst et al. (2015) demonstrated the importance of process in a TDT and how it determines the quality of teachers' PD and curriculum materials. Nevertheless, even under challenging conditions and limited physical meetings, this exploratory study reveals a potential role of TDTs in stimulating teachers' PD and curriculum materials. The emergence of negative affected attitudes and beliefs among some teachers could be linked to the impact of these events on their mental well-being as reported by the participating teachers. Moreover, this study indicates that despite the support teachers feel by working together in TDTs, collaboration during a stressful period like a reform or pandemic can negatively affect teachers' attitudes and beliefs. The doubts and difficulties experienced by teachers were also openly shared during collaboration within the TDTs. To summarise, the occurrence of Covid-19 and the educational reform shows influence on the presented results. Nevertheless, we consider these results to be valid in demonstrating the influence of Teacher Design Teams on general subject teachers. The educational reform was included here as a contextual background, recognising reforms as integral parts of the educational landscape. Educational reforms will often coincide with long-term PD initiatives, and our study offers insights within this context, acknowledging its potential impact on teaching practices and outcomes.

A major limitation in this study is the practical impact of Covid-19 measures. The researcher, as an external, was not allowed to visit schools, impeding intervention monitoring. Additionally, mandatory online teaching led to shortened or postponed meetings. The transition to online teaching also influenced the research results by altering the TDT's design goal in two schools, with a focus on prioritising digital curriculum materials. Although the teachers in the TDT that focused on developing an aligned curriculum across grades for digital competences reported no acquisition of digital competences during collaboration. It is crucial to consider the influence of the selected curriculum topics when interpreting the results. Another limitation in this study is the small number of interviewed teachers. Due to the limited number of participating teachers, this study serves as an exploratory study. Consequently, the results are presented in a more generalised manner, with limited comparisons across teachers and TDTs. Additionally, since this study took place over two school years, the same schools and teachers had to participate both years. This study started in four secondary schools with 14 participating teachers, but participants dropping out during the study is a risk in long-term research.

Finally, participants voluntarily enrolled in this two-year study, suggesting an inherent positive attitude towards collaboration in education. While this positive baseline attitude may not guarantee a positive reception of the TDTs in which the participants were involved, it is crucial to acknowledge voluntary participation when interpreting the results.

Considering future research directions, an investigation of the sustainability of TDTs following their implementation could provide valuable insights into TDTs' long-term contributions to fostering lifelong learning among teachers. The TDTs occurred with guidance and support from the researcher. It would be useful to have a view on how TDTs continue to work in an autonomous way, as continuous PD of teachers is crucial (Darling-Hammond et al., 2009). The integrated descriptive framework for TDTs of Binkhorst et al. (2015) can be useful in this regard to ascertain the conditions that cause the long-term progression of TDTs. In addition, it would be relevant to examine the effect of Covid-19 measures on teachers. The ability to map this impact would also provide a better understanding of the results of this study. Lastly, the educational reform context enriches our understanding of the outcomes of PD initiatives. It underscores the need for careful consideration of contextual factors in educational research. Future research could delve into the specific mechanisms through which educational reforms interact with PD initiatives.

The results of this research also provide practical recommendations. It is important for PGS teachers to have a clear direction and interpretation about PGS both at school and government levels. It has become apparent that a lack of clarity regarding PGS affects teachers' PD. At international level, these findings demonstrate that when moving toward more cross-curricular and interdisciplinary learning, a clear delineation and interpretation must be determined before an interdisciplinary course is implemented in education. Additionally, as this research illustrates, the facilitation of TDTs can ensure that teachers are supported in designing curriculum materials for interdisciplinary courses and enhances their PD through active participation. Finally, involving students in designing teaching materials was found to be positive in TDT A. This can add value not only to the curriculum materials but also to students' learning opportunities.

Notes

1. Due to Covid-19 measures, both the implementation of the TDTs and the scheduling of interviews were postponed. As a result, the interviews were conducted during the second trimester of the 2020–2021 school year.
2. A Flemish reform is ongoing and will be completed in the school year 2025–2026. This reform implies revised attainment targets for the general subjects in vocational education and caused uncertainty about the continued existence of PGS as an integrated course. The participating schools chose to continue PGS as an integrated course.

7 References

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