Josine Görtzen



Professional development of secondary school teachers in facilitating feedback dialogues and student reflection

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Professional development of secondary school teachers in facilitating feedback dialogues and student reflection

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven,
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door

Josine Johanna Henrika Görtzen

geboren te Zevenaar

Dit proefschrift is goedgekeurd door de promotoren en de samenstelling van de promotiecommissie is als volgt:

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Het onderzoek of ontwerp dat in dit proefschrift wordt beschreven is uitgevoerd in overeenstemming met de TU/e Gedragscode Wetenschapsbeoefening.

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Persoonlijke noot



FIGUUR 1 JOSINE GÖRTZEN

Na het opzetten van een goedlopend Technasium groeide mijn interesse in de proceskant van O&O. Het bracht mij op een vraag die centraal staat in dit proefschrift: hoe begeleid je leerlingen in hun leerproces, in plaats van alleen hun eindproduct?
Het Technasium is een onderwijsvorm waarin leerlingen werken aan realistische bèta-technische opdrachten van echte opdrachtgevers. Binnen het vak Onderzoek & Ontwerpen (O&O) werken zij in teams aan open vraagstukken waarin samenwerken, onderzoeken, ontwerpen en reflecteren centraal staan. Leerlingen ontwikkelen daarbij niet alleen vakkennis, maar ook vaardigheden zoals communiceren, plannen en nadenken over hun eigen leerproces.
Wat mij vooral interesseerde, was wat er tijdens dat proces gebeurt: hoe leren leerlingen nadenken over hun eigen werk, hun samenwerking en hun persoonlijke ontwikkeling? In de praktijk zag ik dat feedback vaak eenrichtingsverkeer was: de docent vertelt iets, de leerling luistert en gaat door. Echte gesprekken, waarin leerlingen actief meedenken en hun aanpak aanpassen, kwamen weinig voor. Ook reflectieopdrachten bleven vaak oppervlakkig. Die spanning tussen wat er mogelijk is en wat er in de praktijk gebeurt, vormde uiteindelijk de aanleiding voor dit proefschrift. Dit onderwerp liet mij niet meer los. Wat begon als een observatie in de lespraktijk, groeide langzaam uit tot de wens om dit serieuzer te onderzoeken.

In 2015 zette ik daarin de eerste stap. Op advies van de Eindhoven School of Education startte ik met een research master Onderwijswetenschappen aan de Open Universiteit, een keuze waar ik geen moment spijt van heb gehad. Met een lerarenpromotiebeurs van NWO en OMO begon ik in september 2021 aan mijn promotietraject. Dat traject bracht niet alleen nieuwe inzichten, maar ook een heel nieuwe manier van denken en schrijven met zich mee.
Ergens in de loop van dit traject vergeleek ik de verschillende vormen van schrijven met zwemstijlen. Lesmateriaal schrijven voelde als schoolslag, vertrouwd en overzichtelijk. Beleidsstukken waren meer borstcrawl: efficiënt en doelgericht. En wetenschappelijk schrijven? Dat was de vlinderslag. Krachtig als je het beheerst, maar in het begin allesbehalve elegant. Ik vroeg mijn begeleidingsteam hoe zij die vlinderslag uitvoerden. Het antwoord was ontnuchterend: zij deden het gewoon, zonder precies te weten hoe.

Gaandeweg werden hun aanwijzingen concreter. Een uitspraak die me is bijgebleven: "*Even uitrusten, naar buiten kijken, brainstormen en alles opschrijven wat in je opkomt. Je hersenen helemaal uitpersen tot ze uit je oren komen."* Als beelddenker vond ik dat zowel hilarisch als verhelderend. En het werkte.



FIGUUR 2 HERSENEN UIT JE OREN

Inhoudelijk raakte ik het meest geïnspireerd door het werk van Naomi Winstone en Renske de Kleijn over feedbackdialogen. Hun inzichten in de vaardigheden die docenten en studenten nodig hebben om echt deel te nemen aan zulke gesprekken, en de rol die emoties spelen rondom feedbackgesprekken, gaven woorden aan iets wat ik in mijn eigen praktijk al langer voelde maar nog niet goed kon duiden. Beide onderzoekers zien presenteren tijdens een studiedag in Utrecht was zo'n moment waarop alles samenvalt: dit is waar het om gaat. Dat gevoel van herkenning heeft dit onderzoek richting gegeven.



FIGUUR 3 NAOMI WINSTONE, IK EN RENSKE DE KLEIJN

Tegelijkertijd leerde het promotietraject mij ook hoe complex deze thematiek eigenlijk is. Wat ik bij aanvang van dit traject niet had verwacht, was dat ik aan het einde meer vragen zou hebben dan aan het begin. Toen mijn begeleidingsteam mij bij de start vroeg wat mijn intentie was, vond ik dat een merkwaardige vraag. Mijn antwoord was eenvoudig: het Technasium beter maken en ondertussen leren hoe je goed onderzoek doet. Ik verwachtte antwoorden. Wat ik kreeg, was een groeiend besef van hoe complex de vragen zijn en hoe waardevol het is om die complexiteit niet uit de weg te gaan.

Dit proefschrift had niet bestaan zonder de 24 O&O-docenten die deelnamen aan de inventarisatiestudie en de tien docenten die twee jaar lang met mij hebben meegedacht, geëxperimenteerd en gereflecteerd. Zij lieten mij toe in hun lespraktijk, deelden hun twijfels en hun groei, en lieten zien dat professionele ontwikkeling moed vraagt. Daar ben ik hen oprecht dankbaar voor.
Veel dank gaat ook uit naar mijn begeleidingsteam van de Eindhoven School of Education. Jullie combineerden hoge verwachtingen met het geduld om mij de ruimte te geven om die vlinderslag zelf te leren, precies zoals goede begeleiding zou moeten zijn.

Aan mijn collega's van de ESoE en het Varendonck College: jullie betrokkenheid en belangstelling maakten dit traject niet alleen haalbaar, maar ook plezierig. En aan de stichting Technasium: dank voor het vertrouwen, het faciliteren van de bijeenkomsten en het meedenken over de toekomst van het vak.
NWO en OMO maakten dit alles mogelijk via de lerarenpromotiebeurs. Dat ik deze kans heb gekregen, is voor mij van grote betekenis geweest, en iets wat ik veel andere docenten ook zou gunnen.

Mijn paranimfen Neeltje en Ilse verdienen hier een bijzondere vermelding. Dat jullie op 2 oktober 2026 naast mij staan, is precies zoals het de afgelopen vijf jaar was en het op deze speciale dag hoort te zijn.
Tot slot wil ik mijn familie bedanken en in het bijzonder Pierre, Marit en Niek. Jullie hebben mij de afgelopen jaren hard zien werken en mij altijd gesteund in wat ik wilde onderzoeken en leren. Ook op momenten dat ik zelf twijfelde, bleven jullie geloven dat ik dit kon. Zonder die steun had ik dit niet kunnen doen.


FIGUUR 4 ILSE, IK EN NEELTJE

Ik hoop dat dit proefschrift inspiratie biedt aan docenten, leidinggevende en onderzoekers en hen nieuwe inzichten geeft die zij kunnen meenemen naar hun eigen (onderwijs)praktijk.
Veel leesplezier!

Josine Görtzen

“That students are taught to receive, interpret and use the feedback provided is probably more important than focusing on how much feedback is provided by the teacher, as feedback given, but not heard is of little use”.

Hattie & Clarke (2018, p5)

Chapter 1

Introduction

Introduction

The research presented in this dissertation examines feedback as a means of supporting and deepening students' reflection in secondary education. Across education systems and levels, there is a growing emphasis on preparing students for complex, uncertain, and socially relevant challenges (OECD, 2025). Secondary education increasingly adopts inquiry-oriented pedagogical approaches that require students to take an active role in their learning (Hmelo-Silver, 2004), which in turn requires teachers to shift their role from instructor to facilitator (Svojanovsky, 2017). Meaningful engagement in active learning presupposes students' competences to reflect on their experiences, to regulate their learning, and to foster personal growth. Reflection enables learners to connect concrete experiences to underlying concepts, to evaluate their progress, and to plan subsequent actions (Nguyen, 2022). In doing so, it nurtures students' self-awareness, autonomy, and adaptability (e.g. Moon, 2013). Reflection is enhanced by feedback. Feedback, grounded in observations and interaction, provides external perspectives that help learners verify and refine their interpretations of their own experiences (Boodt, 2014; Voerman et al., 2015). By comparing these external perspectives with their own internal reflections, students can identify gaps between their intentions and actions, deepening their engagement and supporting more accurate, self-regulated learning (Hattie & Yates, 2014; Moon, 2013). Reflection and feedback are thus mutually reinforcing processes that together create a foundation for deep learning and personal development (Carless & Winstone, 2020; Moon, 2013).

Despite their interrelatedness, both in educational research and in classroom practice, reflection and feedback have been largely approached from separate research areas. Reflection is commonly studied from the perspective of active, self-regulated learning (c.f. Pintrich, 2004), which emphasizes meaning-making and cognitive-motivational processes, or from the perspective of personal and professional growth through experiential learning (c.f. Korthagen & Nuijten, 2022), whereas feedback research has primarily emerged from traditions of assessment and evaluation (c.f. Hattie & Timperley, 2007).

Although feedback has increasingly been conceptualised as a dialogic process that emphasises interaction, sense-making, and learner agency (Boud & Molloy, 2013; Carless & Boud, 2018; Winstone et al., 2017), this conceptual development has not yet been fully translated into classroom practices. While teachers' feedback is often reduced to one-way information transmission from teachers to students, students' reflection activities often remain fragmented or superficial, resulting in a lower quality of reflection (Görtzen, 2019; Korthagen & Nuijten, 2022; van der Kleij et al., 2019).

The quality of students' reflection strongly depends on teachers' competences to facilitate feedback dialogues and guide reflection through meaningful interaction (Korthagen & Nuijten, 2022; Moon, 2013). Supporting teachers in developing these facilitation skills requires targeted professional development (PD) (e.g. Desimone, 2023). Studies (Antoniou & Kyriakides, 2013; Louws et al., 2017) show that when PD moves beyond knowledge

transmission and supports sustained, practice-embedded enactment, teachers tend to gain most in increasing their competences.
With these theoretical perspectives in mind, we conducted analysis, design, and evaluation activities to develop a two-year PD program. The overarching aim was to support teachers in embedding feedback dialogues and reflection into their everyday classroom practice in ways that deepen students' reflections and, in turn, foster students' learning. In doing so, we examined how the previously separate research areas of feedback and reflection can be meaningfully integrated.

1.1 Conceptual framework

This dissertation attends to three interrelated elements: feedback, reflection, and PD. Feedback is positioned within a socio-constructivist paradigm that emphasises interaction and the construction of meaning, reflection is defined based on perspectives on self-regulated learning and personal growth, and PD is situated within literature emphasising sustained, practice-embedded teacher development. Although these elements are intertwined, they are introduced separately in the following sections to enhance conceptual clarity and to align with distinctions commonly made in the literature.

Feedback understood as feedback dialogues

Feedback has traditionally been conceptualised as a predominantly one-directional process in which teachers transmit evaluative information to students (i.e. teacher-led), with limited student involvement in interpreting its meaning (Hattie & Timperley, 2007; van der Kleij et al., 2019). These traditional approaches position feedback as an instructional product rather than as a learning process. More recent literature has reconceptualised feedback as an interactive and dialogic process in which teachers and students jointly make sense of feedback information and negotiate subsequent learning actions (Boud & Dawson, 2021; Carless & Winstone, 2020; de Kleijn, 2021). Feedback dialogues support students' understanding and uptake of feedback by strengthening their sense of ownership, autonomy, and confidence in acting on evaluative information (e.g. Winstone et al., 2022). Meaningful engagement in such dialogues, however, requires deliberate facilitation by teachers. Teachers' facilitation encompasses to structure feedback dialogues, to invite students to share their perspectives, and to guide students' engagement in ways that support learning while reducing anxiety and defensiveness (Ajjawi & Boud, 2017; Wu et al., 2024).
Contemporary feedback models distinguish between feedback information and feedback processes (Winstone et al., 2017). Feedback information refers to ***what*** is communicated and is respectively product-oriented or process-oriented. Product-oriented feedback information concerns (improving) the outcome of the learning task, whereas process-oriented feedback information focuses on the student's approach to tasks and the development of their personal qualities or skills (Winstone et al., 2017). Feedback

processes concern ***how*** feedback information is discussed and how it is enacted, interpreted, and used within the teacher-student dialogues. This research is mainly focusing on feedback processes: how (product oriented as well as process oriented) feedback is discussed, interpreted, and integrated within classroom practices.

Students' reflection as a cyclical and deep learning process

Reflection is widely recognised as a key process underpinning students' learning, personal development, and skills development for lifelong learning (Hilden & Tikkamäki, 2013; Welch, 1999). Through reflection, learners revisit experiences, interpret their actions, and consider how these experiences inform future learning (Moon, 2013). Reflection is largely internal and therefore not directly visible, which limits teachers' insights into students' reflections and makes it challenging to assess and to support in classroom practice (Korthagen & Nuijten, 2022).

According to Esser-Noethlichs et al. (2024) and Wallman et al. (2008), students often remain at descriptive or superficial levels of reflection, by focussing on the product or outcomes (e.g. a grade), instead of explaining underlying processes, referring to struggles or articulating personal interpretations and uncertainties as examples of deeper levels of reflection. Engaging in these deeper levels of reflection requires cognitive effort and emotional openness, highlighting the importance of psychologically safe learning environments (Korthagen & Nuijten, 2022; Nguyen, 2022).

Teacher professional development as a dynamic process

Teacher professional development is perceived as a dynamic process in which teachers implement changes in their classroom practices, observe their effects on student learning, reflect on the outcomes, and adjust their conceptions and practices accordingly. This continuous cycle of action, reflection, and adaptation shapes both teaching practices and professional growth (Guskey, 2002). Achieving such effects, requires PD that actively engages teachers in formulating and adjusting their own learning goals and responds to their conceptions, expertise, and classroom contexts (e.g. Borko et al., 2010; Louws et al., 2017).

The PD program developed in this study, the Collaborative Teacher Reflection (CTR) program, was designed using an educational design research approach and builds on these PD-related insights. Within the program, feedback and reflection are deliberately intertwined as mutually reinforcing processes: feedback introduces alternative perspectives that challenge and deepen students' thinking, whilst reflection enables learners to interpret feedback, integrate it with prior experiences, and plan subsequent learning actions (Moon, 2013; Winstone et al., 2017). Together, these processes create conditions for deeper and more self-regulated learning.

The CTR program operationalises this interplay by engaging teachers in cycles of observation, feedback dialogue, reflection and collaborative discussion, allowing them to develop the competences needed to facilitate both processes effectively in their classroom practice.

1.2 Context of the study

The study is situated in the context of Technasium schools. The teachers in these schools for secondary education are expected to have experience in facilitating feedback conversations and guiding students' reflection tasks. Combined with the curriculum's emphasis on authentic, collaborative, and inquiry-based Science, Technology, Engineering, and Mathematics (STEM) projects, this makes Technasium an excellent setting for investigating how feedback and reflection can be integrated in classroom practices that offer student-centred, project-based education.

Technasium is a distinctive educational track in Dutch secondary schools. Established in 2004, Technasium schools aim at bridging the gap between secondary education and higher STEM education. The track offers an interdisciplinary curriculum that integrates subjects such as biology, physics, engineering, and technology through authentic, project-based learning. Technasium schools offer this education as an elective track, available across all years of lower and upper secondary education, with the aim of enabling students to develop both disciplinary knowledge and 21st-century competences, including collaboration, problem-solving, and reflective thinking. Students participate from both the senior general secondary education track (havo, spanning 5 years) and pre-university education track (vwo, spanning 6 years), which prepare them respectively for challenge-based or inquiry-based learning at polytechnic and research universities.

At the heart of Technasium is the Research & Design (R&D) course (in Dutch: Onderzoek & Ontwerpen, O&O). In R&D, students work in small teams on open-ended, real-world projects commissioned by external stakeholders, such as local businesses or organisations facing STEM-related challenges. For example, students may design a tomato-picking robot to improve agricultural efficiency or develop a toy to enrich the environment of pigs. A typical R&D project spans approximately ten weeks and follows a structured process. It begins with the teacher collaborating with an external stakeholder to define a problem and formulate an assignment. The teacher prepares supporting materials, including assignment guidelines and reflection tasks. In addition, students formulate personal learning goals twice a year, using a competency monitoring tool. Project groups of three to four students are then composed, ideally in ways that allow students to work towards their personal learning goals.

After an introduction to the project, student groups analyse the assignment and develop their own project planning. They conduct preliminary research and visit the stakeholder, as a class, to gain a deeper understanding of the context and the problem at hand. This is

followed by a design or advisory phase, in which student groups formulate a ‘list of requirements’ based on stakeholder input and their research. Multiple drafts are generated and evaluated against ‘the list of requirements’, leading to a final design prototype or a possible solution. The outcomes of the project, including the research findings, design rationale, and final design, are documented in an advisory report and presented, together with the final prototype or solution and the justification of design decisions to the stakeholder.

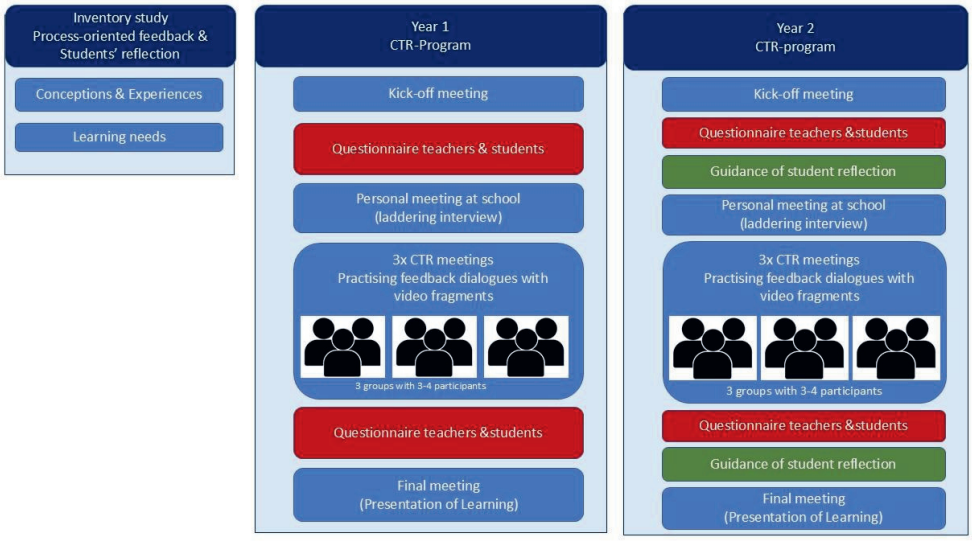
The intention of R&D is that students reflect on both the product-oriented work and the process dimension. On a regular basis, teachers meet each group to discuss progress, collaboration, and individual developments. Students write weekly individual reflections in which they describe their activities and evaluate their learning processes. At the end of the project, students complete a more comprehensive individual reflection. These reflections are discussed in a feedback dialogue between the team and the teacher, and the outcomes inform students’ learning goals in subsequent projects. These reflections form the basis for feedback dialogues with teachers. Within these dialogues, teachers support students in two complementary ways: they guide students in interpreting feedback related to their design decisions and improving the project outcome, while also guiding reflection on personal growth and the individual effort within the group. In this way, feedback and reflection are closely integrated, supporting students in regulating their learning and development over time.

In reality, however, enacting this integration of feedback and reflection proves challenging. In professional exchanges between R&D teachers, questions regularly arise about how to apply feedback processes to support student reflection. A previous study conducted within the Technasium context (Görtzen, 2019) found that teachers lacked concrete tools and structured approaches to guide students' reflection through feedback. This observation is consistent with broader research indicating that facilitating feedback as a dialogic process and embedding reflection meaningfully in everyday teaching are demanding practices that many teachers find difficult to enact (Bock et al., 2024; Paulson Gjerde et al., 2017; Veine et al., 2020). Strengthening teachers' facilitation of feedback dialogues and the guidance of student reflection requires targeted professional development that bridges knowing and acting, supporting sustained, practice-embedded enactment rather than mere knowledge transmission (Antoniou & Kyriakides, 2013; Louws et al., 2017). It is in response to this need that the Collaborative Teacher Reflection (CTR) program was developed.

1.3 The Collaborative Teacher Reflection -program

Building on the specific features of the Technasium context and the challenges teachers encounter when facilitating feedback and guiding students in their reflection, the CTR program was developed to support R&D teachers in strengthening their facilitation of feedback dialogues and guidance of student reflection. Within the CTR program, teachers mirror the processes they are expected to facilitate with students by engaging in feedback dialogues with each other in iterative cycles of learning. The two-year CTR program starts with a visit from the course leader to each school followed by five group meetings per year (see Figure 1.1). During small group meetings, teachers participate in structured activities that encourage reflection on their recorded classroom practices, they experiment with feedback dialogues and assessments of students' written reflections. The video recordings of classroom interactions provide a concrete basis for the feedback dialogues, enabling teachers to revisit challenging moments, to refine their interactions with students, and to develop their conceptions of feedback and reflection. The collaboration during the group meetings between the teachers aims at fostering shared reflection and mutual support and exposing them to alternative perspective on facilitation of feedback dialogues and guidance of students' reflection, enhancing both individual and collective learning.

Figure 1.1 *Graphical overview of the CTR program*



1.4 Problem statement and research questions

Building on the theoretical and practical foundations outlined in the previous sections, the aim of the study is to examine how teachers can be supported in facilitating feedback dialogues and student reflection into their everyday classroom practice. Accordingly, the central research question guiding this study is: *What should professional development encompass to enable teachers to facilitate feedback dialogues and support students' reflective processes?*

This overarching question is addressed through five studies. The first study is an inventory study exploring teachers' practices and learning needs. Based upon this study and literature, the CTR program was designed (see Chapter 6). The subsequent studies are all conducted in the context of this CTR program with the same 8-10 teachers participating. For the video-recordings, the teachers select students from one class; over the first and second year of the study, the classes were different.

The second and third study focus specifically on feedback, examining teachers' professional growth as well as students' and teachers' perceptions of feedback practices. Study four examines the guidance of students' reflection, and the fifth study concerns the design, enactment, and evaluation of the CTR program. The overarching question is further specified through the following sub-questions:

Study 1: Inventory

1. What conceptions and experiences do Dutch R&D teachers report regarding their process-oriented feedback practices to stimulate students' reflection processes?
2. What learning needs do Dutch R&D teachers have regarding process-oriented feedback practices to stimulate their students' reflection processes?

Study 2: Exploring teachers' growth on feedback processes

3. What growth do teachers show across the five key areas of feedback dialogues during the CTR program?

Study 3: Exploring perceptions of feedback practices

4. Do students rate their teachers' feedback behaviour different pre and post teachers' participation in the CTR program?
5. Do teachers rate their classroom behaviour different pre and post teachers' participation in the CTR program?
6. How do student and teacher perceptions of feedback dialogues correspond?

Study 4: Exploring students' reflection

7. Do students show deeper levels of reflection after their teachers have completed the CTR program?
8. Do the teachers' perceived changes in guidance practices relate to students' levels of reflection?

Study 5: Design, enactment and evaluation of the CTR program

9. What design principles characterise a PD program that supports teachers in facilitating feedback dialogues for student reflection in secondary education?

Together, these five studies (see Figure 1.2) contribute to a dual yield. Theoretically, this dissertation advances understanding by bringing together two research areas that have largely developed in isolation: feedback research, rooted in assessment and evaluation, and reflection research, rooted in self-regulated and experiential learning. By integrating perspectives from both areas, this dissertation offers conceptual insights that allow these fields to inform one another. Practically, it provides actionable guidelines and a PD program that supports teachers in enacting this integration in their classrooms. By bridging theory and practice, the findings are primarily relevant to Technasium education settings.

1.5 Overview of the dissertation

The dissertation is structured around five studies, each addressing the research questions in the order presented in Section 1.2. Figure 1.2 provides a graphical overview of the dissertation and its chapters.

Chapter 2 reports on the inventory study exploring R&D teachers' conceptions, experiences, and professional learning needs related to the facilitation of student reflection through process-oriented feedback (RQ 1 and 2). The aim of this inventory study is to examine how R&D teachers understand and describe their practices to facilitate feedback and reflection and to identify the types of external support they perceive as needed for developing these practices. To address this aim, semi-structured interviews are conducted with 23 R&D teachers. The interview data are analysed to identify patterns in teachers' perspectives, experiences, and contextual conditions shaping their engagement with process-oriented feedback and student reflection. In Study 1, process-oriented feedback is conceptualized as part of the feedback content rather than as the mode of delivery. To avoid ambiguity, the CTR program and the subsequent studies consistently distinguish between "feedback information", referring to feedback content, and "feedback dialogues", referring to the way feedback is communicated.

Chapter 3 addresses the professional growth of R&D teachers in facilitating feedback dialogues (RQ 3), examining how teachers develop their feedback dialogue practices through structured, collaborative reflection on their own classroom interactions within the CTR program. Ten teachers participate in three learning communities. Within each community, teachers analyse video recordings of their own feedback dialogues under the guidance of the course leader. Qualitative methods, including reflexive thematic analysis of transcribed dialogue sessions, are applied to examine changes in teachers' facilitation of feedback dialogues over the two years.

Chapter 4 focuses on perceptions of feedback practices among R&D teachers and their students before and after joining the CTR program (RQ 4, 5, and 6). The aim of this third study is to investigate how feedback practices are perceived by both teachers (n=10)

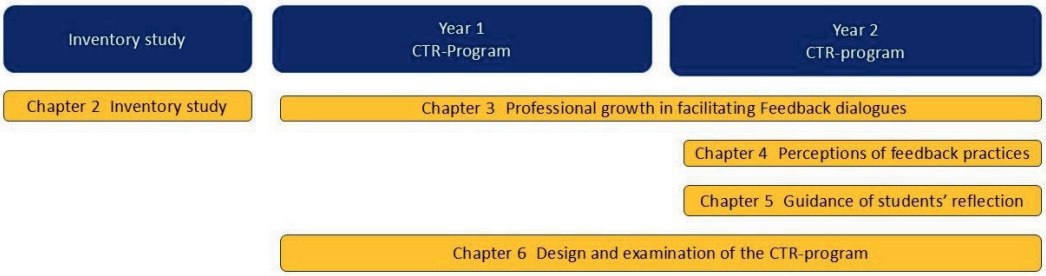
and students (n=165) over time, and how these perceptions relate to one another. The study draws on questionnaire data collected at four measurement points, at the beginning and end of each program year, capturing both teachers' and students' perceived feedback practices in the classroom.

The fourth study, presented in *Chapter 5,* investigates the effects of the CTR program on the depth of students' written reflections and on teachers' practices for guiding reflection (RQ 7 and 8). The aim of this study is to examine how teachers can be supported in guiding student reflection through combining a cyclical process model with a depth model. Eight secondary school teachers (N = 135 students) learn to apply five literature-based teacher actions for supporting reflection. Data consist of 270 written student reflections collected at the beginning and end of the CTR program that are analysed on the depth of reflection and 32 hours of CTR meeting transcripts that are analysed to explore how structured teacher actions relate to changes in the depth of student reflection.

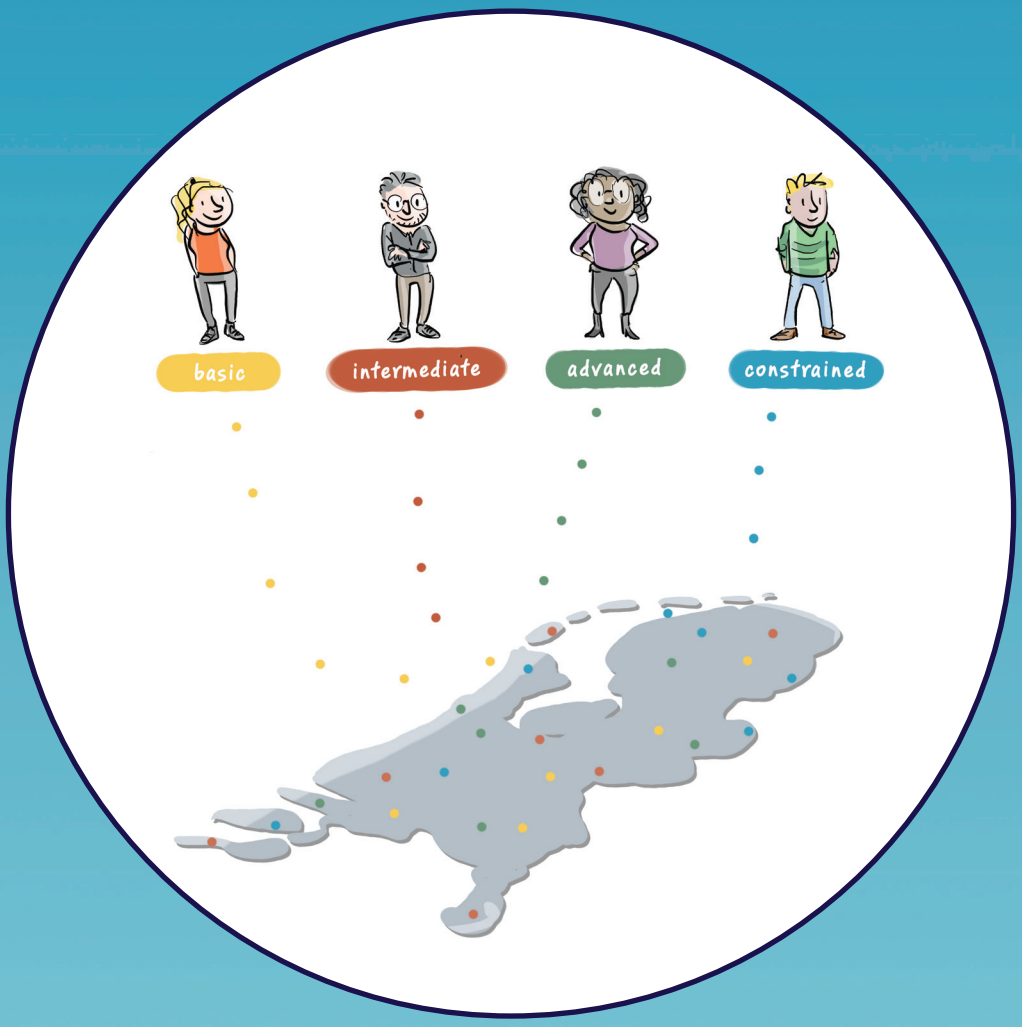
Chapter 6 addresses the design, enactment and evaluation of the two-year CTR program (RQ 9). The aim of this study 5 is to examine the design and enactment of the CTR program, to investigate how it supports teachers' facilitation of feedback dialogues and guidance of student reflection, and to identify the key design principles of the CTR program as well as the conditions that foster PD related to integrating feedback dialogues with student reflection. The study draws on qualitative data from teachers' interviews and CTR meetings (study 2, 3 and 4), as well as on the depth of student reflections tasks (study 5), to examine teachers' professional learning and the supportive conditions. By synthesising insights from program design, enactment, and evaluation, the study articulates evidence-informed design principles that may inform future PD initiatives in secondary education.

Chapter 7 summarises and discusses the main findings of the research, addresses methodological limitations, and outlines implications for educational practice as well as directions for future research.

Figure 1.2 *Graphical overview of the study and its chapters*



The chapters in this dissertation are written as stand-alone articles that can be read independently. As a result, some overlap in introductory and methodological sections across chapters is unavoidable.


basic
intermediate
advanced
constrained

Chapter 2

Promoting students' reflection through process-oriented feedback: teachers' conceptions, practices and learning needs

Abstract

This study explores teachers' conceptions, experiences, and learning needs regarding the important 21st-century teaching skill of promoting student reflection through process-oriented feedback. Interviewing 23 secondary school teachers about their perceived practices and challenges identified four groups: Basic, Intermediate, Advanced, and Constrained. The Basic group teachers struggled with concepts of process-oriented feedback and reflection, hindering the provision of effective reflection tasks and feedback. The Intermediate group teachers faced difficulties with increasing reflection task frequency and providing weekly feedback. The Advanced group teachers, with extensive experience, still struggled with implementing cyclical reflection on school level. The Constrained group teachers encountered external limitations like limited lesson hours and lack of support. Learning needs varied among the teachers' groups, emphasizing the importance of tailored professional development programs to enhance teachers' process-oriented feedback literacy. Findings contribute to understanding stages of effective teaching and their implications for teacher evaluation towards stage-geared professional development of teaching skills.

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2.1 Introduction

The positive impact of feedback on learning is well-documented (e.g., Hattie & Yates, 2014), with research highlighting its role in enhancing students' motivation, self-regulation, and overall academic performance. Effective feedback fosters deep learning by providing students actionable insights, enabling them to refine their thinking processes and develop 21st-century skills such as problem-solving, collaboration, and adaptability. Moreover, feedback supports metacognitive skills, helping students to assess their own progress and take ownership of their own learning.

However, a key challenge remains: how can teachers' feedback be effectively discussed to stimulate students' reflection? This study explores secondary school teachers' strategies and learning needs related to process-oriented feedback, particularly in fostering student reflection. Identifying these needs can guide the development of professional training programs that enhance teachers' ability to provide feedback that promotes reflective learning. Despite extensive research on feedback's benefits, especially in fostering reflection, the literature offers diverse definitions and perspectives on this complex and multidimensional process (Hattie & Yates, 2014; Lipnevich & Panadero, 2021; Wisniewski et al., 2020). Many studies emphasize immediate student actions and task performance while overlooking students' personal, future-oriented growth (e.g. Thurlings et al., 2013). In their review, Thurlings and colleagues found that the 65 reviewed studies were mainly focussed on providing feedback at learning goals or at the task level, without addressing feedback aimed at fostering future-oriented growth, such as the development of 21st-century skills. Wisniewski et al. (2020) conducted a meta-analysis of 435 empirical studies on the effectiveness of feedback and also found that teachers predominantly provide feedback on task-level. These researchers emphasised the need for further empirical research into the factors that influence the effectiveness of feedback, including timing, type of feedback and method of delivery.

In their comprehensive review Lipnevich and Panadero (2021) compared different feedback models, analysing theoretical frameworks, empirical evidence, and practical applications. They concluded that only a limited number of feedback models were substantiated by empirical evidence. In addition, they emphasised that implementing theoretical models in classroom practices can refine and validate the theories by revealing the challenges teachers face. For example, the study of Bock et al. (2024) indeed shows the challenges of the teachers, in this case 141 student teachers, to implement effective feedback in their educational practices. The student teachers followed an intervention program to enhance their feedback competences by discussing the effects of different types of feedback. Their findings are congruent with those reported by Paulson Gjerde et al. (2017) and Winstone et al. (2017), who revealed that teachers often struggle to alternate between product-oriented and process-oriented feedback to optimise student learning. Winstone and colleagues explicitly emphasize the importance of balancing

product-oriented and process-oriented approaches. Product-oriented feedback focuses on the improvement of the product, whereas process-oriented feedback targets the student's approach to the task and provides information regarding the advancement of personal qualities or skills (Winstone et al., 2017). Process-oriented feedback is particularly valuable as it allows learners to gain insight into their learning strategies and identify possible improvements in their approach to tasks. This type of feedback promotes self-regulation and reflective thinking, which increases learner autonomy and leads to more meaningful learning outcomes (Korthagen & Vasalos, 2005; Winstone et al., 2017).

The majority of research about feedback has been conducted in the field of higher education, this study is aiming at secondary education by exploring the current perceptions and needs of secondary school teachers. Research in secondary education has mainly focused on product-oriented feedback (Heemsoth & Heinze, 2016; Sluijsmans et al., 2013), but the valuable process-oriented feedback remains open for further investigation. This study examines teachers' learning needs (Desimone, 2023) and the teachers' conceptions and experiences concerning discussing feedback (van der Kleij et al., 2019) to stimulate students' reflection processes. Specifically, it explores teachers' conceptions of feedback and students' reflection processes, analysing self-reported experiences and challenges in using process-oriented feedback to foster student reflection.

The insights gained from this exploration will inform future professional development (PD) programs that equip teachers with the knowledge and skills needed to discuss feedback that enhances secondary school students' reflective processes.

2.2. Conceptual framework

Teachers' feedback

In the current study, we take a socio-constructive perspective on feedback (Carless & Winstone, 2020), one that entails active engagement from both teachers and their students. Teachers take an active role by offering support, approachability, and sensitivity when discussing feedback, while students actively seek, comprehend, and apply the feedback they receive (Carless & Winstone, 2020; de Kleijn, 2021; Tielemans et al., 2023). In this perspective, feedback encompasses two intertwined aspects: feedback information and feedback processes. Winstone et al. (2022) stated that feedback information (either product or process-oriented) refers to the data used by learners to enhance their work or learning strategies, while feedback processes involve all activities undertaken to obtain, understand, and apply feedback information.

Hattie and Timperley (2007) described four different kinds of feedback information: feedback about the task, about the process, about self-regulation and about the self. The objective of task feedback is to address and correct errors in task performance. Process feedback targets the methods used to complete tasks, thereby fostering strategy

improvement. Feedback on self-regulation aids students' ability to monitor and control their own learning, enhancing self-assessment, planning, and error correction skills. The fourth type of feedback described by Hattie and Timperley is feedback about the self. This personal feedback focuses on the individual's traits, such as praise or criticism. In this study we follow Winstone's (2017) reasoning, who conceptualizes feedback on self-regulation as an integral aspect of process-oriented feedback, rather than a distinct category of feedback. The acceptance of process-oriented feedback is influenced by its proximity to the self (the student's person). Feedback that is closely tied to the self is more likely to be rejected, thereby diminishing its effectiveness (Hattie & Timperley, 2007; Kluger & DeNisi, 1996). In order to prevent the rejection of process-oriented feedback, it is essential that it is discussed in a constructive, substantive, specific, and timely manner (Tielemans et al., 2023). In addition, acceptance of feedback is also influenced by teachers' observations of students' behaviour during learning (Boodt, 2014; Voerman et al., 2015). Observation enables teachers to provide feedback that is more precise and relevant. In alignment with the perspectives put forth by Voerman et al. (2015) and Boodt (2014), we posit that feedback should be substantiated by observations that teachers verify with their students.

Students' reflection

Reflection is seen as an important skill for secondary school students (Ananiadou & Claro, 2009; Dutch Inspectorate of Education, 2022). Given the expectation that these students will encounter future scenarios marked by ambiguity, complexity, and conflicting goals (Barr et al., 2022), fostering reflection becomes essential for their future life (Veine et al., 2020). In this study, students' reflection is defined as a cognitive skill that enables students to understand, analyse, and critically evaluate their own assumptions, beliefs, feelings, and emotions. In this way, reflection is a means to establish learning goals, but it is a lifelong skill as well (c.f. Hilden & Tikkamäki, 2013). Secondary school teachers have an important role in facilitating this forward-looking learning approach (Moon, 2013; Veine et al., 2020). By offering opportunities for reflection, teachers enable students to explore their thoughts about an experience, share these reflective thoughts with others, and by doing so, further deepen their reflection. Students who are encouraged to contemplate their own behaviour and its consequences for themselves and their surroundings are more inclined to establish realistic goals and adapt their behaviour to achieve the desired outcome. Through this process, their reflections attain the level of understanding (Korthagen & Vasalos, 2005). Guiding students through the reflection process presents challenges for teachers. To effectively encourage students' reflection, teachers must ensure that students are actively engaging in reflection processes by providing them with iterative reflection tasks (Grossman, 2009). By explicitly explaining the expectations of the reflection tasks, emphasizing the importance of students' reflection, and tailoring the approach to the students' current learning process, teachers make students' reflection

processes visible (Coulson & Harvey, 2013; Moon, 2013).

Promoting students' reflection through process-oriented feedback

To facilitate students in sharing reflective thoughts and enhance their acceptance of feedback, teachers must create a safe learning environment (e.g. Hattie & Yates, 2014; Korthagen & Vasalos, 2005; Moon, 2013). Such an environment should embrace students' mistakes, while highlighting the significance of teachers' expression of genuine interest in their students. Establishing such a safe environment fosters a sense of comfort and value among students, enabling them to participate actively in reflection, share their reflective thoughts and receive teachers' feedback with openness and trust (Hattie & Yates, 2014; Korthagen & Vasalos, 2005).

Students' reflection entails comparing external experiences with their internal perspectives (Moon, 2013; Hattie & Yates, 2014). An external experience may involve a feedback conversation between teacher and student about process-oriented feedback, supported by verified observations of the teacher. The internal perspective involves the student's sense of self, including prior knowledge, emotions, and personal experiences. Nicol (2021) refines Moon's notion of external experience by including the concept of external feedback. This type of feedback comes from sources external to the learner, such as teachers, peers, or other external agents. Although Moon examined external experience through the lens of reflection and Nicol (2021) focused primarily on the mechanisms underlying feedback, both come to the same conclusion, emphasising that external experience and external feedback enable students to assess their progress against pre-defined goals and standards. For external feedback to be effective in improving learning, students must pay attention to it, interact with it and make comparisons with their internal view (Nicol 2021). In this reflective process, teachers play an important role in supporting students to identify relationships between ideas and extend basic concepts to encourage the development of personal theories (Hattie & Yates, 2014).

Voerman et al. (2012) found that teachers' feedback was only in 20% specifically formulated to provide an opportunity for learning. Students perceive non-specific feedback as irrelevant, and excessive detail can easily lead to information overload (Kluger & DeNisi, 1996), making the feedback unlikely to be accepted nor prompting action by the students (Carless & Boud, 2018). Not only do students complain about the lack of relevance of feedback information, but they also express dissatisfaction with feedback processes, citing issues with the adequacy, timing, and comprehensibility of feedback information (Hattie & Yates, 2014). While students are dissatisfied with feedback delivery, teachers may feel overwhelmed by their workload and become frustrated when students do not engage with their feedback. To facilitate effective self-reflection and progress, students first need to accept feedback from teachers, then compare it with their own perspective and use it as a means to deepen their reflection processes (Moon, 2013; Nicol

2021). In other words, if feedback is acceptable and actionable, it can trigger students' (mental) activities and enhance meaningful learning.

Teachers' learning needs

As previously outlined, teachers encounter numerous feedback challenges, necessitating their own ongoing development in discussing process-oriented feedback to stimulate the reflection of their students (Bock et al., 2024; Paulson Gjerde et al., 2017; Wisniewski et al., 2020). In a Norwegian study, Veine et al. (2020) found that university teachers who were experienced in promoting student reflection desired further professional development. These teachers, seeking practical guidance to enhance students' reflection and improve their own feedback skills—encompassing both product- and process-oriented feedback—aimed to deepen students' reflection levels through written feedback. Examples of challenges found in literature are balancing product-oriented and process-oriented feedback and addressing timing issues (Bock et al., 2024; Paulson Gjerde et al., 2017; Tielemans et al., 2023; Winstone et al., 2017). In the present study challenges faced by teachers are referred to as their learning needs. Identifying these learning needs is essential for designing a relevant and effective PD program (Borko et al., 2010; Desimone, 2023).

Current study

While most research on feedback to facilitate reflection focuses on higher education, this study examines secondary education. Specifically, it explores the STEM-related subject Research and Development (R&D) teachers' conceptions of feedback and student reflection processes in Technasium schools in the Netherlands. The study examines teachers' self-reported experiences and challenges in discussing process-oriented feedback to promote student reflection and identifies their learning needs. Given the increasing use of innovative pedagogies such as project-based, problem-based and challenge-based learning in secondary and higher education (e.g. Doulougeri et al., 2024), understanding teachers' feedback practices in this context is increasingly relevant.

Specific context of Technasium

Technasium schools have been in existence since 2004. As a boundary-crossing subject, R&D integrates STEM-related subjects such as biology, physics and engineering, and is provided as an elective track throughout all years of secondary school. Project-based learning and guiding students' reflection processes are the core in R&D. Students collaborate on authentic science and technology projects, such as designing a tomato-picking robot to making harvesting more efficient or a toy for pigs in order to prevent them from boredom. Assignments come from external stakeholders. These are representatives of companies outside the school organization who are facing a STEM-related issue that may be tackled through a project in the R&D course. These stakeholders

present the project to the students, are available to answer questions, and participate in the evaluation of their respective projects. After a 10-week period, students then reflect on their development and team progress. Formative assessment tools, such as rubrics, reflection tasks and feedback, need to be implemented for reflecting on cross-curricular competencies such as teamwork and collaboration with the commissioner. To explore how teachers discuss feedback to stimulate student reflection, we have to understand teachers' interpretations or conceptions of the terms 'reflection' and 'feedback' and to discuss their classroom practices (experiences).

This study focuses on how R&D teachers discuss process-oriented feedback to promote students' reflection processes and aims to answer two key research questions:
RQ1: What conceptions and experiences do Dutch R&D teachers report regarding their process-oriented feedback practices to stimulate students' reflection processes?
RQ2: What learning needs do Dutch R&D teachers have regarding process-oriented feedback practices to stimulate their students' reflection processes?
Results with respect to these questions will inform a set of design principles for a PD program that aims at enhancing teachers' provision of process-oriented feedback on students' reflective processes.

2.3. Materials and methods

Participants

R&D teachers were invited via a national newsletter from the Dutch Technasium Foundation, that supports schools that provide R&D as a school subject. A total of 23 R&D teachers participated from the 102 Technasium schools. To collect data regarding both research questions, five meetings were organized; each meeting involved three to six participants, with three schools having two teachers attending. With respect to teaching experience in R&D, 52% of the participants had 0-5 years of experience, 30% had 6-10 years, and 18% had 11-15 years of experience in teaching R&D. The academic backgrounds of the R&D teachers were mainly in STEM disciplines, with three specializing in mathematics, eight in biology, and five in physics. Additionally, a smaller number had backgrounds in geography (2), the arts (2), or languages (2). The geographical distribution of the participants accurately reflected the broader Technasium community spread across the Netherlands. Ethical clearance was obtained prior to data collection.

Procedure and design

Participants had the option to register for one of the five meetings; formation of the groups was based on the availability of the participants. The meetings facilitated discussions among teachers, allowing them to share experiences from their daily teaching practices (Doyle & Ponder, 1977). Meetings took place from November 2021 to February 2022, with all but the first meeting being held online due to COVID regulations. The first researcher led the meetings, and each meeting lasted about 3 hours. Data were collected

through individual mind maps and focus group interviews, both answering research questions 1 and 2 (see Table 2.1).

Table 2.1

Overview of data collection

Data collection	RQ1	RQ2
Individual mind map	Individual concepts and practices	Individual problems
Focus group interview	Concepts and experiences	Learning needs

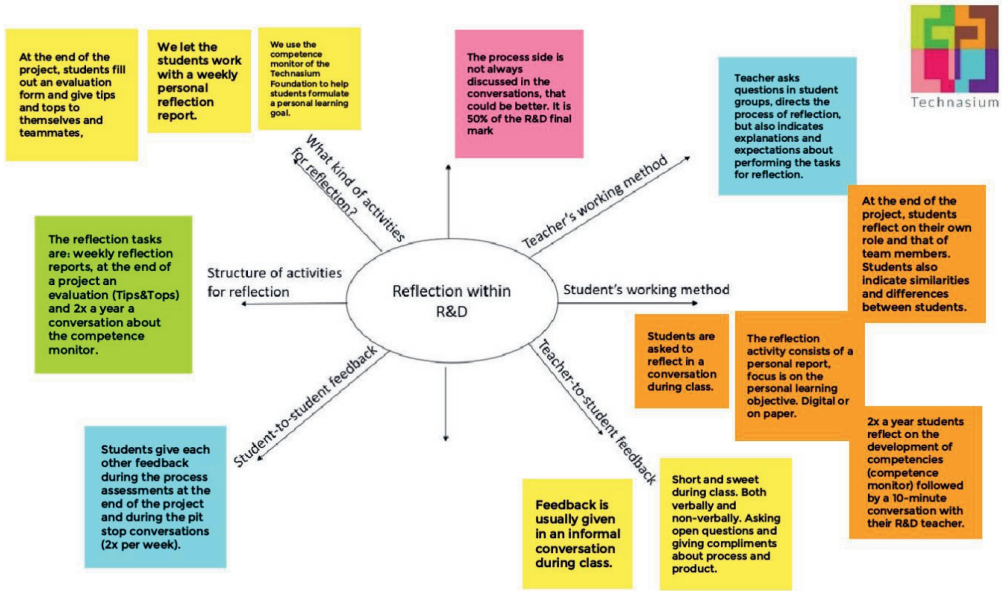
Instruments

Mind maps

Participants were given 30 minutes to create individual mind maps (c.f. Cañas et al., 2015) in Dutch. These mind maps had two purposes: (a) to stimulate participants' prior knowledge and facilitate discussions about their school's current situation and (b) to gather individual conceptions and experiences alongside of the group interviews. To streamline their thinking about the current situation of R&D at their school, the participants were given the interview topics. These prompts can be seen next to the arrows in the mind map (see Figure 2.1).

Figure 2.1

Example mind map with topics (translated in English)



Focus group interview

Robson and McCartan's (2016) guidelines for focus group interviews were used to gather information about the participants' conceptions and experiences of feedback and reflection. Focus group interviews were chosen to facilitate discussions among participants, allowing them to share insights and supplement each other's ideas on the topic. Interview questions had the following topics: (a) conceptions of reflection processes, (b) experiences with guiding reflection processes, (c) conceptions of (process-oriented) feedback, (d) experiences with discussing (process-oriented) feedback and (e) learning needs regarding feedback to stimulate reflection processes. Table 2.2 provides examples of specific interview questions (translated into English). The interviews were video-recorded and transcribed verbatim in Dutch. All participant quotes presented in the results section have been translated.

Table 2.2 *Examples of questions asked (in Dutch) during the interview, per topic*

Topics	Examples of questions (translated into English)
Conceptions of reflection processes	What, in your opinion, is the purpose behind engaging in reflection?
Experiences with reflection processes	How do you let students reflect within R&D?
Conceptions of (process-oriented) feedback	How would you describe feedback?
Experiences with (process-oriented) feedback	What kind of feedback do you provide?
Learning needs	What do you still want to learn about feedback to stimulate students' reflection and how do you want to learn it?

Data analysis

Qualitative content analysis (Miles et al., 2014) was used for both analysing the focus group interview data and the mind maps. The analysis started with the transcription of all interview texts. The researchers then familiarised themselves with the data by carefully reading the transcripts. Following the iterative process described by Braun and Clarke (2021) five main themes for each interview topic were identified; a) conceptions, b) motives, c) experiences, d) difficulties and e) learning needs. In the second round of analysis, these five main themes were further refined into 12 sub-themes through an iterative process. Main and subthemes can be seen in Table 2.3.

Atlas.ti was used for the coding and the decision rules for assigning fragments to themes were documented in a codebook. For the analysis coherent text fragments were used as the unit of analysis, ensuring that the text was of adequate length to be comprehended independently of context (Creswell, 2014).

Themes were then used to briefly describe each participant, and this description was collected in a framework analysis matrix to provide a structured overview of individual contributions. This matrix was further supplemented with information derived from the individual mind maps, increasing the depth and richness of the data representation. Combining the individual data from the interviews with the mind map information allowed for in-depth analysis at an individual level. Participants were then compared and grouped based on similarities and differences in key themes.

The theme *Conceptions* referred to an opinion or an explanation about the term's "reflection" or "feedback." With *Motives*, teachers described why they considered feedback to stimulate reflection important. In *Experiences*, the teachers described how they stimulated students' reflection by providing feedback. Positive and neutral experiences were named *Experiences,* while teachers' negative experiences were named as *Difficulties*. These difficulties were reflected in quotes that highlighted problems and provided explanations for why feedback sometimes did not yield the desired outcomes. The last main theme was *Learning Needs*, used when participants indicated what they still wanted to learn and how.

An example of a text fragment coded under the main theme *conceptions* is from Teacher p19, who shares her perspective on the differences between product- and process-oriented feedback. She attempted to formulate a definition of two types of feedback:

> I believe feedback on the product and feedback on the process are two distinct things. With product feedback, the focus is mainly on the requirements of the document the students have created. You assess whether the product meets the client's needs and if those requirements have been fulfilled, which makes it much more straightforward to evaluate and provide feedback on. However, I find process-oriented feedback to be the most valuable, as it encourages students to think critically.

A second example relates to the main theme *experiences*. This fragment was coded under *experiences with feedback*, as Teacher p16 described how he provided feedback to his students, using verbs such as feeling, finding, and observing:

> I feel that providing feedback on the product is easier because I have a clear idea of what I expect, which allows me to form a mental picture of it. In contrast I found giving feedback on the process more challenging, as it requires a careful approach to avoid coming across too personal or offensive. I observed that some students become defensive immediately, and with product feedback, it felt easier because the focus was on a group of three or four students, rather than focusing on an individual student.

A second researcher independently coded part of one interview to ensure accuracy; differences were discussed and the codebook was further refined. Using this updated codebook, the first researcher coded all interviews. Interrater reliability was assessed by having the second researcher independently code a second interview, representing 20% of

the total data, yielding a Cohen's kappa of 0.83 for the five main themes. Disagreements were resolved through discussion until consensus was reached. Due to their fine-grained nature, it was not possible to calculate Cohen's kappa for the subthemes. However, agreement was checked between the two researchers, and they agreed in 95.6% of cases. A framework analysis was used to summarize the data in a matrix, allowing thematic and case-based analysis. Interesting quotes were included in the matrix, facilitating individual participant-level analysis. By synthesizing the information within the matrix, the researchers identified differences and similarities among participants in terms of their perceived practices.

Table 2.3

Coherence between interview topics, main themes and subthemes

Interview topics	Main themes	Subthemes
Conceptions of reflection processes	Conceptions (A) Motives (B)	Conceptions of reflection (1) Conceptions of competencies (2) Reflections on motives (3)
Experiences with reflection processes	Experiences (C) Difficulties (D)	Experiences of reflection (4) Difficulties with reflection (5)
Conceptions of (process-oriented) feedback	Conceptions (A) Motives (B)	Conceptions of feedback (6) Motives for feedback (7)
Experiences with (process-oriented) feedback	Experiences (C) Difficulties (D)	Experiences with feedback (8) Difficulties with feedback (9)
Learning needs	Learning needs (E)	Learning needs guiding reflection process (10) Learning needs structuring reflection tasks (11) Preferred way of learning (12)

2.4. Results

Perceived feedback practices

RQ1 addresses R&D teachers' self-perceived feedback practices regarding student reflection. The analysis of the 23 dominant self-reported ways of discussing process-oriented feedback, particularly in terms of perceived depth, revealed four groups of teachers: basic, intermediate, advanced, and constrained. This classification also considered teachers' initiatives to use iterative reflection tasks to enhance students' reflections (see Table 2.4).

These four groups (basic, intermediate, advanced, and constrained) differed from the groups of teachers who participated in the focus interview groups. In the remainder of this section, the four teacher groups are described according to their conceptions and motives, their experiences, and difficulties. Conceptions and motives (although analysed as separate themes) appeared to be so closely related that they are discussed together.

Table 2.4

Teachers grouped into Basic, Intermediate and Advanced groups based on the perceived depth of process-oriented feedback offered and reported use of iterative reflection tasks to stimulate reflection (n = 23)

		Perceived depth of offering process-oriented feedback		
		Little	Average	A lot
Reported use of iterative reflection tasks	Little	Basic group P7, P9, P11		
	Average		Intermediate group P4, P5, P10, P13, P14, P16, P17, P20, P22, P23	
	A lot			Advanced group P1, P2, P6, P8, P12, P18, P19
Constrained group P3, P15, P21				

Basic group

Overall, three teachers in this group reported that they were struggling to grasp the concepts of process-oriented feedback and reflection, hindering their ability to design effective reflection tasks for their students and provide timely feedback.

Conceptions. While these teachers recognized the importance of reflection skills, their comprehension of the concepts of process-oriented feedback and reflection was limited. Basic group teachers had a less distinct understanding of how to present reflection tasks,

compared to the other groups. They could distinguish between process-oriented and product-oriented feedback, but their definitions lacked specificity.

Experiences. Basic group teachers tended to provide more product-oriented than process-oriented feedback, sometimes unintentionally. For example, Teacher P9 said: “I want to give process-oriented feedback, but instead I often catch myself giving feedback just on the product.”

They primarily focused on challenged or less-engaged student groups, hence neglecting well-functioning groups during their R&D lessons. According to these teachers, this often led to a lack of communication with all groups. Teacher P7 said: “Groups that have trouble collaborating demand all my attention, resulting in not having a chat with all my groups during class.”

Difficulties. This group faced challenges regarding class management and formulating process-oriented feedback. They hesitated to interrupt students for a reflection task or a feedback conversation about reflection tasks. Teacher P7 shared her hesitation: “I am looking for a balance between letting them work and making time for a feedback conversation to stimulate reflection. I feel like I'm slowing them down.”

Due to the infrequent use of reflection tasks, basic group teachers had fewer chances to observe the benefits of such tasks, making it difficult to emphasize the value of reflection to their students.

Intermediate group

Intermediate group teachers (*n* = 10) consistently offered process-oriented feedback, reporting greater experience with incorporating feedback on reflection tasks compared to the teachers from the basic group. They balanced product-oriented with process-oriented feedback, offering reflection tasks at least twice per project, and had a better understanding of reflection processes and feedback timing.

Conceptions/Motives. Teachers from the intermediate group emphasized the importance of reflection for students' self-awareness and growth. Teacher P10 said: “Reflection is learning from your own experiences and being aware of the growth you are making.” Intermediate teachers viewed feedback as valuable only when students actively engage with it, particularly highlighting the need for process-oriented feedback. They reported asking open-ended questions and providing examples that shed light on student behaviour, believing that feedback and reflective conversations act as a mirror for students to gain self-insight. For example, Teacher P23 stated: “A student needs process-oriented feedback to have input for reflection. You have to give examples.”

Experiences. Intermediate group teachers reported initially giving product-focused feedback and later process-oriented feedback, with feedback conversations following reflection tasks that happened midway through and at the project's end. Some teachers collaborated with students to establish learning goals. One teacher (P14) said: “Students can put into words what learning goals they have, what they do well, and what can be

improved. Their overall sense of cause and effect is pretty good."
Difficulties. This group faced challenges in providing weekly process-oriented feedback and increasing the frequency of reflection tasks. The timing of guidance on the process was not yet systematic, and some teachers expressed a need for a structured overview of students' learning goals, as these are not regularly discussed. Teacher P13 formulated it as follows: "I find the cyclical part of the reflection tasks difficult. How do I keep an overview of what learning goals all students are working on? (...) even when many students no longer know what their learning goal was."

Advanced group

Advanced group teachers (*n* = 7) reported extensive experience with guiding students' reflection processes, offering a high frequency of process-oriented feedback and reflection tasks. These teachers were confident in timing their feedback on both the product and process and provided process-oriented feedback at the group or individual level. They offered weekly reflection tasks, showcasing a comprehensive understanding of iterative reflection processes.
Conceptions/Motives. Advanced group teachers highlighted that effective process-oriented feedback entails asking appropriate questions to offer students insights into their behaviour. They stressed the importance of timely, specific, and constructive feedback for increased acceptance by students. They took on a coaching role, making observations and engaging in conversations; they aimed for a balanced approach, delivering more critical feedback on the product and softer feedback on the process.
Teacher P12 mentioned: "With process-oriented feedback, you act as a mirror. You provide feedback on behaviour, on attitude, you describe what you see, what happens, you talk about it and you ask if the student sees it similarly."
Some teachers also held the belief that teachers should personally endorse and empathize with the significance of reflection tasks. By conveying this message to students and acting as role models, they emphasize the importance of reflection. Teacher P6 stated: "You have to explain why students need to learn how to reflect and be clear what you expect of them."
Experiences. Advanced group teachers indicated that they effortlessly provided balanced feedback on both product and process, seamlessly transitioning between the two during lessons. They delivered process-oriented feedback through informal conversations, personal reports, and end-of-project evaluations. These teachers prioritized individualized attention, dedicating additional conversations to students who might require extra support. Teacher P8 said: "Every group receives weekly attention, and students who may be struggling receive additional conversations. (...) I strive to identify the underlying causes of their behaviour."
Teachers actively engaged students in iterative reflection tasks, fostering meaningful interactions and emphasizing students' responsibility for portfolio maintenance and

progress discussions. Teacher P19 stated: “The student is responsible for maintaining the portfolio and preparing the conversation about it. There are regular conversations about the progress.”

Difficulties. Advanced teachers aimed to offer feedback on reflection tasks consistently throughout the year and even across multiple years. However, they encountered difficulties with implementing a cyclical approach to these activities among the whole R&D team. Teacher P18 expressed the need for more guidance on establishing a seamless learning trajectory, stating: “I would like more information on how to create a continuous learning trajectory, from the first years to the exam classes at my school."

Constrained group

Three teachers formed a distinct group due to the external constraints they encountered, leading to unique experiences compared to the other groups. These teachers faced limitations in conducting R&D lessons according to their preferences, including issues such as insufficient R&D hours, lack of support from school management, and a shortage of R&D teachers. These external factors restricted their ability to provide feedback and implement reflection tasks.

Conceptions/Motives. Teachers in this group were experienced teachers, and their conceptions and motives were similar to those of teachers in the intermediate or advanced groups.

Experiences. These teachers provided feedback on both the product and the process. While individual process-oriented feedback was given in conversations whenever possible, it was more frequently provided to groups or classes during lessons to optimize time.

Difficulties. Constrained teachers faced distinct challenges compared to other groups, dealing with the above-mentioned external factors. These external constraints hindered them from meeting the basic requirements of the Technasium Foundation for R&D. Time limitations led these teachers to prioritize the product over the process, sometimes skipping process-oriented feedback due to external deadlines. Teacher P3 stated: “I often catch myself steering the product, instead of the process. Because students need the product feedback and there is too little time to do both.”

The lack of time also influenced collaboration among R&D teachers, leading to differing conceptions and motives. Teacher P21 said, “Activities to stimulate reflection depend within my school on the coaching qualities of the teacher.” Additionally, insufficient support from management could diminish their motivation to offer reflection activities and guide students effectively. Teacher P15 shared his observation: “I've observed that learning to reflect doesn't receive much attention from management. As a result, I find myself not paying enough attention to it either.”

Reported learning needs

The second research question addresses teachers' learning needs. Teachers within each of the four groups expressed similar learning needs. The following descriptions highlight what teachers wanted to learn and how they would prefer to receive professional development in the future. Learning needs were deduced from the teachers' interview responses and their reported difficulties. One key finding among all groups was the desire for collaborative training with other R&D teachers that aligns with their educational practice.

Basic group

Teachers in the basic group desired to deepen their understanding of process-oriented feedback to stimulate reflection. These teachers struggled with aligning reflection tasks and timing, finding it challenging to determine the right moment for interrupting students. Teacher P7 said: "I find it difficult to make enough time for reflection tasks. What is the right moment to let students stop working so that they can mentally get involved?" Providing process-oriented feedback to all groups within a class was found challenging. Teacher P9 formulated his learning need as follows: "I would really like to grow in stimulating the students' reflection processes by asking open-end questions."

Intermediate group

The intermediate group wanted to refine their process-oriented feedback, sought ways to enhance iterative reflection tasks and wanted to set students' learning goals in a more structured way. Providing process-oriented feedback was more challenging to them, as it requires sensitivity. This sensitivity was described by Teacher P16: "I find it challenging to give process-oriented feedback, since it requires careful consideration to avoid it becoming personal or offensive."

Intermediate-group teachers desired to give more individual attention if necessary, prompting this question by Teacher P13:" How can I give attention to all students?" Additionally, teachers wanted a more structured approach to reflection tasks. Currently implementing these tasks at least twice per project, they sought ways to offer a cyclical structure to enhance reflection. Furthermore, they were interested in setting personal learning goals. For example, Teacher P22 asked: "How do I formulate personal goals together with my students?" Additionally, teachers in this group struggled to keep track of the learning goals their students formulated, and they sought ways to offer reflection tasks in a cyclical way.

Advanced group

Teachers in the advanced group wished to learn how to coordinate process-oriented feedback to stimulate reflection with their R&D colleagues at the school, aiming for a consistent approach. Teacher P1 asked: “How do you ensure the same approach concerning process-oriented feedback for the entire R&D team?” They also sought to refine their own teaching approach, specifically by aligning reflection tasks over multiple years. They wanted to establish a continuous learning trajectory with both short and long reflection cycles within a year and ensure the cyclical offering of these activities over time and wondered how to do that. Additionally, they had learning needs regarding increasing student ownership of the reflection process.

Constrained group

Despite suboptimal conditions for R&D, teachers in this group wanted to learn more about guiding reflection processes. Their learning needs were related to effectively managing their limited time; for example, Teacher P3 said: “How can coaching and giving process-oriented feedback to stimulate reflection be optimized?” Additionally, they had questions about increasing support from management and expanding their R&D team with motivated teachers.

2.5. Conclusion and discussion

This study explored secondary school teachers’ conceptions and self-reported practices when discussing feedback with students to encourage student reflection (RQ1) and identified their learning needs related to stimulating reflection through feedback (RQ2).

Perceived practices of R&D teachers

The 23 participating teachers were classified based on their dominant self-reported ways of discussing process-oriented feedback and providing reflection tasks, resulting in three groups (basic, intermediate and advanced). A fourth group, who encountered external constraints, was identified as the constrained group.

This study shows a relevant connection between teachers' comprehension of the concepts of "feedback" and "reflection" (i.e., their thoughts) and their reported practices (i.e., their actions). Limited understanding, especially in the basic group, led to difficulties with assigning reflection tasks. These teachers perceived that both students and colleagues doubted the usefulness of reflection tasks, hindering the application in their lessons. Also, their uncertainty about the optimal timing resulted in missed opportunities to make students' reflective thoughts visible and engage in feedback conversations about reflection. In contrast, the intermediate group provided feedback on reflection tasks twice per R&D project, and the advanced group fostered reflective thinking through weekly tasks and having feedback conversations at an individual and team level. The advanced

group's iterative approach to reflection tasks and feedback conversations aligns with the principles for guiding critical reflection articulated by Korthagen and Vasalos (2005).

Further, a difference between discussing product- and process-oriented feedback was found, particularly between the basic and advanced teacher groups. The basic group reported mostly giving product-oriented feedback, while the advanced group reported a more balanced mix of product- and process-oriented feedback. Although all groups acknowledged the importance of feedback conversations with all students, their reported actions differed. The basic group reported that they focussed on guiding individuals with negative work attitudes, the intermediate group reported on providing feedback to all, and the advanced group indicated that they guided on both the group and individual levels. Unlike basic-group teachers, advanced-group teachers actively observed students, considered their emotions, and shared external observations. The responses of advanced teachers showed that they were able to share an external perspective (Moon, 2013) and to take the emotions of the students into account to enhance the reflection process (Korthagen & Vasalos, 2005).

Unlike those in the other groups, advanced teachers perceived themselves as proficient in formulating and discussing actionable feedback with their students. They prioritized clarity, specificity, and relevance, demonstrating their ability to guide students' reflection effectively (Tielemans et al., 2023). These teachers found it easy to discuss feedback on aspects of both product and process, considering individual student needs. They believed that their careful and skilful formulation of feedback information contributed to the effectiveness of their teaching practices. During the data collection meetings, teachers also mentioned feedback processes, emphasizing the roles of both students and teachers in discussing and understanding feedback messages. Although feedback information and feedback processes were mentioned by teachers, it is notable that teachers in the current study were not familiar with the literature on teacher feedback literacy (Boud & Dawson, 2021; Carless & Winstone, 2020; Tielemans et al., 2023).

Linguistic variations are also evident between teachers in the basic and advanced groups. For example, teachers in the basic group frequently use the verb "providing" feedback, reflecting an emphasis on delivering information about a student's current work to enhance the quality of future work. The verbs employed by basic group teachers align with the engineering model proposed by Nieminen and Carless (2023). In contrast, teachers in the advanced group adopt a more student-centered approach, favoring the verb "discussing" feedback, and thereby recognizing students as active participants in the learning process. This approach corresponds more closely with the sustainable model proposed by Nieminen and Carless (2023).

Constrained-group teachers reported difficulties with providing timely feedback for student reflection due to external circumstances, such as limited R&D hours. Among the other three groups of teachers, we observed differences in their reported ability to stimulate reflection processes and discuss process-oriented feedback when external

conditions were more favourable. This finding aligns with Kangas-Dick and O'Shaughnessy's (2020) literature review on interventions promoting teacher resilience. Teachers facing constraints require practical measures, such as dedicated R&D hours and an available R&D team, to cope with suboptimal circumstances. Kangas-Dick and O'Shaughnessy (2020) underlined the importance of cultivating teacher resilience and the urgent need for practical solutions to support teachers and enhance educational quality.

In conclusion (regarding RQ1), teachers' understanding of the feedback-reflection relationship is grounded in practical knowledge and personal experiences, as revealed through focus group interviews on everyday practices. The advanced group recognized a strong connection between feedback and reflection, providing a fresh perspective on academic knowledge. By using an iterative approach to reflection tasks, these teachers encouraged their students to express reflective thoughts. Subsequently, advanced teachers said they engaged in feedback conversations and shared external perspectives. They seem to be able to arrange a safe learning environment where feedback is accepted and actionable. This could allow students to compare their teacher's (or teammates') external viewpoint with their internal perspective, thereby enhancing the depth of their reflection. These research findings are consistent with the theories described by Coulson and Harvey (2013), Moon (2013), Nicol (2021) and research done by Veine et al. (2020), supporting the idea that teachers with awareness of feedback processes can effectively communicate the significance of reflection tasks and stimulate students' reflection. Moreover, deepening understanding and accumulating experience enable teachers to skilfully integrate feedback and reflection-stimulating tasks in a coherent and aligned way enabling an iterative approach across the school years (Grossman, 2009; Veine et al., 2020).

Learning needs of R&D teachers

Distinct learning needs emerged among the teacher groups in this study (RQ2), shaped by differences in teaching experience and practices. The basic group's learning needs focused on time and classroom management, indicating that they have difficulty finding the time to offer reflection tasks and engage in feedback conversations with their students. The intermediate group sought to enhance their skills for feedback dialogues and integrate reflection-stimulating tasks throughout the school year, while the advanced group sought to refine their approach and align their guidance across multiple years and among the whole teacher team. The constrained group's learning needs centred on school policy issues, including time utilization, increased support, and building a motivated R&D team. Despite their strong desire for development, challenging circumstances posed significant obstacles for this group.

Wolff et al.'s (2021) research supports our findings on distinctions between the basic and advanced teacher groups. Basic-group teachers, identified as novices in Wolff et al.'s

research (2021), had difficulty perceiving classroom situations, due to a lack of practical knowledge. Information overload causes them to miss crucial information, resulting in learning needs concerning making timely decisions and classroom management. Conversely, in their research, advanced-group teachers swiftly processed information. Their learning needs addressed meeting individual student needs, aligning with our own findings in which advanced-group teachers expressed similar needs.

Teachers in our study expressed a desire for literature-based guidelines on feedback processes or feedback literacy and collaborative learning with R&D colleagues, aligning with meaning-oriented and application-oriented teacher learning concepts (Overman et al., 2014). Meaning-oriented learning deepens understanding, while application-oriented learning emphasizes practical implementation in the classroom. The findings of the current study direct the way of designing PD programs that combine feedback processes, reflection tasks, and literature-based guidelines for each teacher group to strengthen teachers' abilities to discuss process-oriented feedback (Overman et al., 2014; Voerman & Faber, 2016). In section 5.3 we will elaborate on this kind of PD programs.

Implications for theory and education

Although teachers face challenges in their practice, our study shows that these challenges are not uniform. The differences that we found between teachers may have been caused by different trajectories in initial teacher education programs. In addition, the review study of Winstone et al. (2017) showed old-fashioned perceptions about ('providing') feedback to be prevalent in teachers' lessons and in their curriculum designs and assessments. Their review and our study raise the question how student teachers are prepared through initial teacher education programs to organize feedback processes or feedback dialogues in their lessons. Although initial programs should consider incorporating feedback discussions as learning goal, PD programs will still be needed to let in-service teachers develop from basic to advanced levels.

PD programs have been criticized for not involving teachers in the choice of content or their aims for learning (Louws et al., 2017). Teachers possesses distinct experiences, expertise, and learning needs, which evolve throughout their careers (Antoniou & Kyriakides, 2013; Louws et al., 2017; Wolff et al., 2021). As a result, PD programs must adopt a differentiated approach, tailoring support and training to align with teachers' varying levels of experience and specific areas for growth (Borko et al., 2010; Dam 2014; Desimone, 2023; Louws et al., 2017).

What can we learn from this paper in relation to the central aims of the special issue? In our view, these contributions pertain to (a) the identification of stages of development in the teaching skill of promoting students' reflection through discussing process-oriented feedback; (b) the evaluation methods of this teaching skill; (c) identification of important elements when discussing feedback that can be further developed; (d) establishment of links between the evaluation of this teaching skill and professional development needs;

and (e) the practical possibilities to develop simple measuring instruments for establishing teachers' stages of development in feedback practices.

With regard to (a) identifying stages of development, the current study found three groups representing three stages of development in engaging in feedback conversations. A fourth group, the constrained group, is relevant in the context of how the school environment limits the actions of (experienced) teachers. However, the Constrained group is not discussed in the discussion of stages of professional development. The three stages (three groups) resemble the five stages of teacher development described in the Dynamic Integrated Approach (DIA) by Antoniou and Kyriakides (2013). The basic group is comparable with the Orientation stage, as teachers in this stage are mainly striving to understand the concepts of feedback in relation to students' reflection. Besides these teachers are focused on classroom management issues i.e. the basic teaching skills. The intermediate teacher group demonstrated a more effective approach to organizing and planning their feedback, incorporating a variety of feedback conversations in the classroom. Their practices align with the Preparation and Implementation stages of the DIA model, in which teachers are focused on enhancing student engagement and learning. The advanced group consisted of teachers who reported tailoring their instruction to meet the individual needs of students and expressed a learning need to further refine their feedback practices. These practices align with the Integration stage, nearing the refinement stages of Antoniou and Kyriakides (2013).

Concerning (b), the evaluation methods of discussing feedback, the current study highlights the importance of recognizing the different stages of teacher development in order to adequately evaluate and enhance feedback practices that promote students' reflective processes. By encouraging teachers to articulate their daily feedback practices, it becomes possible to assess their reported feedback practices; to make them aware of their practices and to identify the next steps they should take to improve their practices. Furthermore, by inquiring about their learning needs, teachers are recognized as active agents who are capable of self-directed learning (Louws et al., 2017). Considering their developmental stages allows for the design of PD programs that align with their experience levels, ensuring a more differentiated and effective approach to professional growth (Antoniou & Kyriakides, 2013; Borko et al., 2010; Louws et al., 2017). Evaluation methods such as individual mind maps and group interviews, as implemented in this study, has proven to be useful in revealing teachers' professional learning needs for their feedback practices.

With regard to (c), the identifying important elements when discussing feedback, this study contributes to further refinement of feedback models by revealing the implementation challenges faced by teachers in an educational setting, underscoring the

necessity for theoretical models to be empirically validated (Lipnevich & Panadero, 2021). While feedback is often seen as a holistic phenomenon (e.g.Hattie & Yates, 2014; Korthagen & Vasalos, 2005), the current study presents feedback as a multifaceted process, requiring teachers to address different aspects of feedback (see section 2.3) and engage in feedback processes at various stages of their development. Teachers in the Basic group need to deepen their understanding of process-oriented feedback, enhance the alignment of reflection tasks, and improve classroom management strategies. Teachers in the Intermediate group should enhance their sensitivity in discussing process-oriented feedback and cultivate strategies for supporting individual students. Individual support means discussing students' personal learning goals and fostering student personal reflections through using reflection tasks. The more experienced teachers (Advanced group) encountered increasingly complex challenges, such as effectively differentiating their guidance to meet diverse student needs and determining learning objectives for reflection that extends over school years and shared by the different colleagues in the school.

The fourth aim (d) refers to the establishment of links between the evaluation of this teaching skill and professional development needs. The findings of this study underscore the necessity for differentiated approaches in both professional development and classroom instruction to foster deeper learning and growth of both teachers and students. For example, a differentiated approach to professional development stages could be structured as follows: First, theory should be discussed, clarifying the different feedback conceptualizations and highlighting evaluation methods. For the basic group, the focus should be on developing the necessary knowledge and skills to implement feedback conversations and reflection tasks. The intermediate group should become aware of their sensitivity to students' emotions and improve the balance between different feedback types. Peer consultation can be used in the form of recording feedback conversations with students and discussing them with colleague teachers (Voerman et al., 2016). The experienced teachers require a more advanced approach, addressing complex and adaptive feedback strategies tailored to their expertise, for example by attending to individual students' needs and their realized achievements in reflection.

Regarding (e), the practical possibilities to develop simple measuring instruments for establishing teachers' stages of development in feedback practices, this study employed mind maps and focus group interviews what might be understood as preliminary measurements methods. Alternative instruments concern questionnaires (e.g. Louws et al., 2017), while a more objective measurement could be achieved through classroom observations of teacher behaviour, guided by an observation instrument based on characteristics identified across the three groups (e.g. Boodt, 2014; Voerman et al., 2016). Additionally, measurement instruments should also capture students' perspectives,

assessing how they experience their teachers' developmental stages. In the section follow-up research, we give some more suggestions for developing measurement instruments.

Limitations

One limitation of our study could be the use of focus group interviews, which could introduce interference and bias compared to individual interviews. Despite this limitation, the data obtained from the focus group exceeded expectations, providing valuable insights. Moreover, the research team combined individual mind maps with personal interview responses, allowing for an examination of data at the individual level.
Another limitation could be reliance on teachers' perceived practices, which could differ from their actual practices. This possible limitation is in line with Voerman et al.'s (2012) research, which highlighted teachers' unrealistic perceptions regarding the scope and quality of their feedback. Future studies could address this by incorporating measures such as classroom observations and student voices for additional perspectives.
Additionally, there is a potential bias in the mindset of the participating R&D teachers, as volunteers could have greater interest and different experiences compared to other teachers, affecting the generalizability of findings to the broader population. R&D teachers are likely to have more experience in feedback practices, because of the R&D curriculum's aim of teaching students 21st century skills. However, even within the small group of teachers in this study, we found that teachers were at different stages of development.

Follow-up research

This study identified two key areas for further exploration: first, integrating feedback and reflection; second, the design of effective PD programs aligning with teachers' needs and practices. The study suggests further research to delve into how feedback supports reflection and identify relevant conditions. These conditions are key aspects in the formulation of practical guidelines (Coulson & Harvey, 2013; Moon, 2013). To assess teachers' current knowledge and skills in integrating feedback with reflection tasks, future research should develop a structured measurement instrument. This instrument could include self-assessment surveys, structured observations, and reflective journaling.
This study also highlights the need for tailored PD programs that combine feedback processes, reflection tasks and literature-based guidelines thereby enhancing the effectiveness of feedback implementation in educational practice (Borko et al., 2010; Moon, 2013; Voerman et al., 2015; Winstone et al., 2017). We suggest also assessing the impact of such PD programs on students (Antoniou & Kyriakides, 2013), exploring how they perceive and benefit from process-oriented feedback and evaluating changes in the level of reflection of their written reflection tasks (Veine et al., 2020; Voerman & Faber, 2016).



Chapter 3

Transitioning from Feedback Delivery to Feedback Dialogue: Teachers' Professional Growth

Abstract

This study investigates the professional growth of secondary school teachers in conducting feedback dialogues, using a socio-constructivist perspective. Ten teachers, grouped into three learning communities, engaged in structured discussions to analyse video recordings of their own classroom feedback dialogues. Through reflexive thematic analysis of 78 hours of transcripts, individual vignettes were developed to capture growth across five key areas: teacher readiness, monitoring student readiness, interaction mode, feedback content, and use of observations. By the end of the program, eight teachers had improved in at least two areas, highlighting the program's strength. The findings inform professional development programs by emphasizing the need to support teachers not only in what to communicate during feedback dialogues, but also in how to orchestrate the complex areas involved. An adapted feedback dialogue model, grounded in both theory and empirical evidence, is proposed as a practical tool for conducting feedback dialogues.

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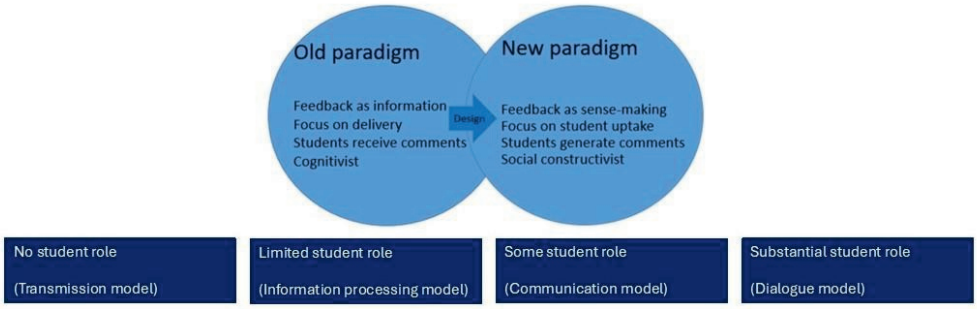
3.1 Introduction

This study examines the professional growth of secondary school teachers following a professional development program aimed at moving from a traditional, one-way feedback approach to a dialogic approach engaging both teachers and students. Feedback dialogues enable students to become active participants in the feedback process and promote their engagement in their own learning (Ajjawi & Boud, 2017; van der Kleij et al., 2019; Winstone et al., 2017). By encouraging open feedback dialogues and reflections, this approach promotes students' critical thinking, self-awareness and deeper learning (Moon, 2013). Feedback dialogues transform "feedback delivery" into a collaborative process involving both students and teachers (Winstone et al., 2022). Developing the skills to realize this transformation requires time, effort, and ongoing professional development for teachers (Borko et al., 2010; van der Kleij et al., 2019). In their comprehensive review, Lipnevich and Panadero (2021) analysed various feedback models and concluded that only a small number had been empirically validated. They emphasised that implementing theoretical models in classroom settings contributes to their refinement while simultaneously exposing the practical challenges teachers encounter in their application. In line with this, the present study aims to enhance teachers' professional growth required to conduct effective feedback dialogues within the context of their actual classroom practice, thereby promoting a more reflective learning experience for students.

Historically, feedback has been approached largely one-sided, with teachers providing feedback to students without the intention of much student involvement (Winstone et al., 2017). However, recent studies (Ajjawi & Boud, 2017; Winstone et al., 2022) have suggested a theoretical shift toward collaborative feedback, in which teachers and students engage in a dialogue about feedback. A meta-review by van der Kleij et al. (2019) discussed a significant shift in the approach to feedback in educational settings between 1969 and now. They outlined four levels of student involvement, from the transmission model (minimal involvement) to the dialogue model (maximum involvement). The information-processing and communication models fall between both extremes (see Figure3.1. In traditional settings, the transmission model dominates, characterized by teacher-driven feedback focused on identifying and correcting errors with limited student interaction (Hattie & Timperley, 2007). In contrast, the dialogue model promotes two-way communication, allowing both teachers and students to actively discuss student performance, thereby enhancing student reflection, questioning and understanding (Hattie & Yates, 2014; Korthagen & Vasalos, 2005; Moon, 2013).

Figure 3.1

Students' role concerning feedback, based on van der Kleij et al. (2019)



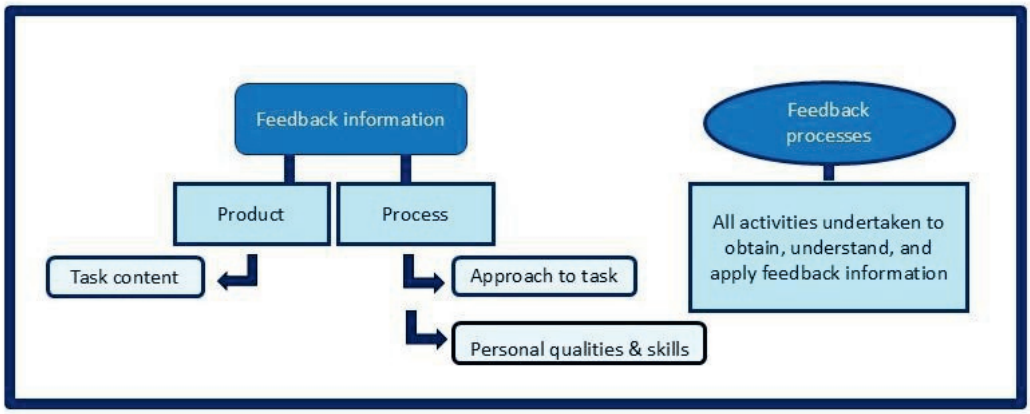
By engaging in feedback dialogues with their students, teachers foster student autonomy and facilitate acceptance of feedback by students. Additionally, teachers can reduce students' anxiety by framing feedback as a collaborative and ongoing process, rather than a one-time evaluative judgment (Winstone et al., 2022). To facilitate the shift from feedback delivery to feedback dialogues, teachers need guidance on the implementation of feedback dialogues in educational settings (Wu et al., 2024).

Although recent theoretical feedback models subscribe the changing roles of students, and sometimes the changing roles of teachers, they emphasize different elements needed in feedback dialogues. Carless and Winstone (2020) emphasize the role of feedback information (i.e. the "what") and feedback processes (i.e. the 'how') and see them as two intertwined aspects (See Figure 3.2). Winstone et al., (2017) further unravelled feedback information into a product-oriented or process-oriented part. Product-oriented feedback information is concerned with improving the outcome of the learning task, whereas process-oriented feedback information is focused on the student's approach to tasks and the development of personal qualities or skills (Winstone et al., 2017). The goal of product-oriented feedback information is to assist students in identifying the strengths and areas for improvement of their learning product, enabling them to align their work with established criteria (Hattie & Timperley, 2007). Process-oriented feedback information is aimed at promoting self-regulation and reflective thinking, that enhance learner autonomy and support meaningful learning (Korthagen & Vasalos, 2005; Winstone et al., 2017).

The term feedback processes refer to the way of how feedback information is discussed including all steps of obtaining, understanding, and applying feedback (e.g. Carless & Winstone, 2020; de Kleijn, 2021). Although theory assumes equal partnership in feedback processes, this balance is not always present in educational practice. In classroom contexts, teachers are responsible for assisting students in developing feedback skills that enable them to proactively seek, comprehend, and apply feedback to enhance their learning outcomes (Carless & Boud, 2018; de Kleijn, 2021).

Figure 3.2

Schematic representation of feedback information and feedback processes



In her theoretical model, Moon (2013) also addresses feedback processes by emphasising the importance of incorporating external perspectives to support students' understanding and application of feedback. Additionally, Boud and Dawson (2021) emphasise the actionable dimension of feedback, what can teachers do to ensure feedback uptake, which also represents an element of feedback processes. Within and across the models of Carless and Winstone (2020), Moon (2013), and Boud and Dawson (2021), five key areas were derived that are important for effective feedback dialogues in educational settings: 1) teacher readiness; 2) student readiness; 3) feedback content; 4) interaction mode; and 5) verified observations to substantiate feedback. Although effective feedback dialogues require active participation from both teacher and student, this study focuses on supporting teachers in facilitating these dialogues within their educational contexts.

3.2 Conceptual framework

Feedback readiness both for students and teachers:

In feedback dialogues both teachers and students need to be prepared to engage collaboratively (Boud & Molloy, 2013). The term *feedback readiness* describes the emotional, cognitive and motivational mindsets the participants need for effective engagement in feedback dialogues (Garino, 2020). All participants (teachers and students) must cultivate an awareness of their readiness for feedback, monitor their emotions during feedback dialogues and demonstrate adaptability in their dialogue strategies (Adarkwah, 2021). As this study focuses on teachers, both their own readiness and their responsibility to monitor students' readiness were taken into account.

Teacher readiness encompasses the teacher's competence to establish a safe learning environment that encourages open communication and critical thinking, wherein all participants feel at ease providing feedback and asking questions (Hattie & Yates, 2014; Moon, 2013). Teacher readiness also concerns recognizing opportunities for initiating feedback dialogues, implementing them within the classroom context, and assessing their own readiness by monitoring their mindset and emotions, and being aware of their own behaviour and demeanour (Adarkwah, 2021; Evans, 2015).

Monitoring student readiness for a feedback dialogue involves the teacher observing the student's attentiveness, openness, and real-time judgments to determine the student's receptiveness to feedback (Adarkwah, 2021; Garino, 2020). Student readiness also depends on the student valuing the feedback and trusting its source, urging teachers to think about their own credibility as feedback giver and about the relevance of their feedback for students' self-assessment (e.g. Garino, 2020).

Feedback content

A balanced approach to feedback information, combining product- and process-oriented elements, has been suggested as the optimal strategy (Winstone et al., 2017). Teachers can further support students by employing open-ended questions and encouraging them to summarise feedback, prioritise key points, and formulate subsequent action steps (Boud & Dawson, 2021). The feedback content discussed should be timely, coherent and consistent with prior feedback exchanges (Tielemans et al., 2023). Within this study, feedback content refers to the specific information exchanged between participants during a feedback dialogue.

Interaction mode

To promote meaningful engagement in feedback dialogues, teachers aim to involve all students. Ensuring feedback is accepted and acted upon requires both teachers and students to engage actively in discussions that are constructive, substantive, specific, and timely (Ajjawi & Boud, 2017; Tielemans et al., 2023). This also involves shifting from an evaluative to a facilitative communication style (van der Kleij et al., 2019). In this facilitative role, teachers adopt a student-centred perspective, using active listening techniques and posing open-ended questions to encourage students to seek feedback and draw their own conclusions (Winstone et al., 2017). In the present study, the term interaction mode refers to the specific way feedback dialogues are conducted.

Use of verified observations

The actionability of feedback depends on the student's willingness to accept it, which is influenced by its proximity to the self, the student's person (Hattie & Timperley, 2007; Kluger & DeNisi, 1996). This proximity has greater impact in the context of process-

oriented feedback than for product-oriented feedback, given that process-oriented feedback concerns the student's personal learning strategies, personal skills or qualities (Winstone et al., 2017). Feedback closely tied to the self, such as praise or criticism, is more likely to be rejected (Hattie & Timperley, 2007; Kluger & DeNisi, 1996). However, process-oriented feedback substantiated with teachers' observations of student's behaviour during learning is more likely to be accepted (Boodt, 2014; Voerman et al., 2015). By observing student's behaviour and engaging in discussions with the student to verify their interpretations for accuracy, teachers can formulate more precise and contextually relevant feedback (Boodt, 2014; Voerman et al., 2015). Such feedback offers an external perspective that facilitates internal reflection (Hattie & Yates, 2014; Moon, 2013). By comparing these external perspectives with their internal ones, a student can identify discrepancies between their learning objectives and their actual behaviours, thus enhancing their engagement with the learning process (Moon, 2013).

In conclusion, the identified key areas support teachers in implementing effective feedback dialogues that foster student's reflection and self-regulated learning. Teachers must cultivate their own feedback readiness while simultaneously monitoring their student's readiness. Additionally, they are required to adopt a facilitative, student-centred interaction mode, deliver a balanced combination of product- and process-oriented feedback, and substantiate their input with verified observations.

Context of the study

The present study aims to support teachers' professional growth by enhancing the specific competencies needed to conduct feedback dialogues focusing on process-oriented feedback. This study was conducted among secondary-school Technasium Research & Design (R&D) teachers in the Netherlands. The R&D curriculum emphasizes authentic, project-based learning in cooperation with local businesses. Groups of 3 or 4 students engage in collaborative projects, for example, developing technological innovations such as a tomato-picking robot or toys to increase animals' activity levels. At the end of each 10-week project cycle, students present their recommendations to external clients. An R&D project ends with reflective tasks about students' individual development and team dynamics. These reflections are part of feedback conversations between students and teachers. R&D teachers are considered well-suited for the study, given their prior experience with feedback conversations and their presumed knowledge, skills, and motivation to facilitate them. Despite the curricular emphasis, earlier research (Görtzen et al., 2025) indicated that R&D teachers faced challenges in conducting effective feedback dialogues and balancing product and process-oriented feedback.

Based on the five key areas, a professional development program called "Collaborative Teacher Reflection" (CTR) was designed. R&D teachers practised with feedback dialogues, while fostering teacher and student feedback readiness, discussing feedback content,

facilitating a conducive interaction mode, and making use of verified observations. This study addresses the following research question: What growth do teachers show across the five key areas of feedback dialogues during the CTR program?

3.3 Materials and methods

Participants

Ten R&D teachers from nine Technasium schools responded to an open invitation in a national newsletter from the Dutch Technasium Foundation. Ethical clearance was obtained prior to implementing the 2-year CTR-program. Teachers freely selected one class in which feedback dialogues took place during the duration of the CTR-program. The classes, selected by the R&D-teachers, varied in size and educational level. In the first year, nine teachers participated: seven continued into the second year, joined by one new participant, for a total of eight in the second year. Participant details are presented in Table 3.1.

Table 3.1

Participant information.

		CTR Year 1 (22-23 Class)		CTR Year 2 (23-24 Class)	
Name*	R&D Experience (years)	Number of students	Student age (years)	Number of students	Student age (years)
Rick	0-5	24	12-13	12	15-16
Sarah	6-10	21	16-17	31	16-17
Norah	11-15	10	16-18	8	15-16
Lian**	6-10	12	15-16	-	-
Esther**	6-10	-	-	23	16-18
Marit	0-5	21	14-15	19	15-17
John	6-10	24	16-18	13	15-17
Irene	0-5	13	16-18	17	15-16
Robert	11-15	10	15-16	25	13-14
Karel	6-10	20	15-17	-	-

** Names are pseudonyms*

*** Worked at same school*

Six teachers (Rick, Norah, Marit, John, Irene, and Rob) actively participated in both years, completing all CTR program activities. Karel left the education sector, and Lian stopped teaching R&D, but was replaced by her colleague Esther to ensure the school's continued

participation in the CTR-program. However, Esther faced personal challenges limiting her participation. Sarah also experienced personal challenges, temporarily pausing her involvement during the 2023–2024 academic year.

Study Design

Data were collected as an integral part of the CTR-program. The CTR-program began with a kick-off meeting in September 2022, followed by an individual face-to-face meeting with the researcher at each teacher's school. Using a laddering technique, each participant formulated a personal learning goal. The participant's group was divided into three learning communities, each consisting of three to four teachers. Three CTR meetings per learning community were held, one every 3-4 weeks, each lasting approximately 3 hours. Before each CTR meeting, teachers recorded and selected video fragments of feedback conversations with their students. During CTR meetings, teachers and the researcher systematically discussed the recordings using a viewing guide, posed questions inspired by the five areas and practised discussing feedback to each other. Each CTR year ended with a final plenary meeting where the participants evaluated their learning. In the second year of the CTR-program, all teachers were assigned to different classes (see Table 3.1), thus requiring them to select a new class to practise with. The program's structure is shown in Figure 3.3.

Figure 3.3

Components of the 2-year Collaborative Teacher Reflection program per year



Instruments

Data to address teachers' growth in terms of their feedback dialogues were collected via laddering interviews, semi-structured discussions about the video fragments during CTR meetings, and the teachers' presentations of their perceived learning in the final, plenary meeting.

Laddering interview

A laddering interview (cf. Van Veen & Janssen, 2016) was conducted in a one-on-one meeting at the participant's school to explore an existing R&D project. The interviewer employed iterative "why" questions to elicit the participant's underlying rationale, resulting in a means-end hierarchy. This approach enabled identification of the participant's existing knowledge and practices related to feedback, as well as gaps in understanding. Based on this analysis, participants independently formulated a personal learning goal regarding feedback dialogues.

Semi-structured discussions

During the CTR meetings, guidelines were used to focus participants' discussions on the video fragments. These semi-structured discussion guidelines were used to direct attention to both the feedback information and the dynamics of the feedback processes. The conversations between the teachers during the CTR meetings were videorecorded, transcribed and analysed. Classroom videos, though discussed during CTR meetings, were excluded from the research due to Dutch privacy regulations.

Presentation of perceived learning

A Presentation of Learning (PoL) was used to enable the participants to share their perceived growth on their personal learning goals with peers. They presented their personal learning goals, described undertaken actions, reflected publicly on their achievements, and formulated new learning goals for the following school year. The presentation and the shared reflective thoughts on their progress were videorecorded, transcribed and analysed.

Data Analysis

To analyse the qualitative data from laddering interviews, CTR meetings, and PoL sessions, we used reflexive thematic analysis (Braun & Clarke, 2021). This approach revealed a nuanced understanding of each teacher's professional learning trajectory and informed the construction of individual vignettes. The method of composing vignettes was chosen since vignettes present realistic scenarios that elicit detailed descriptions about teachers' competences (Skilling & Stylianides, 2020). For six teachers the vignettes were based on data from both years, while for four teachers (Sarah, Lian, Esther, and Karel) the vignettes were based on 1 year.

Framework and analytical procedure

The five areas (introduction) steered the analysis (see table 3.2). A framework was iteratively constructed through the following steps:

1. Audio-recordings of the CTR meetings (approximately 78 clock hours of discussion) were transcribed verbatim. Text segments were then systematically extracted and the primary researcher made detailed notes to become familiar with the data.
2. The initial analytical framework, based on the five key areas, was further operationalised by specifying observable behaviours associated with each area (see Table 3.2)
3. Following the qualitative approach of Skilling and Stylianides (2020), the primary researcher constructed a vignette for each teacher based on the CTR transcripts, learning goals (laddering interviews), and reported progress by the teachers (PoL).
4. A matrix table was constructed in Excel to compare each teacher's growth across the five key areas; the resulting conclusions on professional development are presented in Figure 3.4.
5. An independent researcher audited the process by reviewing the raw data, the descriptive framework (Table 3.2) and one vignette (Akkerman et al., 2008). The auditor concluded that the analysis had been carried out carefully and with traceable procedures. Small changes were made to the vignettes to improve the readability.

Table 3.2

Framework with five key areas their description and operationalisation

	Key areas	Description	Operationalisation
1	Teacher readiness	Teacher's mindset to engage in a feedback dialogue by conveying confidence, promoting safety and aligning verbal and non-verbal cues for effective open communication and support.	Teacher engages in dialogue, shows forward leaning or upright posture, maintains student gaze, shows friendly expression, focuses on conversation with only notetaking, remains calm, does not show anxiety or restlessness
2	Monitoring student readiness	Teacher's assessment of the student's mindset for engaging in a feedback dialogue, including real-time judgments of their receptiveness and willingness to participate.	Teacher monitors students' verbal and non-verbal cues such as student makes eye contact. Teacher asks students if they are ready.

3	Feedback content	Information that the feedback conveys, can be product- or process-oriented and should prioritise consistency of content and alignment with previous feedback.	Teacher and students discuss both product and process-oriented feedback. Teacher encourages, uses open-ended questions, invites students to summarise feedback, to prioritise, to formulate next action steps and – if needed- to revise personal learning goals.
4	Interaction mode	Ways teacher and students communicate, including open collaborative communication. Teacher actively promotes all students to join.	Teacher uses active listening attitude, asks open-ended questions, and encourages all students to interact.
5	Use of verified observation	Feedback that is substantiated with verified observed student behaviour. Verified observation involves both noting the student's behaviour and discussing these observations with the student for accuracy.	Teacher discusses interpretation of observation with student. Teacher invites students to respond to teacher's observation and interpretation.

Based on the teachers' individual vignettes, professional growth throughout the CTR-program was assessed for each teacher by comparing their progress from the beginning to the end. Growth was categorized into three levels: no change (denoted with "-"), slight increase (single upward arrow "↑"), and substantial increase (double upward arrow "↑↑"). In the final column of figure 3.4, the primary researcher provided an overall assessment based on the degree of change. A teacher scores 'overall no change' when 'no change' was scored three times or more; a teacher scores 'overall slight increase' when 'no change' was scored three or less times and 'slight increase' was scored between two and four times; the teacher shows 'overall substantial increase' when 'slight change' was scored five times, or when any amount of 'slight increase' was scored plus 'substantial increase'.

3.4 Results

The individual vignettes that were composed are represented by the example vignette for Rick given below.

Rick's vignette

Learning goal*:* Rick's learning goal was to facilitate regular meetings with each student group within his class, during which they could discuss the status of the product, the working method chosen and the process of collaboration within the group.

Teacher readiness ↑: Rick described that he found discussions with one group in the R&D lessons particularly challenging. Initially, he stood at the front of the classroom (as shown in his video-fragment) to monitor the rest of the students (i.e. the other groups). By standing there, he created a physical distance from the targeted small group, reflecting limited teacher readiness for feedback dialogues. Near the end of the first year, Rick demonstrated increased teacher readiness by confidently sitting with one group of students and trusting the class to stay on task. Despite his reported stress, Rick maintained a calm and friendly demeanour and thoughtfully articulated his responses in feedback dialogues with his students throughout both CTR years.

Student readiness ↑: Rick became aware of the influence of student readiness, stating that providing feedback is ineffective if the student is preoccupied with other thoughts. However, in his video fragments, Rick did not engage in a dialogue with the students about their readiness.

Feedback content ↑: Video fragments at the start of the CTR-program showed feedback primarily focused on the product. In the second year, Rick began to address students' individual learning processes by discussing process-oriented feedback as well. Rick also started to encourage students to obtain feedback, summarise feedback and check for comprehension and relevance. Rick realized he could stimulate students' even further by asking them to think about their reasoning ("why") and how to apply it. In this way he helped students to formulate and prioritise future actions.

Interaction mode ↑↑: Rick initially struggled with time management and classroom dynamics, which limited his interactions with all student groups. By the end of the first year, Rick offered praise and encouraged students to engage in the conversation. In the second year, Rick grew further, initiating discussions, asking relevant open-ended questions, and allowing students time to respond.

Verified observations ↑: In the first year, Rick did not use any observations. In the second year, he incorporated observations of classroom behaviour and connected feedback with previously discussed feedback. Although Rick' mentioned his observations during the feedback dialogues, he did not validate them with the students.

Analysis of observed professional growth

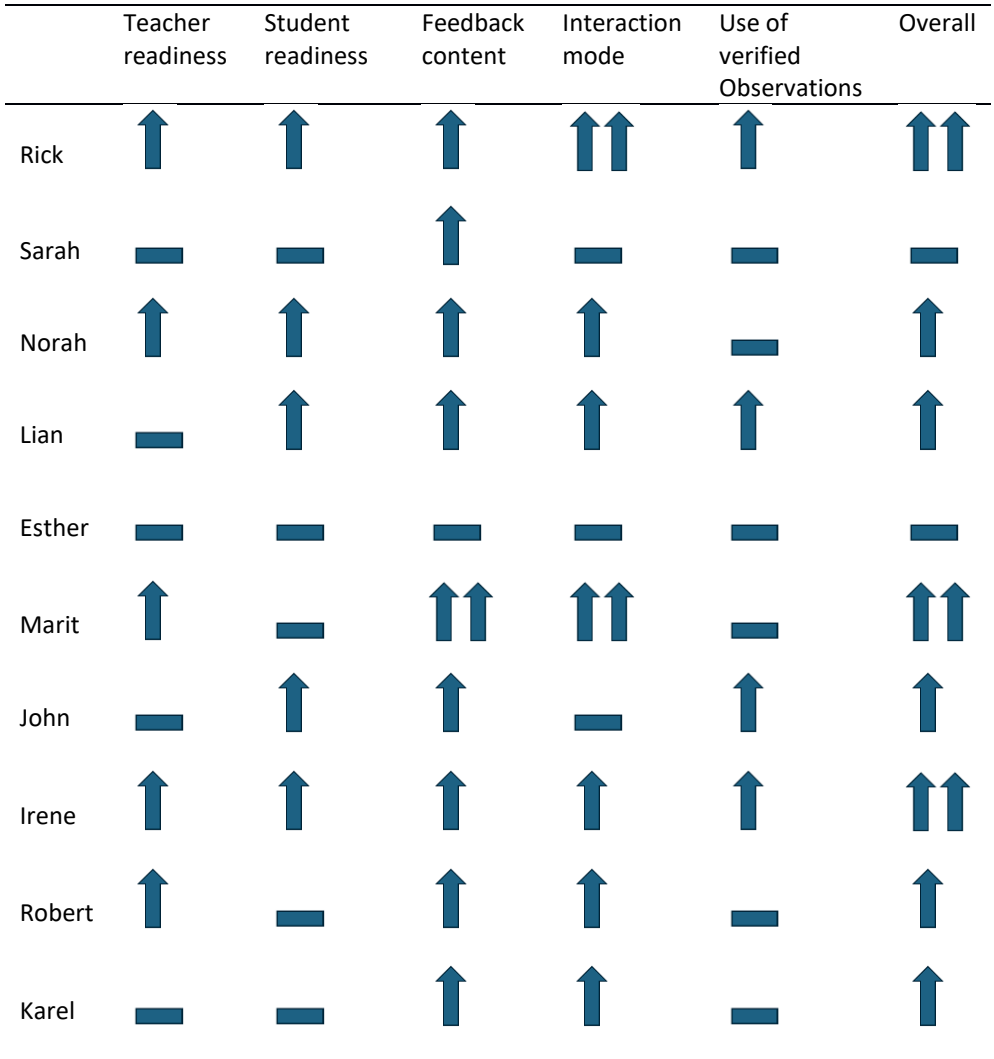
This section describes the professional growth of all 10 teachers based on their individual vignettes. Figure 3.4 provides an overview for all participants within the final column the overall assessment of the teachers' growth in conducting feedback dialogues. Quotes in these sections are from the CTR program and PoL transcripts and translated from Dutch.

Teachers' readiness: Five teachers demonstrated professional growth in teacher readiness, with two teachers focusing primarily on fostering a friendly and safe environment, and three teachers on reducing their restlessness. Four teachers exhibited an open and approachable demeanour at the beginning of the CTR-program, adopting a focused and receptive posture during feedback dialogues. Norah, Sarah, John and Irene showed genuine curiosity about the students' perspectives and fostered a safe environment for these dialogues. During the program, Norah and Irene became more aware of their demeanour and mentioned their state of mind in their dialogues with the students. For example, Norah said; "I'm very tired today, so my story may be a bit rambling". There was no change visible with Sarah and John.

Marit, Robert, Rick, Esther, Lian, and Karel showed signs of restlessness in their video fragments, potentially indicative of time constraints or multitasking demands, suggesting limited teacher readiness. At the end of the CTR-program, Marit showed a better planning of her conversations thus overcoming her sense of restlessness. Robert showed restlessness by displaying inconsistencies between his verbal and non-verbal communication, which initially resulted in unclear signals for his students. Increased self-awareness allowed him to explicitly articulate his thoughts, resulting in improved alignment between his verbal and non-verbal cues. Rick showed restlessness by undertaking multiple tasks at the start of the CTR-program. He maintained standing afront during group discussions so he could keep an eye on the rest of the class. By the second year, Rick engaged more securely with students, displaying a calm, friendly demeanour and thoughtful communication, reflecting his growth. There was no visible change with Lian and Karel.

Figure 3.4

Teachers' professional growth across key areas and overall assessment



Monitoring student readiness: At the outset of the CTR-program, seven teachers exhibited limited awareness of students' readiness levels; at the program's end, five of those seven teachers demonstrated professional growth. Karel was unfamiliar with the concept of “student readiness” and had yet to develop an understanding. Marit made unchecked, often negative, assumptions about student readiness: “I believe that students don’t like to have conversations with me”. They did not show change at the end of the program. Rick showed increased understanding of student readiness compared with the start of the CTR-program but was still struggling with implementing it in his dialogues with his students at the end of the program. Rick stated: "It is crucial to include student readiness in the conversation, as it is useless to give feedback if the student is preoccupied with other thoughts".
Robert, Irene and Sarah made assumptions about student readiness without checking with the students. Although all three teachers recognised the importance of readiness for learning, only Irene adapted her approach accordingly and checked her assumptions with her students. For example, Irene said: “You’re not quite following me, is that correct?”. Norah, Lian, and John demonstrated awareness of student readiness at both the start and end of the CTR-program. They occasionally asked students about their readiness before discussing feedback.

Feedback content**:** Nine teachers showed progress on feedback content. At the start of the CTR-program, six teachers provided feedback information on both product and process, although the extent of this varied. To illustrate, Karel, Rick, Irene and Marit initially concentrated on the product. However, as the program proceeded, their feedback increasingly encompassed both aspects. Sarah's students frequently shifted the focus of their discussions from the process to the product, which Sarah managed by organizing the subject of the conversations. “We meet weekly with all teams, alternating focus between the product and the process”. Norah exhibited a balanced approach from the beginning, demonstrating the ability to transition seamlessly between product- and process-oriented feedback. Norah and Sarah checked students' understanding by seeing if they recognized themselves in the feedback from peers and teachers. At the end of the second year, Norah was the only teacher to inquire about students' emotions during feedback dialogues. She encouraged self-reflection through questions such as: "How did this situation affect you emotionally?" and “What steps could you take to ensure better self-care in the future?”

Interaction mode**:** Seven teachers demonstrated growth in interaction mode. Prior to the CTR-program, Rick, Irene and Marit did not have feedback dialogues with their students, but at the end of the first year, they all had such dialogues with all of their groups. Rick, Karel, Lian, Irene, and Marit initially struggled with student-centred approach, often drawing conclusions for their students. In the second year they shifted from instruction to

facilitation, helping students draw their own, more comprehension-oriented and action-oriented, conclusions from feedback. In contrast, Robert and John did not ask students to summarize feedback, assuming they could independently derive insights. In the second year, Robert encouraged students to form their own opinions based on the feedback discussed. Another example was experienced by Marit. Initially, her dialogues were short and teacher-centred, and over time, she adopted a more student-centred approach. As Marit explained, "Last year I really flooded the students with all kinds of tips. This year I took a more student-centred approach and let the students express themselves as much as possible". At the start of the CTR-program, John (and Irene at the start of the second year) engaged in lengthy discussions, fostering a safe learning environment that encouraged students to give detailed responses. During the CTR-program, and especially looking back at the video fragments, John and Irene recognised the need to shorten dialogues to engage all student groups during R&D lessons. Initially, Robert and Lian's feedback dialogues were frequently disrupted by concurrent tasks and classroom management. In the second year, they shifted to quieter settings and improved their feedback interactions. Lian formulated it as followed: “I felt the urge to speak but held back, and it was great to see that it worked”.

Robert and John also struggled with asking open-ended questions to sustain feedback dialogues. In the second year, Robert practiced asking follow-up questions, while John admitted forgetting his intention to ask follow-up questions during R&D lessons. Sarah and Norah successfully conducted feedback dialogues with all groups at the start of the program, and. Norah demonstrated professional growth in balancing group and individual-level feedback dialogues.

***Use of verified observations*:** Four teachers demonstrated growth in using observations to substantiate their feedback. At the start of the CTR-program Rick, Marit, Irene, John, Robert, and Karel did not use observations. In the second year, Rick and John began referring to observations from previous teaching moments, though they did not verify them with students. Similarly, Irene referred to greater awareness of observations; “Since the CTR-program, my classroom observations have become more focused. I really like this new way of working.”

At the start of the CTR-program, Sarah, Norah and Lian already used observations as means of substantiating feedback or used them to act upon in the classroom setting. To illustrate, Norah observed a student who was silent and recognized his need for additional time to respond, subsequently allowing the student to engage at his own pace.

Lian was the sole teacher who sought to validate her observations of students' behaviour by consulting with them to verify the accuracy of her interpretations.

3.5 Conclusion and discussion

This study aimed to enhance teachers' professional growth in conducting feedback dialogues during the two-year CTR program. The findings provide insights into teachers' development across the five key areas. Moreover, the findings offer implications for these kinds of professional development programs. Finally, an adapted feedback dialogue model is proposed as a practical tool for conducting feedback dialogues.

Professional growth in five key areas

By the end of the two-year CTR program, eight out of ten teachers showed professional growth in at least two of the five key feedback areas: teacher readiness, monitoring student readiness, feedback content, interaction mode, and the use of observations to substantiate feedback. Two teachers showed no noticeable development. The extent and nature of teachers' growth across the five areas exhibited variability.

Five teachers demonstrated professional growth in ***teacher readiness***. Three overcame their restlessness, becoming more confident in engaging with student groups. Two teachers developed greater awareness of their own demeanour and shared their mindset with their students. Hattie and Yates (2014) and Moon (2013) highlighted the critical role of a safe learning environment in promoting comfort and facilitating open communication. Notably, during the CTR-program, five teachers reported increased confidence and a sense of safety, enabling them to more comfortably engage as facilitators in feedback dialogues.

At the start of the CTR-program, seven teachers showed limited awareness of ***student readiness***. In Year Two, all teachers highlighted its importance, and five also reported behavioural changes: two monitored student emotions, and three checked students' readiness before engaging in feedback dialogues. During the CTR-program, teachers appeared to give more attention to student readiness, the affective aspects of feedback alongside the cognitive components, thereby expanding their feedback competencies (Adarkwah, 2021; Garino, 2020).

As far as ***feedback content*** is concerned, all nine teachers improved in balancing process and product feedback information. Less experienced teachers gradually started to incorporate process-oriented feedback in their feedback dialogues, while experienced teachers achieved better balance between product-oriented and process-oriented feedback. Improvements were also found in encouraging students to draw own conclusions, monitoring how students perceived the feedback content and assessing whether students recognized the feedback. One teacher engaged students in discussing their emotions elicited by a certain event and discussed their options to use this experience in the future. Addressing emotions within feedback dialogues enhances feedback interaction and promotes deeper reflection, enabling students to acknowledge the emotional impact of feedback and engage with it more constructively (Garino, 2020; Korthagen & Vasalos, 2005). Teachers emphasized the active role of students in the

learning process by addressing both feedback content and it's processing (Tielemans et al., 2023). This dual focus was evident not only in the videos of student–teacher dialogues but also in teacher-teacher discussions during the CTR-program.

Seven teachers demonstrated improvement in their ***interaction mode***. Three teachers adopted a student-centred approach, two teachers adjusted the length of the feedback dialogues to speak with all groups, one displayed better balance between group and individual feedback, and one teacher progressed in asking follow-up questions. The seven teachers assumed a different role, focusing on how feedback was discussed and ensuring that it was constructive, substantive, specific, and timely. This shift marked progress from merely delivering feedback to adopting a facilitative role, aligned with the dialogue model proposed by van der Kleij et al. (2019).

The last key area is the ***use of verified observations*** to substantiate feedback. Initially, six teachers did not use observations in their feedback dialogues, and four discussed student behaviour without verifying it with their students. At the end of the program, three teachers who initially did not incorporate observations began using them in feedback, and one teacher progressed from using observations to validating them. By verifying observations, the feedback becomes more precise and relevant for the students, enabling students to compare external and internal perspectives (Boodt, 2014; Voerman et al., 2015). An external view helps students to identify potential gaps between learning goals and their learning process and learning outcomes, enhancing their engagement (Moon, 2013).

In the current study, teachers' interpretations and understandings of feedback changed, as indicated in their CTR discussions. These understandings influenced them in their feedback dialogues with their students and how they interpreted their students' reactions, enabling them to refine their facilitation of the feedback dialogues and their responses to students' emotions (van Der Kleij & Adie, 2020).

By the end of the CTR-program, nine teachers conducted feedback dialogues in their classes, including three for whom this was a novel practice. For feedback dialogues to be effectively integrated into practice, they must extend beyond delivering feedback. Teachers with previous experience in facilitating feedback dialogues showed at the end of the CTR-program nuanced improvements, such as differentiation between group and individual conversations, while the less-experienced teachers conducted weekly discussions with all their groups.

Transforming feedback into a collaborative process not only engaged students as active participants in their learning (Carless & Winstone, 2020) but also seems to foster stronger teacher–student relationships. As Irene noted during her second PoL presentation; "The feedback dialogues facilitated a deeper connection and trust between me and the students. I really like this deeper connection.

Implications for PD programs

The findings highlight the CTR-program's potential for enhancing feedback-dialogue practices while underscoring the importance of variability in their implementation and the need for tailored professional development support. Teacher readiness appeared to be a critical and rather new key area regarding enabling teachers to participate actively in feedback dialogues. Within the CTR program, teachers dedicated the first year to understanding and discussing feedback theory and its pedagogical implications for their own practices. By the end of the CTR program, teachers demonstrated increased readiness to implement feedback dialogues. This development reflects the complexity of managing multiple interrelated aspects, such as fostering a safe learning environment, scheduling opportunities for dialogue, and evaluating their own emotional and cognitive readiness to engage. Teachers also became more attuned to the emotional impact of feedback and, in some cases, explicitly addressed the emotions it elicited. This aligns with existing literature, which underscores the importance of teachers being responsive to students' expectations and emotional reactions during feedback discussions (Ryan & Henderson, 2018), while also modelling effective emotion regulation themselves (Ajjawi et al., 2022; Evans, 2015).

To support teachers, PD programs should not only address *what* teachers need to do, but also *how* they can organize and integrate the five key areas in practice. Specifically, PD programs should explicitly guide teachers in evaluating both their own and their students' readiness, identifying appropriate feedback content, structuring feedback dialogues within their educational context, and using validated observations to substantiate feedback. Teacher readiness was a new concept for the participants in this study, who were more accustomed to focusing on their students than on their own preparedness for receptiveness, attentiveness, and openness to feedback (Adarkwah, 2021; Garino, 2020).

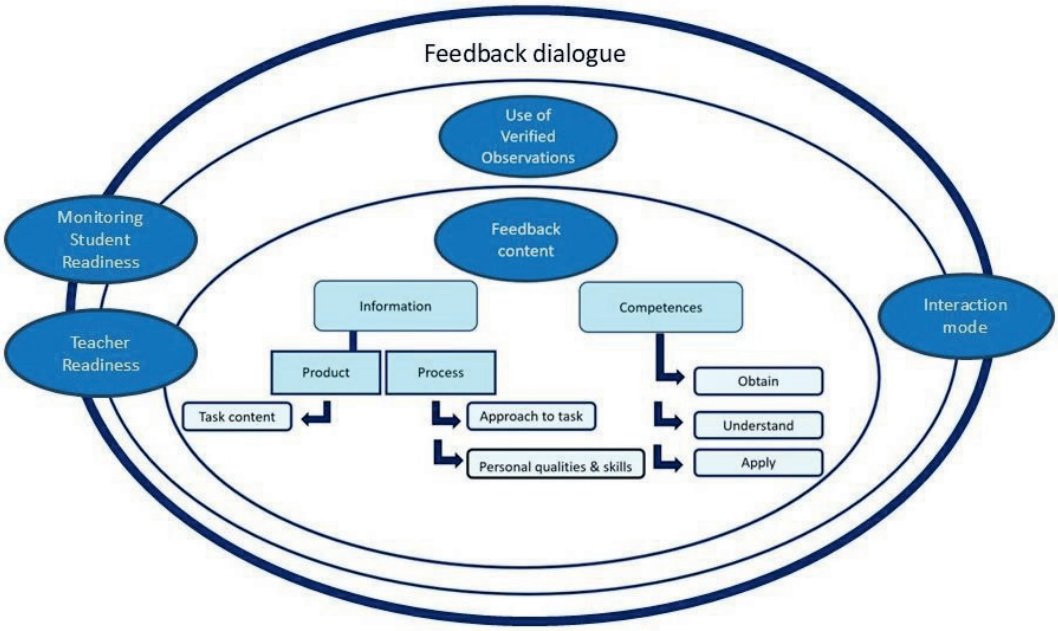
Adapted model of feedback dialogues

This study synthesised three theoretical models leading to the identification of five key areas essential for effective feedback dialogues. While the initial framework (Figure 3.2) conceptualized feedback information and processes as intertwined, the empirical findings informed an adapted model (Figure 3.5) that defines the position of each of the five key areas. The core element in the adapted model is feedback content, which includes both process- and product-oriented feedback information and feedback competences. As the study progressed, it became evident that the term "*feedback processes*" lacked clarity due to its broad scope, encompassing diverse elements such as teacher readiness, monitoring student readiness, feedback interaction mode, and using verified observations. Therefore, in the adapted model, the term "feedback processes" has been replaced with "feedback competences" meaning that teachers learn students how to actively engage in obtaining, understanding, and applying feedback. The second ellipse represents observations, which are considered essential for facilitating the transition from a communicative to a dialogic

feedback model (Van der Kleij et al., 2019). Verified observations are a valid instrument with which teachers can provide process-oriented feedback, thereby enhancing the credibility and acceptance of that feedback by students (Boodt, 2014; Voerman et al., 2015). Furthermore, observations play a significant role in monitoring the quality of interaction and assessing the readiness of both teacher and student—both prior to and during the feedback dialogue. The third ellipse represents the feedback dialogue, encompassing all five key areas. Although the five key areas were described separately in the framework (see Materials and Method section), our data analysis revealed their inherent interconnectedness within the dynamics of feedback dialogue practices. This interconnection is visually represented by the overlapping ellipses in Figure 3.5.

Figure 3.5

Adapted Model of Five *Key Areas in Feedback-Dialogue Practice.*



Limitations

This study used vignettes to describe the teachers' individual professional growth. Vignettes are inherently context-specific and person-specific. Creating vignettes is a resource-intensive process and may be influenced by the researchers' own experiences with feedback dialogues, introducing the possibility of bias in how individual experiences are portrayed.

Another limitation is potential researcher bias due to the researcher's roles as both the coach during the CTR-program and the primary researcher while studying its outcomes. These dual responsibilities may have influenced data collection, analysis, and interpretation, potentially introducing bias into the study. As a preventive measure, the vignettes were shown to participants for member checking. Furthermore, the audit procedure involving an external researcher, along with discussions within the research team, helped to further reduce potential bias.

Follow-up Research and Implications for Theory and Education

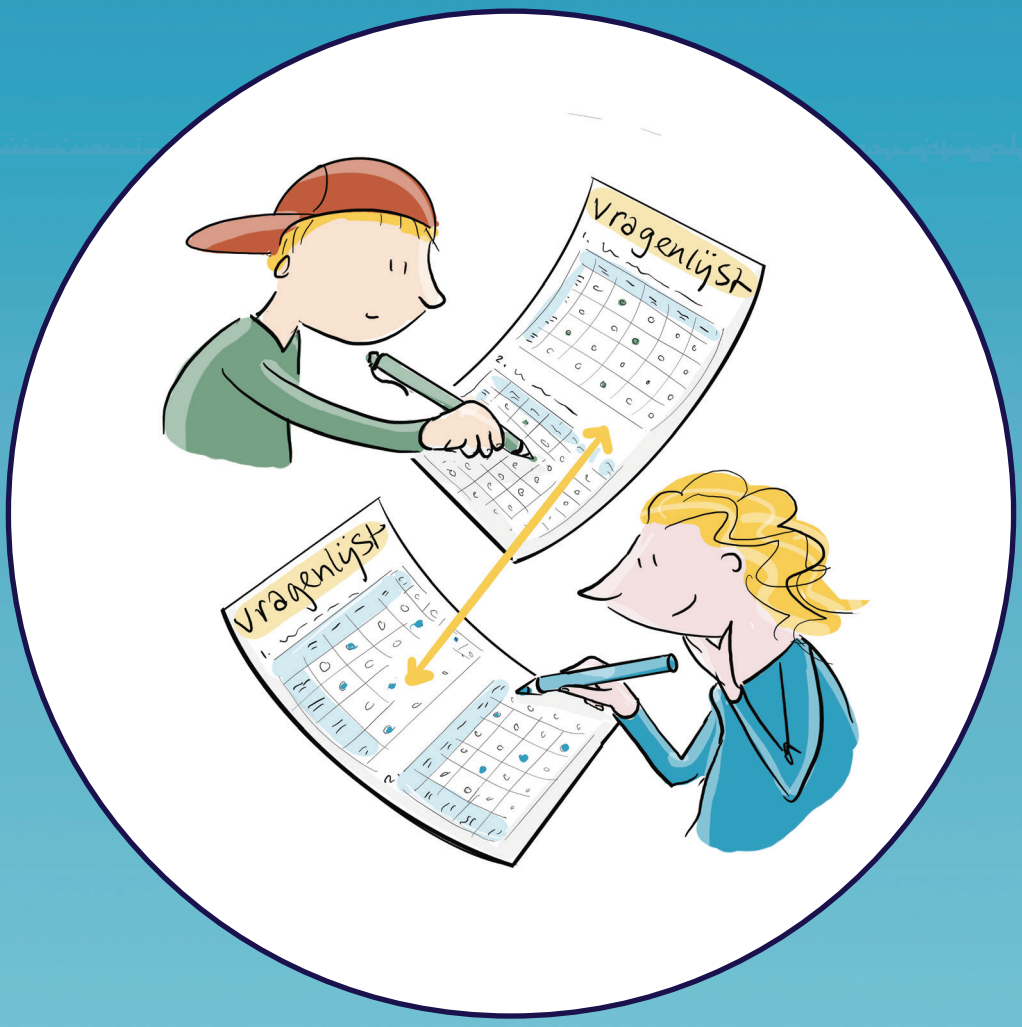
During the CTR program, teachers successfully executed the necessary steps to implement feedback dialogues, demonstrating the program's potential for fostering such practices in educational settings. To better understand its impact, future research could investigate how specific components of the two-year program contribute to outcomes such as teachers' social-emotional learning and the role of positive teacher–student relationships in promoting feedback readiness (Lapidot-Lefler & Israel, 2024). Further insight into the transfer of CTR outcomes to classroom practice may be gained by examining students' perceptions of teacher development or by observing changes in students' roles within feedback dialogues. In line with Gonzalez (2024), who emphasizes the importance of sustained support after professional development, future studies should also explore which forms of follow-up, such as coaching, peer collaboration, or additional training, are most effective in maintaining and advancing feedback practices over time.

Feedback dialogues in R&D educational practice were compiled into one adapted feedback model (Figure 3.5) and proposed as a practical tool for conducting effective feedback dialogues. Follow-up research is required to validate the model's applicability across diverse contexts, including diverse educational settings, disciplines, and teacher experience levels. Such studies are essential for further refining and strengthening the model to ensure its relevance, effectiveness, and broader generalizability.

Teacher readiness emerged as a critical factor in facilitating effective feedback dialogues. Further research is needed to examine how both teacher and student readiness influence teacher practices and long-term student learning outcomes, with particular attention to sustainability and integration into everyday classroom routines.

Notwithstanding the proposed future studies, the results at hand are promising. The findings indicate the power of the CTR-program in delivering targeted support across five key areas, enabling teachers to successfully integrate feedback dialogues into their

educational practices. This study contributes to the field of feedback research by offering implications for these kinds of professional development programs. Finally, an adapted feedback dialogue model, grounded in both theory and empirical evidence, is proposed as a practical tool for conducting feedback dialogues. As such, it provides a concrete foundation for ongoing refinement of feedback dialogues in secondary education.


Vragenlijst
Vragenlijst

Chapter 4

Discrepancies in Feedback Perceptions of STEM Teachers and their Students: Giving or Discussing Feedback

Abstract

Teachers' transitions from providing one-sided feedback to discussing feedback is key for fostering student engagement, reflection and learning. This study investigates perceptions of feedback practices among STEM secondary school teachers and their students before and after a two-year professional development (PD) program designed to promote feedback dialogues. The program aimed to shift classroom feedback from traditional teacher-led to interactive dialogues that support personal growth. Drawing on questionnaire data from both teachers and students, the study examined changes in perceived feedback behaviours across two scales: '*About the Student'* (teacher-led) and '*With the Student'* (dialogic). Results indicate student-reported increases in teacher-led feedback across both years. In the second year, a significant growth on the *'With the student*' scale: was found, mirroring that feedback dialogues were emerging. At the end of the program, teacher self-reports showed mixed perceptions of feedback behaviours, often underestimating their occurrences rated by their students. This discrepancy reflects the complexity of self-assessments. Findings also suggest that teachers' growth is related to students taking more active roles in feedback processes. The study underscores the value of student perceptions as complementary indicators of teacher behaviour and highlights the importance of sustained, practice-based PD for embedding dialogic feedback in everyday teaching.

This chapter is published as a conference contribution:
Görtzen, J. J. H., Schellings, G. L. M., & Nieveen, N. M. (2026). *Discrepancies in Feedback Perceptions of STEM Teachers and their Students: Giving or Discussing Feedback*. [Paper presentation]. NARST Annual International Conference, Seattle, WA, USA.

4.1 Introduction

This study explores perceptions of STEM secondary school teachers and their students about feedback behaviours while teachers participated in a professional development (PD) program, called "Collaborative Teacher Reflection" (CTR). This CTR program was designed to shift feedback practices from a traditional, transmission-based model to a dialogic approach (van der Kleij et al., 2019). Feedback dialogues enable students to become active participants in the feedback process and promote their engagement in their own learning (Winstone et al., 2022). These dialogues foster students' critical thinking, self-awareness and deeper learning (Hattie & Yates, 2014). Developing feedback competences to transform "feedback delivery" into a collaborative process, requires time, effort, and ongoing professional development for teachers to guide their students to become active participants in the dialogue (Borko et al., 2010; van der Kleij et al., 2019).

4.2 Theoretical framework

Traditionally, feedback in classrooms has been predominantly one-sided, with limited student involvement (van der Kleij et al., 2019). However, recent theoretical studies (e.g. Ajjawi & Boud, 2017) emphasize the value of collaborative feedback dialogues, in which the meaning of feedback is co-constructed through interaction. In contemporary education, feedback dialogues are closely tied to new pedagogical approaches that actively engage students in their own learning processes. Student-centred approaches such as project-based, problem-based, and challenge-based learning are gaining ground in secondary and higher STEM education (Doulougeri et al., 2024). These approaches require students to take initiative, collaborate, and respond flexibly to changing demands. Such learning activities are supported by structured feedback dialogues and reflective practice (Moon, 2013). Examining both student and teacher's perceptions of feedback behaviours can enhance teachers' ability to shape effective feedback dialogues. Student perceptions can provide valuable insights into classroom interactions and teacher practices. Compared to teacher self-reports or classroom observations, student perceptions are more efficient to collect, offer a broader view of classroom dynamics, and represent a composite perspective that reduces individual bias (den Brok et al., 2004). Moreover, students' varied classroom experiences enable them to present a more nuanced understanding of teaching practices (Karamane et al., 2023). Such insights help teachers identify discrepancies between their instructional intentions and students' experiences, ultimately improving teacher regulation of feedback dialogues.

To examine changes in teachers' classroom feedback behaviours after the CTR-program, this study is guided by the following research questions:
RQ1. Do students rate their teachers' feedback behaviour different pre and post teachers' participation in the CTR program?
RQ2. Do teachers rate their classroom behaviour differently as pre and post teachers' participation in the CTR program?
RQ3. How do student and teacher perceptions of feedback dialogues correspond?

4.3 Research design

Context

The study context of the Research & Design (R&D) curriculum, as implemented in Dutch Technasium schools, offers a relevant STEM-context to explore feedback behaviours that relate to dialogues. In the R&D curriculum, secondary school students work on authentic design challenges commissioned by external organizations. Over the course of a 10-week project cycle, students collaborate in teams, present their outcomes to stakeholders, and reflect on both their individual learning and their team's progress. These reflections steer feedback conversations between students and teachers. R&D teachers are considered well-suited for feedback studies, given their prior experience with these feedback conversations and their presumed knowledge, skills, and motivation to facilitate them.

Participants

Ten R&D teachers from nine Technasium schools responded to an open invitation in a national newsletter from the Dutch Technasium Foundation to join a two-year PD program. In the second year, eight teachers continued with the program. Without restrictions they selected a class per school year in which to practice feedback dialogues. See table 4.1 for participants' details. Before and after the program, teachers and their students completed a questionnaire about feedback. Ethical clearance was obtained prior to implementing the 2-year CTR-program.

Aim CTR-program

The CTR-program aimed to enhance feedback dialogues by deepening teachers' conceptual understanding through engagement with theory, and by supporting the practical application of this knowledge using classroom video recordings, collaborative reflection, and peer feedback.

Data Collection

Pre-program questionnaires were administered each September and post-program questionnaires in April. The teacher questionnaire included two parts: open-ended questions on teachers' background, and 30 items distilled from different feedback theories to apply a broad operationalization of feedback dialogues. Three perspectives on

feedback were covered: feedback information, feedback processes and external view (Boud & Dawson, 2021; Moon, 2013; Tielemans et al., 2023; Winstone et al., 2017). See chapter 3. The student version mirrored the 30 items. Teachers rated their own behaviour (e.g., “I ask which aspects the student wants feedback on”), while students rated the same behaviour from their teacher (e.g., “My teacher asks which aspects I want feedback on”). Responses were given on a 5-point Likert scale (1 = almost never to 5 = almost always), with 6 indicating no answer.

Table 4.1 *Participant information.*

	CTR Year 1 (Students)		CTR Year 2 (Students)	
Name*	Number	Age (years)	Number	Age (years)
Rick	24	12-13	12	15-16
Sarah	21	16-17	31	16-17
Norah	10	16-18	8	15-16
Lian**	12	15-16	-	-
Esther**	-	-	23	16-18
Marit	21	14-15	19	15-17
John	24	16-18	13	15-17
Irene	13	16-18	17	15-16
Robert	10	15-16	25	13-14
Karel	20	15-17	-	-

* Names are pseudonyms, ** worked at same school

Data Collection

Pre-program questionnaires were administered each September and post-program questionnaires in April. The teacher questionnaire included two parts: open-ended questions on teachers’ background, and 30 items distilled from different feedback theories to apply a broad operationalization of feedback dialogues. Three perspectives on feedback were covered: feedback information, feedback processes and external view (Boud & Dawson, 2021; Moon, 2013; Tielemans et al., 2023; Winstone et al., 2017). See chapter 3. The student version mirrored the 30 items. Teachers rated their own behaviour (e.g., “I ask which aspects the student wants feedback on”), while students rated the same behaviour from their teacher (e.g., “My teacher asks which aspects I want feedback on”). Responses were given on a 5-point Likert scale (1 = almost never to 5 = almost always), with 6 indicating no answer.

Data Analysis

A principal component analysis (PCA), Oblimin rotation method with Kaiser Normalization (SPSS 28), was conducted on the student questionnaire data (n = 155) collected in April of the first CTR year. See Table 4.2. Responses marked '6 – no answer' were treated as missing. Pairwise deletion was then used, so only missing items were excluded, resulting in different sample sizes across items.

Although the questionnaire was initially designed to capture three dimensions, the PCA indicated a two-factor solution. In an iterative process, 14 items were excluded because they either showed substantial cross-loadings or failed to load sufficiently on either factor (<, 500). These items seem to address more general aspects of feedback and did not clearly relate to one of the two emerging factors, and were therefore not retained in the final scales. For instance, item 2 ('My teacher gives feedback on my development') was considered too broad formulated to align meaningfully with either scale. Although item 13 showed a cross-loading on both factors ; we decided to retain this item for conceptual reasons; given its forward-looking, process-oriented content, this item was considered to be aligned with feedback dialogues (the teacher providing concrete examples to support the student's development). In all, the analyses resulted in a final set of 16 items across two scales, see appendix 1.

The analysis identified two scales: '*About the Student'* and '*With the Student'*. The '*About the Student'* scale consisted of 10 items (α = 0.89). These statements focused on how the teacher primarily takes the lead, using verbs such as tell, refer, check, and assess. This corresponds more with a traditional feedback model, that is the teacher-led feedback (van der Kleij et al., 2019). The '*With the Student'* scale consisted of 6 items (α = 0.87) with statements emphasizing greater student involvement, using verbs such as react, talk, use, and substantiate. This scale can be understood as representing a scale about feedback dialogue (van der Kleij et al., 2019). Scale reliability for students' questionnaires remained high across all four measurement points (see Table 4.3).

To examine changes over time (see Table 4.4), two-sided paired t-tests were conducted for both scales and for each year using data from all students' questionnaires (all classes). The data were further analysed to look closer at the impact of individual teachers. Student means from the pre- and post-tests were compared with their teacher's means to assess potential changes in teachers' feedback behaviours. Per teacher and class, the degree of change was calculated as a percentage (see Table 4.4).

Table 4.2

Factor analyses.

	Component	
	1	2
Item 15	,921	
Item 17	,789	
Item 14	,760	
Item 12	,705	
Item 4	,631	
Item 11	,631	
Item 9	,626	
Item 6	,593	
Item 8	,588	
Item 7	,573	
Item 25		,893
Item 30		,884
Item 26		,756
Item 10		,583
Item 16		,572
Item 13	,381	,403

= loadings lower than .5 are omitted,

except item 13 for conceptual reasons.

Table 4.3

Cronbach's alpha per scale of the student questionnaire (all measurement points).

		Cronbach's alpha			
		Year One		Year Two	
Scale	Items	Pre n = 165	Post n = 155	Pre n = 147	Post n = 138
About the Student	10	.86	.89	.85	.88
With the Student	6	.79	.87	.77	.81

4.4 Findings

Addressing RQ1, the students rated a significant increase at the *'About the student'* scale during both years of the CTR program (see Table 4.3). In Year 1, this increase was statistically significant, $t(100) = -2.42$, $p = .017$. A significant increase emerged in Year 2, $t(100) = -2.35$, $p = .021$, as well. No significant change was rated at the *'With the student'* scale in Year 1, $t(100) = -0.63$, $p = .530$. However, a significant increase was reported in Year 2, $t(100) = -2.42$, $p = .017$. These findings suggest that, after participating in the two-year CTR program, students perceived their teachers providing both types of feedback.

Table 4.4

Means for all four measurements of the student questionnaire and paired t-test.

Year 1	T0 Mean (SD)	T1 Mean (SD)	Paired t-test
About the student	3.28 (.68)	3.46 (.79)	t(100) = -2.42, p = .017
With the student	3.96 (.72)	3.96 (.81)	t(100) = -0.63, p = .530
Year 2	T2	T3	
About the student	3.01 (.80)	3.24 (.79)	t(100) = -2.35, p = .021
With the student	3.66 (.78)	3.87 (.75)	t(100) =-2.42, p = .017

In this study, we were particularly interested in whether teachers shifted towards dialogic feedback behaviours. Therefore, in the analysis phase, we focused on the *'with the student'* scale at the class level. The student responses on this scale showed notable differences, indicating variation in how dialogic feedback was experienced across classrooms. In the classes of Sarah, Norah, John, and Robert, the students' ratings were increased, with John's class showing the most notable gain. Slight declines were observed in Esther's and Marit's classes, and no change in Irene's. Overall, these results suggest that while students in several classes perceived a shift toward 'W*ith the students'* interactions, this pattern was not consistent across all classrooms.

In response to RQ2 addressing the perceptions of the teachers, teacher ratings at the '*With the Student'* scale varied considerably between the first and second measurement in the second year (see Table 4.4). Rick, Norah and Marit rated a positive shift toward more dialogic feedback behaviours, suggesting increased student involvement. In contrast, Esther reported a minimal change; Irene provided no post-program data, and Sarah, John, and Robert reported slight declines.

Also, for RQ3, the analysis focused on the scale representing dialogic feedback. Here, teacher and student ratings were compared for the '*With the Student'* scale from the second program year, revealing both corresponding and diverging ratings. For Norah, both she (6%) and her students (10%) rated the statements higher, suggesting a shared perception of more student involvement and emerging feedback dialogues. In contrast,

notable discrepancies emerged among the remaining participants (see Table 4.4). While Robert, Sarah, and John rated slight declines in their own dialogic feedback behaviours, their students perceived increases, with the most pronounced difference observed in John's class (20%). For Esther, both teacher and student ratings indicated little changes, respectively 3% and – 2%, suggesting no increase in dialogic feedback.

Table 4.5

Mean on scale 2 ('With the Student') in year 2

	Teacher			Student			
Question	I do			Teacher does			
Name	Pre-test	Post-test	Change*	N	Pre-test	Post-test	Change
Rick	3.83	4.50	13%	12	3.83	3.52	-6%
Sarah	3.67	3.33	-7%	31	3.79	4.13	7%
Norah	4.33	4.67	6%	8	3.83	4.33	10%
Esther	3.17	3.33	3%	23	3.83	3.73	-2%
Marit	3.83	4.17	7%	19	4.19	4.06	-3%
John	3.83	3.50	-7%	13	3.33	4.33	20%
Irene	3.67	No data		17	3,52	3,74	4%
Robert	4.50	4.00	-10%	25	3.17	3.77	12%

4.5 Discussion, implications and conclusions

This study examined changes in perceived feedback behaviours before and after participation in the CTR program, as reported by students (RQ1), their teachers (RQ2), and correspondence in ratings (RQ3). Looking at the full student data set, a significant increase in teacher-led feedback behaviours was found across both program years. In contrast, a significant increase in dialogic feedback behaviour was only observed in the second year. These findings suggest a gradual shift from teacher-led toward more student-centred feedback behaviours over time. At the class level, student data were mixed: four of eight classes reported increases in dialogic feedback, while others showed declines or no change. Teacher-reported perceptions of change on '*With the student'* scale varied similarly widely. While three teachers rate more dialogic feedback behaviour after the program, the others reported no change or a slight decline. Notably, in some cases, such as John's class, students perceived substantial increase at the scale despite the teacher reporting a decline. Such discrepancies reflect the complex and sometimes divergent nature of perceived behavioural change within classroom settings. Airasian and Gullickson (1994) reasoned that a discrepancy in perceptions between teachers and their students indicates that teachers were too self-critical. Teachers' self-assessments are often guided by tacit, intuitive, and variable standards or criteria that lack consistency (Airasian & Gullickson, 1994). Additionally, for self-assessment to meaningfully support professional

development, it must promote an objective awareness of practice, for instance by providing teachers with student ratings, which is essential for reflection and informed decision-making (Moon, 2013). Within this study, student questionnaire responses provided teachers with an external perspective, offering a valuable second opinion on their feedback practices, and enabling comparison between their self-perceptions and students' experiences (Boodt, 2014; Moon, 2013).

A second possible explanation for the discrepancy between student and teacher perceptions also relates to the gap between teachers' intentions and their enacted behaviour (Ajzen, 2011; Sheeran & Webb, 2016). This intention–behaviour gap may be particularly relevant for teachers starting the school year with high aspirations and self-critical mindsets. When these ambitious goals are not fully realized, they may perceive their performance as falling short, resulting in lower self-assessment scores over time, even as students recognize growth. Translating intended actions into consistent classroom routines is inherently complex and can be hindered by contextual constraints, limited self-efficacy, or insufficient institutional support (Sheeran & Webb, 2016). Bridging this gap remains a key area for further research, particularly in the context of feedback dialogues.

A further consideration concerns the accuracy of self-reported data from both teachers and students, which may not always concur with observed classroom behaviour. As van Beek (2024) notes, teachers often tend to overestimate the quality and scope of their feedback behaviour. Likewise, student perceptions may be subject to bias, influenced by factors such as their academic performance, level of interest in the subject, or their relationship with the teacher (van der Kleij & Adie, 2020). To address these limitations, future research could adopt a multi-method approach, combining self-reports in a questionnaire with classroom observations and student interviews, to obtain a more comprehensive and objective understanding of feedback practices and their impact.

Students consistently recognized two scales of feedback: '*About the Student'*, led by the teacher, and *'With the student'*, reflecting a more dialogic, participatory approach. This finding mirrors the shift described by van der Kleij et al. (2019). While teacher-led feedback increased steadily across both years, students rated an increase in feedback dialogues only in the second year. Variability in students' perceptions of teachers' behaviour may reflect the evolving and complex nature of these interactions (Carless & Winstone, 2020). Moreover, feedback dialogues are not only new for teachers but also for students, who are now expected to take a more active role. This shift raises important questions: Are students ready for this level of engagement? Do they want to participate this way? These factors may further shape how dialogic feedback practices are received and perceived in the classroom.

In sum, these findings highlight the need for professional development programs like the CTR program that not only build conceptual understanding of feedback dialogues but also support teachers in meaningfully applying and internalizing these practices through structured, collaborative engagement.



Chapter 5

Enhancing student reflection through writing tasks and guided teacher support

Abstract

Deep reflection supports the development of critical thinking, yet students often need guidance to move beyond descriptive accounts of their experiences. Guiding students' reflection is challenging for teachers, as reflection is largely an inner process and students often struggle to articulate their thoughts. To enable teachers' support, students' internal reflections need to be made explicit. This study examined the effects of a Collaborative Teacher Reflection (CTR) program on teachers' guidance practices and the depth of students' written reflections. Eight secondary school teachers and their students (N = 135) used a framework combining a cyclical process model with a depth model. Written reflection tasks were collected at the start and end of the program. Results suggest increases in the depth of written reflections across classes, with the largest gains observed among students whose teachers had less prior experience with guiding reflection. Differences between classes point to the influence of how the framework was enacted. Teachers reported increased confidence in guiding written reflections and drew on the framework to structure their approach. The study contributes to reflection research by integrating process- and product-oriented perspectives and introducing five literature-based teacher actions to support students' reflective competence.

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5.1 Introduction

Learning to navigate complex situations and critically determining the next steps is increasingly central in secondary and higher education, and is supported by approaches such as project-based, problem-based, and challenge-based learning (Doulougeri et al., 2024). These approaches can encourage students to grow as a person by taking the initiative and collaborating. To achieve growth in these types of skills, students need the ability to reflect, fostered through structured reflective practices (Moon, 2013). Such practices rely on pedagogical strategies that actively engage students in their own learning processes.

Students 'reflection, in this study, is defined as a cognitive process through which learners examine and evaluate their own assumptions, emotions, beliefs, and behaviours to foster self-understanding and personal growth (Hilden & Tikkamäki, 2013). This definition was chosen because it frames reflection as a holistic developmental process, which aligns with the broader aims of secondary education beyond task-specific performance. This operationalization emphasizes that not all levels of reflection contribute equally to meaningful learning. Reflection that remains descriptive helps to revisit experiences but is less likely to lead to changes or to new understandings. In contrast, deep reflection involves critically examining experiences and supports meaning-making and restructuring understanding (Moon, 2013). Deep reflection is recognised as both a prerequisite for developing 21st-century competencies, such as adaptability, critical thinking, and problem solving, and a means of growing into a more self-conscious learner (Barr et al., 2022). Despite its importance, deep reflection, in which students critically engage with their own experiences and thoughts, remains challenging for students (e.g., Esser-Noethlichs et al., 2024). Moreover, teachers report difficulties in planning reflective moments and providing targeted guidance (Gadsby, 2022; Görtzen et al., 2025). Reflective engagement does not occur naturally and must be cultivated through intentional practice and continual pedagogical guidance. Intentional, iterative reflection tasks are more effective than incidental reflection in promoting deep, lasting learning (Harvey et al., 2016; Moon, 2013). This study examines whether a structured teacher professional development program improves teachers' guidance practices to promote deep student reflection. The Science, Technology, Engineering, and Mathematics (STEM)-related course Research & Design (R&D) in Dutch Technasium schools provides a relevant context, because this course requires students to engage in authentic, open-ended design projects and to reflect on individual and collaborative learning processes. In other words, deep reflection is a core component of the R&D course.

5.2. Theoretical framework

Conceptualizing reflection

Reflection is widely recognised as a key cognitive process that supports lifelong learning (Hilden & Tikkamäki, 2013; Welch, 1999). Often internal and intangible, reflection is difficult to observe, which limits insight into the depth of students' reflection and may contribute to variability in their learning outcomes (Esser-Noethlichs et al., 2024; Korthagen & Nuijten, 2022). Encouraging students to engage in deep reflection promotes meaningful learning and development. Deep reflection involves a critical and contextual examination of experiences and thoughts, including underlying factors, missed opportunities, and multiple perspectives, going beyond surface-level evaluations (Nguyen, 2022). Ultimately, deep reflection not only supports meaningful learning, but also contributes to personal growth, enhancing students' self-awareness, autonomy, and adaptability (e.g., Moon, 2013).

This study adopts the ALACT model developed by Korthagen and Vasalos (2005), which is familiar in the context of R&D, to understand and guide deep student reflection. The ALACT model stems from an experiential learning perspective. It offers a holistic, cyclical approach to reflection as consisting of five stages, which enables students to draw insights from their actions, experiences and thoughts: (1) taking action, (2) looking back on the action, (3) identifying essential aspects that foster their awareness of thoughts, emotions, and recurring patterns that influenced the action, (4) creating alternative actions, and (5) enacting one of them in practice. All stages help students translate their reflective thoughts into concrete behaviour, thereby initiating a new cycle. Regular engagement with the full ALACT cycle encourages continual, meaningful learning by enhancing self-awareness, promoting deeper levels of reflection, and supporting the intentional application of insights to foster personal growth (Esser-Noethlichs et al., 2024; Korthagen & Nuijten, 2022).

Written reflection tasks are suitable tools for helping students to become aware of their reflective thoughts and to translate these thoughts into concrete behaviour, as they invite students to take the time to carefully consider and articulate their experiences (Trimasse, 2024; Wharton, 2012). They also allow students to reconsider their earlier reflections, supporting ongoing insight into their learning processes, and give teachers a gauge of their students' depth of reflection (Korthagen & Nuijten, 2022).

Reflection can be viewed in a process-oriented cyclical process (e.g. ALACT model), as well as understood in terms of hierarchical levels in a product-oriented way. Wallman et al. (2008), building on Mezirow's (1997) transformative learning theory, identified six hierarchical levels of reflection in written reflections. *Habitual action* (Level 1) occurs automatically without conscious thought; *Thoughtful action* (Level 2) draws on prior knowledge without evaluating alternatives; *Introspection* (Level 3) expresses personal thoughts or feelings without deeper analysis. Levels 1-3 are non-reflective. Reflective

thinking begins at C*ontent reflection* (Level 4), where actions are interpreted and evaluated, considering past experiences. *Process reflection* (Level 5) examines approaches to tasks and their effectiveness. The deepest level, *Premise reflection* (Level 6), critically questions underlying assumptions, beliefs, and values, potentially leading to transformative learning. These levels form a continuum in which each successive stage requires increasing cognitive and emotional engagement. In this study, the ALACT model was used to structure the cyclical process of reflection, while the Wallman et al. (2008) scheme was used to assess the different levels of reflection in students' written reflections (see table 5.1 for detailed information). Together, these models provided a foundation for guiding students toward deep, cyclical reflection.

Table 5.1

Coding scheme for levels of reflection: Level, description and example

Levels	Description	Example text of reflection*
1 Habitual action	Purely factual, listing events in a sequence without deeper analysis or consideration.	"I worked on the report for the stakeholder with my group member."
2 Thought-ful action	Action described as learned behaviour without a thought or feeling.	"I looked up information and added it to the list."
3 Intro-spection	Behaviour with thoughts or feelings, without looking at cause of the behaviour or results.	"Normally, I'm not really a presentation person, but this went really well."
4 Content reflection	Behaviour with thoughts or feelings, cause and results. Student consciously thinks about what they do.	"I want to keep communicating well within the group. This is important because it helps me see how I am doing in this project and how things are going for the others."
5 Process reflection	Behaviour with thoughts or feelings, consciously thinks about what they do and considers how behaviour affects others.	"I like that we discuss tasks weekly and share our work. I hope everyone carefully reviews each other's work, noting what is already good and what could be improved. I believe the quality of our group's work will improve."

6 Premise reflection	Behaviour with thoughts or feelings, consciously thinks about what they do, considers how behaviour affects others and indicates reason why they think, act and feel the way they do.	"This time I avoided checking others' work. Two group members asked for feedback, which I appreciated. I've realized people seek my feedback more now, and I enjoy giving it, though I still find giving compliments challenging."

* Example texts are selected from a previous study examining levels of written students' reflections (Görtzen, 2019b) and translated from Dutch into English.

Teachers' guidance practices for deep reflection

As noted in the Introduction (5.1), students encounter difficulties when reflecting and may remain at superficial levels (Esser-Noethlichs et al., 2024; Korthagen & Nuijten, 2022; Wallman et al., 2008). Supporting deep reflection therefore requires active teacher guidance, particularly in creating a psychologically safe learning environment in which students feel able to share personal thoughts, feelings, and assumptions (Esser-Noethlichs et al., 2024; Korthagen & Nuijten, 2022). Teachers can foster such an environment by valuing students' perspectives, normalising mistakes, and encouraging the articulation of reflective thinking (Korthagen & Nuijten, 2022; Winstone et al., 2017). This is especially relevant in R&D-courses, where open-ended problems require exploration and risk-taking (Doulougeri et al., 2024). To support teachers in guiding students' reflection, a literature-based guidance framework was developed, outlining five concrete actions to guide students' reflective processes.

First, teachers can enhance students' engagement in reflection by explicitly explaining both the purpose and relevance of the (written) reflection tasks. Doing so increases students' perceived usefulness of reflecting and supports their intrinsic motivation to engage with the tasks (Gordijn et al., 2018). Connecting reflection tasks to one another, that is, emphasizing the cyclical process, further promotes knowledge transfer and meaningful learning (Korthagen & Nuijten, 2022; Schön, 1983).

Second, teachers help ensure that reflections remain focused, relevant, and inherently personal by requiring students to formulate personal learning goals to improve their learning skills and to grow as a person. Such goals not only clarify the learning path, but also foster autonomy, motivation, and self-regulation needed for achieving concrete outcomes and supporting students' broader personal development. However, students often need guidance to translate goals that may remain abstract into concrete, achievable steps (Black & Allen, 2017; Saks, 2024).

Third, a consistent, iterative task format that guides students through the consecutive stages of the reflection cycle (as outlined in the ALACT model) fosters deep reflection.

Consistency and iteration promote familiarity, clarify expectations, and reduce cognitive load, allowing students to focus on the reflective process (Moon, 2013; Trimasse, 2024). Providing exemplars of strong and weak responses helps students to understand the different levels of reflection (Grossman, 2009).

Fourth, students can achieve deep reflection when teachers actively monitor their current levels of reflection using coding schemes such as that developed by Wallman et al. (2008) and prepare prompts to help students elaborate or refine their written responses toward greater specificity and depth. Ideally, teachers first read students' written reflections and add prompts (like open-ended questions that elicits critical thinking) directly within those reflections, without immediately sharing them with the students. These prompts support teachers in formulating the feedback they intend to discuss. In this way, teachers stimulate deeper student reflection by providing thoughtful, written feedback on the reflections. (Gadsby, 2022; Moon, 2013).

Fifth, discussing the written feedback with the students ensures that the prompts provided by the teacher (like the open-ended questions) are understood and actionable or need further clarification. These feedback dialogues support meta-reflection (reflection on the reflection process) and encourage students to revise their personal learning goals or approaches when necessary (Gadsby, 2022). The effectiveness of teachers' feedback depends on its perceived relevance and students' willingness to engage with it (Carless & Winstone, 2020; Kluger & DeNisi, 1996).

In this study, a professional development program, called Collaborative Teacher Reflection (CTR), introduced teachers to a structured guidance framework comprising five teacher actions to support student reflection. The aim of this framework is to help shift students' reflection from incidental and occasional to intentional and sustained. Teachers were given opportunities to develop and practise these structured guidance actions in their own classroom contexts. This study examined how this engagement with the framework relates to changes in teachers' guidance practices and the depth of students' written reflections, addressing the following research questions:

RQ1: Do students show deeper levels of reflection after their teachers have completed the CTR program?

RQ2: Do the teachers perceived changes in guidance practices relate to students' levels of reflection?

5.3. Materials and methods

Participants

The study was conducted in Dutch Technasium schools. These secondary schools offer R&D courses from lower to upper secondary levels, providing approximately four to six hours of project work per week. Students typically complete three projects each school year, each project lasting around ten weeks (Technasium, n.d.). The R&D courses integrate STEM subjects through project-based learning, where students collaboratively work on authentic assignments for external stakeholders. This interdisciplinary approach emphasises the development of cross-disciplinary competences, such as collaboration, problem-solving, and reflective thinking, that are relevant for a wide range of educational and professional domains. In R&D, students work in small teams on open-ended projects (e.g. developing a tomato-picking robot or a soccer playing robot), producing tangible outcomes such as advisory reports or prototypes. Reflection forms a central part of the R&D-course: before starting and ending a project, but also during projects students' complete reflection tasks. The written reflections typically focus on students' personal learning goals. Eight R&D teachers responded to an open invitation in a national newsletter from the Dutch Technasium Foundation to join the CTR program. Classes were freely chosen by these R&D teachers. A total of 135 students from eight classes across eight schools participated during the 2023–2024 schoolyear (see Table 5.2). Students completed two written reflection tasks (pre- and post-intervention), resulting in 270 reflections in total. Before data collection started, ethical approval was received from the Research Ethics Committee of the main author's university. Participation was voluntary, on an opt-in basis, with informed consent provided by teachers, students and/or their parents. Data were anonymised: student names were replaced with codes to compare the reflection tasks, and teachers' names were replaced with pseudonyms.

Table 5.2

CTR participant information.

Teacher name*	R&D experience (years)	Number of students	Student age (years)
Rick	0-5	11	15-16
Sarah	6-10	30	16-17
Norah	11-15	7	15-16
Esther	6-10	19	16-18
Marit	0-5	17	15-17
John	6-10	13	15-17
Irene	0-5	16	15-16
Robert	11-15	22	13-14

* Names are pseudonyms.

Procedure and design

The CTR program began with a plenary kick-off meeting in which the theoretical background on reflection was introduced. The guidance framework (see Table 5.3) was explained, and, building on findings from a previous study indicating that teachers value practical tools to support reflection (Görtzen et al., 2025), an exemplar reflection task based on the ALACT model was discussed (see Appendix 2). Teachers also practised assessing the depth of reflection using sample material and the refined coding scheme (see Appendix 3). Following the kick-off, teachers individually formulated a personal learning goal for guiding student reflection using a laddering interview.

Between October 2023 and April 2024, teachers applied the guidance framework in their R&D lessons, providing students with reflection tasks based on the ALACT model. Students completed the same reflection task in approximately 30 minutes at the start (T0, October 2023) and end (T1, March 2024) of the program. The coding scheme was used both to assess the depth of students' written reflections and to formulate written prompts aimed at encouraging deeper reflection.

During this period, teachers participated in three learning communities of three to four members each, which met three times. Prior to each session, teachers' video-recorded a feedback dialogue with their students in which the written reflection tasks were discussed. These video fragments served as discussion material during the community sessions, where teachers used a structured conversation guideline to reflect on the classroom situation and identify strategies for deepening students' reflection. The CTR sessions themselves were recorded, and in accordance with GDPR (European Parliament & Council of the European Union, 2016), only these recordings were used for analysis. The classroom videos were used solely as discussion material and were not analysed.

At the end of each session, teachers completed a written reflection task on their personal learning goal and experiences, received peer feedback, and discussed their reflections in a feedback dialogue. The CTR program concluded with a plenary focus group session in which teachers presented their perceived learning outcomes.

Instruments

To examine changes in the depth of students' reflection (RQ1), the written reflection tasks administered at the beginning and end of the CTR program were used as pre- and post-intervention measures.

To examine perceived changes in teachers' guidance practices (RQ2), three complementary instruments were employed: laddering interviews, recordings of CTR meetings, and Presentations of Learning (PoL). Laddering interviews (Van Veen & Janssen, 2016) were conducted at the start of the program, in which teachers described one of their students' R&D projects and responded to iterative 'why' questions to uncover

underlying beliefs and assumptions about guiding student reflection, resulting in a personal learning goal for each participant. The audio recordings of the CTR meetings were transcribed and analysed as the primary source of data on teachers' guidance practices. At the end of the program, each teacher gave a PoL, in which they shared their perceived growth on their personal learning goal with peers, described actions undertaken, and considered directions for the following school year. These presentations were video-recorded, transcribed, and analysed as additional evidence of changes in guidance practices.

Data analysis

The study employed a mixed-methods analysis. Quantitative data were generated by coding the levels of reflection in the students' writings at the pre- and post-test (RQ1). Qualitative data from laddering interviews and CTR meetings were compiled in case descriptions to address RQ2.

Quantitative analysis of levels of reflection in students' written reflections

The levels of students' reflections were analysed by the main researcher using a refined version of Görtzen' s (2019) adaptation of the Wallman et al. (2008) coding scheme, expanded with detailed level descriptions and exemplars (see Table 5.1). Each students' reflection was treated as a single coding unit. As multiple levels of reflection could occur within a single text, the deepest level identified within the unit was recorded. Results were aggregated at class level to obtain an overall overview of changes across each teacher's class.

To illustrate the observed levels of reflection, three examples are presented. Texts have been translated from Dutch into English and have been kept as close to the original as possible.

The first example is reflection at level 2:

> This week I worked on the advisory report, the introduction and the background for the project went well. **We looked at** what should be in the project and **put that** in the introduction and background. W**e did this neatly and thought a lot about what should go into the document.** What didn't go so well was **making the sub-question**s. **We thought** about them a lot but found it hard to come up with new ideas. **We got stuck a**nd couldn't continue. Next time **we will talk about it togethe**r and come up with new ideas and w**ork them out** into sub-questions. Next week **I will try** to get less distracted.

This reflection is classified as Level 2 (description), because it describes actions without including personal opinions or feelings, see for example the words in bold.

The second example concerns level 4:

> …I also f**ocused more on the bigger tasks** and not on the smaller ones on the scrum board, so most things weren't fully finished… A problem was that w**e depended a lot on each other**. We couldn't continue w**ithout information from someone** else S had some communication issues, so I couldn't continue with task 8 because I needed task 7 from S. In the end, **I called S a**nd we still managed to finish everything.

The words in bold imply the students' awareness of their actions. In addition, the students reflect on the consequences of these actions for the group, such as delays caused by dependencies and communication issues.

Third example assigned level 5:

> …When I started working on my own parts, I got stuck. **I tried to say that I was struggling**, but I found it difficult. **In the end I did mention it, but I don't think I made it clear enough for others** to understand that I needed help… . I didn't ask for help a second time and instead kept putting it off. Because of that, I had to finish everything in the final week, w**hich was quite stressful for myself and also for my group members…**"

This example demonstrates Level 5 reflection, as the student shows awareness of their own behaviour (including repeated difficulty in seeking help) and its consequences for both him and his team. Including an explanation of why they acted this way would have elevated it to Level 6.

Qualitative analysis of change in teachers' guidance practices

Teachers' guidance practices were examined using 32 hours of CTR meeting transcripts, laddering interviews, and POL presentations. Meeting recordings were transcribed verbatim, and relevant segments were extracted and reviewed to identify material related to the five guidance actions (see Table 5.3).

The literature-based framework (see section 5.2)) was further operationalized by describing observable indicators for each action. These indicators were deduced from all data sources.

For each teacher, data were integrated to construct a case description capturing changes in guidance practices over time. Cross-case patterns were then analysed to identify similarities and differences among the teachers.

The entire process, including cross-case comparisons, was audited through an independent researcher familiar with the Technasium context, who systematically reviewed all coding decisions, interpretations, and case descriptions to ensure transparency, consistency, and credibility (Akkerman et al., 2008). Any differences in interpretation were discussed and resolved collaboratively. This thorough and reflective audit ensured confidence in the findings.

Table 5.3

Guidance framework and behaviour mentioned

Five Guidance Actions	Behaviour mentioned by the teacher
Explain reflection tasks	Teacher explains purpose and relevance of reflection and reflection tasks and emphasises their cyclical nature.
Help formulate personal learning goal	Teacher helps student to formulate personal goals by active listening, open-ended questioning techniques, and summarising.
Offer iterative reflection tasks	Teacher assigns iterative reflection tasks using a consistent template and provides exemplars of both strong and weak responses.
Assess depth of reflection	The teacher uses a coding scheme to assess students' levels of reflection and provides written, open-ended questions to prompt deeper responses.
Implement feedback dialogue	Teacher discusses levels of reflection and written feedback. Teacher encourages active student participation in feedback dialogues, and guides students to summarise process-oriented feedback, prioritise it, define next steps, and revise personal learning goals if needed.

5.4. Results

Students' levels of reflection

RQ1 examined whether students demonstrated deeper levels of reflection in their written reflections following their teachers' participation in the CTR program. The CTR program focused on the professional growth of teachers in guiding students' reflection. For this reason, changes in the depth of students' written reflections were examined at class level, as this allows for a comparison of outcomes across teachers and their respective classes. Whilst individual progress in reflection depth was also considered, the following results are reported at class level for clarity and comparability.

Table 5.4 provides an overview of the distribution of reflection levels across the eight classes at T0 and T1. Overall, the results suggest an increase in the depth of reflection in students' written responses. When focusing on the deep levels of reflection (Levels 4–5), the proportion of such responses appears to have increased across classes, with gains in reflective depth ranging from 9.1% to 41%. The largest gain is observed in Robert's class, which included 22 students with a relatively low age (13-14 years) and a teacher with 11-15 years of teaching experience.

Some variation between classes can be observed. In classes where teachers had limited prior experience with written reflection tasks (Rick, Marit, Irene) or where it had been reintroduced after a period of discontinuation (John and Robert), there appears to be a shift from predominantly non-reflective responses (Levels 1–3) towards responses demonstrating greater reflective depth (Level 4 and, in some cases, Level 5).

In contrast, in classes where teachers had prior experience with written reflection tasks (Sarah, Norah, and Esther), students' reflections appear to move from mid-level reflections (Levels 3–4) towards deeper levels (Levels 4–5). By the end of the CTR program, 19 students in six classes produced reflections at Level 5, while in one class (Norah), all students' reflections were coded at Levels 4 or 5. Level 6 was not observed in the data of the current study.

Table 5.4

Levels of reflection in students' written reflections, per class.

Teacher (# students)	Levels of reflection *	Percentage at T0 (October)	Percentage at T1 (April)	Change per level	Total increase Levels 4 + 5
Rick	1	0	0	-	
(*n* = 11)	2	45.5	18.2	-27.3%	
	3	27.3	45.5	18.2%	
	4	27.3	36.4	9.1%	
	5	0	0	-	
	Total 4-5	**27.3%**	**36.4%**		**+ 9.1 %**
Sarah	1	0	0	-	
(*n* = 30)	2	13.3	0	-13.3%	
	3	36.7	20.0	-16.7%	
	4	43.3	63.3	20%	
	5	6.7	16.7	10%	
	Total 4-5	**50%**	**80%**		**+ 30%**
Norah	1	0	0	-	
(*n* = 7)	2	0	0	-	
	3	14.3	0	-14.3%	
	4	71.4	28.6	-42.8%	
	5	14.3	71.4	57.1%	
	Total 4-5	**85.7%**	**100%**		**+ 14.3%**
Esther	1	0	0	-	
(*n* = 19)	2	5.3	0	-5.3%	
	3	42.1	31.6	-10.5%	
	4	42.1	42.1	-	
	5	10.5	26.3	15.8%	
	Total 4-5	**52.6%**	**68.4%**		**+ 15.8%**
Marit	1	5.9	0	-5.9%	
(*n* = 17)	2	47.1	17.6	-29.5%	
	3	29.4	35.3	5.9%	
	4	17.6	47.1	29.5%	
	5	0	0	-	
	Total 4-5	**17.6%**	**47.1%**		**+ 29.5%**
John	1	0	0	-	
(*n* = 13)	2	53.8	23.1	-30.7%	
	3	15.4	30.8	15.4%	
	4	30.8	38.5	7.7%	
	5	0	7.7	7.7%	
	Total 4-5	**30.8%**	**46.2 %**		**+ 15.4%**
Irene	1	0	0	-	
(*n* = 16)	2	25.0	12.5	-12.5%	
	3	50.0	43.8	-6.2%	
	4	25.0	37.5	12.5%	
	5	0	6.2	6.2%	
	Total 4-5	**25%**	**43.7%**		**+ 18.7%**
Robert	1	9.1	0	-9.1%	
(*n* = 22)	2	31.8	0	-31.8%	
	3	54.5	54.5	-	
	4	4.5	36.4	31.9%	
	5	0	9.1	9.1%	
	Total 4-5	**4.5%**	**45.5%**		**+ 41%**

* Level of reflection are (1) habitual action, (2) thoughtful action, (3) introspection, (4)

content reflection, and (5) process reflection. No reflections were scored at Level 6 (premise reflection), which is for that reason not shown in the table.

Changes in teachers' guidance practices

RQ2 referred to whether perceived changes in teachers' guidance practices were related to students' levels of reflection. The findings for this research question are based on teachers' case descriptions and are structured according to the five actions of the guidance framework (see Table 5.3).

Explain reflection tasks. Before the CTR program, none of the participating teachers explicitly explained the concept of reflection, the steps of the reflection task, or its purpose and relevance to students. By the end of the program, six teachers (Rick, Sarah, Norah, Marit, Irene, and Robert) had begun to provide explicit guidance. For example, Norah mentioned: "*I've noticed that when you discuss the content of the reflection task together with students and go over what is expected, they have a better understanding, and the quality of their written reflections improves."* Similarly, Rick initially asked students to complete reflection tasks without extensive guidance. However, after several weeks, he became more aware of the need for support and began to explicitly explain both the task and its purpose: "*I think it's important to really explain at every step why you're doing something. I tend to act quickly and assume students understand."* Sarah and Norah also explicitly explained their interpretation of the term "reflection" to students, with Norah emphasizing the connection between successive reflection tasks. In contrast, Esther and John did not substantially change their approach, continuing to refer students to the course manual. John later noted that this strategy was less effective than expected, observing that *"students really need your guidance in order to complete a reflection task."*

Help formulate students' personal learning goals. At the start of the CTR program, approaches to supporting students in formulating personal learning goals varied. Only Norah guided her students in a structured 10-minute dialogue to help them set achievable goals, while Sarah and Esther asked students to formulate goals independently.

By the end of the program, all teachers encouraged students to define personal learning goals, though their approaches differed. Irene adopted Norah's method, working with students in dialogues to co-construct their goals: *"By defining together with the students a personal learning goal for the coming months, you help them with their personal growth."* Other teachers, including Rick, Marit, John, and Robert, continued to allow students to formulate goals more independently, but revisited and refined these goals during follow-up conversations.

Sarah, Norah, Esther, Irene, and Robert also provided a rubric to give students insight into their current behaviour compared with the desired performance, supporting the formulation of realistic and actionable goals. To ensure these goals lead to meaningful

progress, both teachers and students needed to monitor them and revisit them throughout the project. As Sarah emphasised: *"To properly support students in their development, you need to monitor and regularly discuss the learning goals with your students."*

Offer iterative reflection tasks. During the CTR program, all eight teachers implemented iterative reflection tasks, although their starting points differed. Initially, for Rick, Marit, and Irene, this was a new practice, whereas John and Robert reintroduced written reflection tasks after having discontinued them due to time constraints. In contrast, Norah had already established a continuous approach to reflection, integrating and explaining iterative reflection tasks as a regular part of her teaching practice. By the end of the program, the use of iterative reflection tasks had become a shared topic of discussion within R&D teams of Rick, Marit, John, Irene, and Robert. This evolution in practice appeared to support student engagement, as some teachers observed changes in how students engaged with these tasks over time. As Robert noticed: *"By the end of the CTR program, my students themselves refer back to earlier reflection tasks and make links to previous insights."* Rick emphasized the role of repeated reflection in supporting student growth: *"By consistently facilitating reflection on one's behaviour; you can help students see their personal growth."*

Assess depth of reflection and prompt with written feedback. All teachers adopted the practice of assessing the depth of students' reflections using the Wallman et al. (2008) scheme. They also provided written prompts to encourage deep reflection. This approach was new for everyone and generally perceived as valuable. Rick, Norah, Marit, Irene, and Robert provided written prompts on students' reflections, and some also discussed reflection levels explicitly with their students. Marit explained: "*I shared the reflection levels with my students and discuss how they can take it a step deeper. I showed them their level at the beginning of the school year and at the end of the project. Some students asked what they could do to reach a higher level. I've seen with my own eyes that reflection itself became a form of learning."* John also mentioned*: "I found those reflection levels very helpful as a way to define what a good level of reflection is for students and where they currently stand. It gives me a clear reference point: okay, this is where you are now, where can you go next?"*
Iris reflected positively on the approach, highlighting that assessing reflection levels and asking open-ended questions required little extra time but provided valuable insight: *"I really enjoyed seeing that assessing reflection levels and asking open questions to stimulate students doesn't take much time, but on the other hand does give a lot of insight."*

Implement feedback dialogues. Within the feedback dialogues, teachers varied in their focus. Rick, Sarah, Norah, Marit, John, and Irene centred discussions on students' reflections in relation to their personal learning goals, while Robert emphasised broader, process-oriented aspects such as group collaboration. Five teachers used their written feedback as a starting point to guide the conversation. As Iris reflected: *"I've noticed that offering written reflection tasks is really important. It helps students look back and makes it easier to continue conversations and build on them. I've started to value that more."* Norah highlighted the importance of being aware of both the student's and teacher's mindset during these dialogues. Irene also emphasised the value, noting that both she and her students found the feedback dialogues meaningful and that they should be embedded as a structural component of R&D lessons: *"Students and I both experienced the feedback dialogues about the reflection tasks as very valuable. They should have a fixed place in R&D lessons."*

Next to the action framework, teachers reflected on how the program had influenced their guidance practices on other aspects. Seven reported increased confidence in supporting student reflection, while five perceived that their guidance now fostered greater student engagement and better-prepared feedback dialogues about the written reflections. As Robert explained the program helped him to "learn to guide reflection more purposefully and to ask questions about the process," providing practical tools to support students' thinking. All teachers valued the five steps of the guidance framework, particularly the use of the reflection levels coding scheme, which they found helpful for structuring prompts and supporting students' development.

5.5 Conclusion and discussion

The aim of this study was to examine how engagement with a structured guidance framework, implemented within the CTR program, relates to changes in teachers' guidance practices and the depth of students' written reflections.

Levels of reflection (RQ1)

Across the six-month period, students' written reflections shifted towards deeper levels, particularly Levels 4 (process reflection) and 5 (content reflection), while no instances of Level 6 (premise reflection) were identified. The progression observed shows a movement from predominantly descriptive accounts towards more analytical forms of reflection, in which students increasingly examined their actions and considered alternative approaches. This aligns with Moon (2013), who emphasises that reflection deepens through iterative engagement with reflective activities over time. The absence of Level 6 is consistent with earlier work suggesting that transformative reflection is rarely captured in written formats (Wallman et al., 2008), as it requires students to articulate underlying assumptions about their thinking, actions, and feelings.

Notably, students who initially demonstrated lower levels of reflection appeared to show greater gains. When students have had little prior experience with reflection, the initial step towards more structured and analytical accounts may be more accessible than the subsequent move towards deeper, premise-level reflection.
However, these results should be interpreted with caution. Although it is plausible that teacher guidance and the adjusted reflection tasks contributed to the observed development, the present study does not allow for causal claims. Other factors, such as maturation, prior experience, or differences in classroom context, may also have influenced students' written reflections.

Teachers' guidance practices (RQ2)

The findings suggest that participation in the CTR program was associated with changes in how teachers experienced the guidance of students' reflection. Although teachers recognised the importance of reflection before entering the CTR program, they reported a lack of concrete tools or guidelines to support it in classroom practice (Görtzen et al., 2025). Engagement with the guidance framework, alongside opportunities to implement it in daily practice, appeared to help teachers operationalise reflection in their teaching. This was reflected in increased confidence in their guidance, which is consistent with research indicating that teachers benefit from both structured support and opportunities for success experiences when translating general pedagogical principles into actionable classroom practices (Guskey, 2002; Veine et al., 2020).
Changes in teaching practices became apparent in how teachers enacted the guidance framework during the CTR meetings. A frequently discussed aspect concerned the use of the refined reflection level coding scheme (Görtzen, 2019; Wallman et al., 2008). Teachers reported that working with the coding scheme supported them in two interconnected ways: it provided a clear reference point for assessing the depth of students' reflections, and it enabled the formulation of more targeted written prompts. Teachers also increasingly recognised the value of iterative reflection tasks and feedback dialogues, which appeared to support students in revisiting earlier reflections and building on prior insights over time. These practices align with research emphasising the importance of iterative reflection in deepening learning (Moon, 2013) and the role of dialogue in helping students interpret and use feedback effectively (Carless & Winstone, 2020).
At the same time, variation in how teachers implemented the framework indicates that guidance remained situational, shaped by the teacher, the students, and their interaction. Rather than resulting in uniform change, the findings suggest that individual teachers engaged with the framework in different ways and for different reasons. This was illustrated, for instance, by a teacher working with relatively young students who had little prior experience with reflection, whose class showed among the largest gains in reflective depth. More broadly, such differences suggest that factors including teachers' prior experience, students' familiarity with reflection, instructional focus, and personal

characteristics may have influenced how the framework was enacted and what outcomes were observed.

Outcomes of the CTR program

By actively engaging in the CTR program and following similar reflective steps as their students, teachers experienced the reflective process firsthand. This experiential approach appeared to deepen their understanding of reflection and strengthen their ability to guide students with greater confidence and sensitivity (Kolb, 2014). Teachers reported becoming more aware of the complexity of reflection, including the challenges students may face when articulating personal insights and the importance of creating a safe learning environment. As one teacher noted: *"The whole process of guiding students in reflection was, for me, mostly about learning how to reflect myself."*

Overall, the findings suggest that structured tools, such as the guidance framework and the guidelines for reflection tasks, combined with experiential engagement, may support teachers in developing their role as facilitators of reflection. This resonates with Schön's (1983) notion of professional learning through reflection-in-action and reflection-on-action.

It also aligns with research suggesting that teachers may need structured and experience-based support to reconceptualise their role from instructor to facilitator of learning (Korthagen & Nuijten, 2022; Svojanovsky, 2017; Veine et al., 2020).

In this sense, engaging teachers in reflective practice themselves may be an important condition for effectively guiding students' reflection, as it allows them to better anticipate students' challenges and respond more sensitively in feedback dialogues.

Limitations

This study provides insights into students' reflection and teachers' guidance practices, but several limitations should be considered.

First, although levels of reflection were assessed using an established coding scheme (Wallman et al., 2008) and audited by an independent researcher, some degree of subjectivity in interpreting students' written reflections remains unavoidable. The analysis relies on written texts, without direct access to students' underlying intentions or thought processes.

Second, written reflection tasks may not fully capture students' actual reflective engagement. Students may complete tasks to meet requirements rather than engage in genuine self-exploration. As a result, coded levels of reflection represent textual output rather than necessarily the depth of reflection experienced. This highlights the importance of complementing written tasks with feedback dialogues (Carless & Winstone, 2020).

Third, the interconnected nature of the guidance framework makes it difficult to disentangle the specific contribution of individual elements. Teachers implemented multiple actions simultaneously, such as setting personal learning goals, introducing tasks,

monitoring depth, providing written feedback, and conducting feedback dialogues, and these were not applied with equal frequency or emphasis across contexts.
Finally, variation in implementation should be considered. Although the CTR program provided a structured framework, its enactment depended on teachers' interpretations, classroom interactions, and the context. In practice, not all teachers were able to implement all elements consistently; for example, due to personal circumstances, some teachers were temporarily unable to discuss the prompts (i.e. open-ended questions) during a feedback dialogue with their students, which may have influenced students' levels of reflections. The interaction between teachers and students remains inherently dynamic and cannot be standardised. These contextual variations make it difficult to draw uniform conclusions about the program's effects across all participating classes.

Follow-up research and implications for theory and education

This study raises several directions for future research. Further work is needed to examine how reflection develops over longer periods and across different educational contexts, age groups, and subject domains.
Future studies could investigate how characteristics of teachers and students influence the development of reflection. Teachers vary in their prior experience with reflective practices, beliefs, instructional approaches, and their classroom differ, while students differ in age, initial levels of reflection, and personal learning goals. Understanding how these and other factors interact with the implementation of reflection tasks may help to explain variation in outcomes and inform more tailored professional development approaches.
Additional research could also explore the design and structure of reflection tasks themselves. Questions remain about how task purpose, sequencing, and scaffolding affect students' depth of reflection. Investigating within-class variability, including differences in engagement and responses among students, may provide insights into how reflection emerges in real classroom contexts. Well-documented challenges in writing reflection tasks, such as managing self-presentation, emotional responses, and group versus individual contributions, should also be considered (Wharton, 2012). A more holistic or ecological approach, in which multiple factors (including teacher background, student characteristics, task design, and classroom context) are examined in relation to one another, may contribute to a more nuanced understanding of not only whether structured reflection programs for both teachers are effective, but also how and under what conditions they support student development.
In conclusion, this study provides insights into how teachers' guidance practices may support the development of students' reflection. Participating in the CTR program, teachers reported that engagement with the structured guidance framework supported them in their reflective guidance, providing clearer steps and increasing their confidence in facilitating students' reflection. Experiencing the reflective process themselves further

appeared to strengthen their ability to explain and guide reflection in practice. Teachers also identified the refined coding scheme based on Wallman et al. (2008) as a useful tool for assessing the depth of students' reflections and formulating targeted prompts.
Following their teachers' participation in the CTR program, students' written reflections appeared to have deepened. In particular, students more frequently analysed their actions and considered alternatives, corresponding to Levels 4 and 5 of the coding scheme.
Taken together, these findings suggest that the structured guidance framework, combined with experiential engagement, may support the development of teachers' competences to guide reflection, which in turn may contribute to deeper students' reflection. Although the results are context-specific and shaped by teacher, student, and classroom interactions, they offer a research-informed indication of how deep reflection may be fostered in classroom settings.



Chapter 6

Professional Development in Supporting Feedback Dialogues for Students' Reflection

Abstract

This study reports on the use of educational design research in designing, enacting, and evaluating a 2-year collaborative teacher reflection program designed to strengthen secondary school teachers' facilitation of feedback dialogues and student reflection. The program was developed based on eight design principles derived from literature on professional development, dialogic feedback, and reflective practice. These principles were translated into sustained, practice-based learning activities in which teachers participated as learners in feedback and reflection processes similar to those they were expected to facilitate in their classrooms. Ten secondary school teachers from nine different schools and their students (*N* = 303) participated. Teachers' professional learning was evaluated through reflexive thematic analysis of group discussions. Students' learning was analysed through their written reflections , focusing on depth of reflection. Questionnaires evaluated perceptions of feedback practices. Findings indicate that teachers reconceptualised their role as facilitator, increasingly enacted structured feedback dialogues, and developed greater reflective competence. Students reported more engagement in feedback dialogues and demonstrated deeper levels of reflection in written reflection tasks. The study validated the original eight design principles and added two evidence-informed principles, together highlighting the importance of attentive facilitation, experiential and collaborative learning, sustained duration, differentiation, and supportive organisational conditions.

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6.1 Introduction

Education increasingly aims to prepare students for complex, uncertain, and socially relevant challenges (Barr et al., 2022). In the Netherlands, research and design (R&D) education addresses this aim by engaging secondary school students in open-ended, real-world science, technology, engineering, and mathematics (STEM) design projects. Students work collaboratively in small teams during project cycles of approximately 10 weeks, concluding with the presentation of project outcomes to external clients. Reflection tasks are embedded within these projects and form the basis for teachers' feedback conversations.

For learning within R&D education to reach a higher level, students need to develop deeper reflection skills. Reflection supports students in making sense of feedback, connecting experiences with underlying concepts, and regulating their learning over time (Moon, 2013). Feedback and reflection are mutually reinforcing processes: Feedback prompts students to reconsider their actions, while structured reflection helps them interpret those insights and plan their next step (Carless & Winstone, 2020; Moon, 2013). However, reflection skills do not develop automatically. Their quality depends on both students' engagement and teachers' competences to facilitate feedback dialogues that scaffold students' reflection through purposeful classroom interaction (Kluger & DeNisi, 1996; Korthagen & Nuijten, 2022).

Despite its recognised importance, teachers struggle to enact feedback as an interactive, dialogic process and to embed reflection meaningfully in everyday R&D practice (Görtzen et al., 2025). Feedback is often reduced to one-way information transmission, while the reflection tasks for students remain fragmented or superficial, limiting their contribution to learning (Korthagen & Nuijten, 2022; van der Kleij et al., 2019).

Strengthening teachers' facilitation of feedback dialogues and student reflection requires targeted professional development (PD) that bridges knowing and acting by supporting sustained, practice-embedded enactment, rather than involving mere knowledge transmission (Antoniou & Kyriakides, 2013; Louws et al., 2017). Such PD aims to improve classroom practice and student learning through iterative cycles in which teachers enact new approaches, reflect on the outcomes, and adapt their professional beliefs and practices over time (Guskey, 2002). Effective PD is closely connected with teachers' everyday practice and positions teachers as active agents who collaboratively reflect on and refine their instructional roles (Desimone, 2023).

This study addresses the challenge of designing PD that enables teachers to enact feedback dialogues and meaningfully embed student reflection in everyday R&D practice, through the design and evaluation of a 2-year collaborative teacher reflection (CTR) program. The program was developed and refined using an educational design research

(EDR) approach, enabling iterative alignment between theoretical insights and teachers' professional practice (McKenney & Reeves, 2025).

The overarching design-oriented research question was: *What design principles characterise a PD program that supports teachers in facilitating feedback dialogues for student reflection in secondary education?*

The following three sub-questions (SQ) were addressed:
SQ1. What literature-based design principles (DPs) for the PD program are corroborated by teachers' experiences?
SQ2. What outcomes does the PD program have regarding (a) teachers' professional learning and (b) students' perceptions of feedback practices and the depth of their reflections?
SQ3. How feasible is the designed PD program for the participants?
The CTR program functioned both as a PD intervention and as an empirical context for identifying, evaluating and refining the relevant DPs.

6.2 The CTR program

Context
The CTR program was designed for R&D teachers in Dutch Technasium schools, a national network of secondary schools that offer Research & Development (R&D) as a graduation subject in which students work on authentic STEM design projects. This context was considered suitable because R&D teachers regularly facilitate feedback conversations and student reflection as integral components of project-based learning. The R&D curriculum emphasises collaboration with external organisations and engages students in complex, open-ended STEM design projects conducted in small teams over 10-week cycles, culminating in presentations to stakeholders (Schalk & Bruning, 2014). Each project includes written reflection tasks addressing both individual learning and team processes, which serve as the basis for teacher–student feedback conversations. Despite this structural emphasis on feedback and reflection, teachers experience difficulties in guiding these processes (Görtzen et al., 2025).

6.2.1 Analysis and exploration

The design of the CTR program started with an exploration to answer SQ1: What literature-based design principles (DPs) for the PD program are corroborated by teachers' experiences?

Literature-based DPs
By drawing on the theoretical and empirical literature, eight DPs had already been formulated to inform the initial design of the CTR program and to serve as a basis for subsequent empirical validation and refinement.

DP1: the creation of a **psychologically safe learning environment** was identified as a prerequisite condition for collaborative learning. Teachers require safety to share their uncertainties, receive peer feedback, and articulate reflective thoughts. Trustful relationships and a supportive climate within the group are important for engaging meaningfully in feedback and reflection processes (Dai et al., 2025; Torrance, 2012).
DP2: the PD should be firmly **grounded in teachers' own classroom practice**. Learning activities should focus on authentic teaching situations, enabling teachers to experiment, reflect, and refine their strategies immediately. This principle reflects the theory of practicality, which posits that educational innovations are more likely to be adopted when they are feasible, aligned with existing practices, and perceived as beneficial (Desimone, 2023; Doyle & Ponder, 1977; Louws et al., 2017). It also aligns with andragogical principles emphasising problem-oriented and experience-based learning for adults (Knowles, 1980).

DP3: The PD needs to be designed to **engage teachers in experiential and iterative learning**. For the CTR program this means that teachers experience feedback dialogues and reflection themselves in ways that are comparable to what they would facilitate with their students. This principle draws on Kolb's (2014) experiential learning cycle and is further elaborated in a literature-informed guidance framework developed in earlier research (Görtzen et al., 2026b). The framework outlines five concrete actions teachers can use to scaffold students' reflective processes, including clarifying task purposes, collaboratively formulating students' personal learning goals, fostering iterative reflection, assessing reflection depth, and facilitating feedback dialogues (Gadsby, 2022; Gordijn et al., 2018; Grossman, 2009; Moon, 2013).

DP4: The PD should **incorporate video-supported reflection** as a core design element. Video provides an external perspective on classroom interactions, enabling teachers to revisit moments that are difficult to reflect on in real time. Research has shown that video-based reflection supports professional vision, facilitates teachers' detailed analysis of classroom communication, and strengthens communicative skills (Boodt, 2014; Marsh & Mitchell, 2014; Moon, 2013; Sherin & van Es, 2009; van der Linden et al., 2023)

DP5: Teacher learning will need to be **organised in collaborative teacher groups** to foster shared reflection and mutual support. Learning with and from colleagues creates opportunities for shared sense-making, mutual support, and exposure to alternative perspectives. The dynamics and composition of teacher learning groups have been shown to play a fundamental role in professional learning processes (Ter Beek et al., 2022; Voerman et al., 2015), particularly when dialogue and reflection are central.

DP6: The PD should allow **sufficient time** for experimentation, reflection, and consolidation. Sustained engagement is necessary for iterative learning processes to take hold and for new practices to become embedded in classroom routines (van Veen et al., 2010).

DP7: **Scientific literature needs to be explicitly connected with practice** by jointly interpreting theoretical insights in relation to teachers' classroom experiences. A PD program can support teachers in developing an understanding of key concepts and their implications for practice, thereby bridging the theory–practice gap. Such integration has been shown to enhance teachers' professional learning and instructional decision-making (Broekkamp & van Hout-Wolters, 2007; Vieites-Casado et al., 2025).

DP8: The PD program needs to **adopt a differentiated approach** by supporting teachers in formulating and pursuing personal learning goals. This is important because professional learning is most effective when it aligns with teachers' individual needs, prior experiences, and classroom contexts (Antoniou & Kyriakides, 2013; Louws et al., 2017). Teachers, like students, require guidance to translate abstract goals into concrete, achievable steps (Black & Allen, 2017; Saks, 2024).

Refined DPs

To corroborate the DPs found in the literature, 23 R&D teachers were interviewed in an earlier study about their practices (Görtzen et al., 2025). Using focus group interviews and individual mind maps, we investigated teachers' experiences, challenges, and professional learning needs related to managing feedback dialogues and guiding student reflection.

In the interview study (Görtzen et al., 2025), teachers reported difficulties in facilitating feedback dialogues and guiding student reflection, identifying three key areas where PD support was needed: (1) the timing and sequencing of feedback and reflection tasks, (2) the development of feedback facilitating skills, and (3) the sustained embedding of iterative reflection throughout the school year. More experienced teachers additionally emphasised the importance of aligning feedback dialogue practices across classes and maintaining reflective cycles over multiple years. Beyond these content-related needs, teachers also articulated clear preferences regarding how they wanted to learn. Based on these insights, the original eight DPs were either confirmed, refined, or retained without explicit confirmation. The results are summarised in Table 6.1.

Table 6.1

Design principles of the CTR program: view on design principle and their confirmation or refinement

	Literature based DP	View on DP	Confirmation or refinement of DP
DP1	Psychologically safe learning environment	Confirmed	Teachers emphasised the need for trust and support to share uncertainties, receive feedback, and articulate reflective thinking.
DP2	Grounding in Teachers' Own Classroom Practice	Refined	Teachers added the importance of small, immediately applicable steps rooted in their own classroom contexts.
DP3	Experiential and Iterative Learning	Refined	Teachers indicated that experiencing feedback and reflection processes themselves was essential for developing the facilitation skills needed to guide students effectively.
DP4	Video-Supported Reflection	Not mentioned	Although not explicitly mentioned by teachers, video-supported reflection was retained due to its strong theoretical grounding and its recognised potential to support reflective analysis of classroom practice.
DP5	Collaborative Teacher Groups	Confirmed	Teachers valued peer support, shared sense-making, and opportunities to exchange practical strategies.
DP6	Sufficient time	Confirmed	Teachers noted that longer-term PD programs are necessary to practise, revisit, and embed feedback and reflection practices in everyday teaching.
DP7	Connecting Scientific Literature to Practice	Refined	Teachers expressed a need for active facilitation in interpreting scientific literature and translating insights meaningfully into classroom practice.
DP8	Differentiated Approach	Refined	Teachers emphasised the importance of professional learning aligned with individual expertise, learning goals, and school contexts.

6.2.2. Design and construction of the CTR program

Guided by the eight DPs, the program was structured in successive phases. Given that an exploratory study (Görtzen et al., 2025) reported that teachers had limited experience facilitating feedback dialogues and reflection practices were largely absent in several of the nine participating schools, the first year focused on feedback dialogues as a foundational practice. The second year built on this foundation by adding guidance of structured student reflection tasks.

During the first year, teachers analysed video recordings of their classroom feedback dialogues, guided by five research-informed key elements: teacher readiness, student readiness, feedback content, interaction mode, and the use of behavioural observations. (Adarkwah, 2021; Ajjawi & Boud, 2017; Boodt, 2014; Boud & Dawson, 2021; Evans, 2015; Garino, 2020; Winstone et al., 2017).

In the second year, the program incorporated an action framework for guiding student reflection, comprising five key practices: clarifying task purpose, supporting personal learning goals, fostering iterative reflection, assessing reflection depth, and facilitating feedback dialogues (Black & Allen, 2017; Gadsby, 2022; Gordijn et al., 2018; Grossman, 2009; Moon, 2013; Saks, 2024).

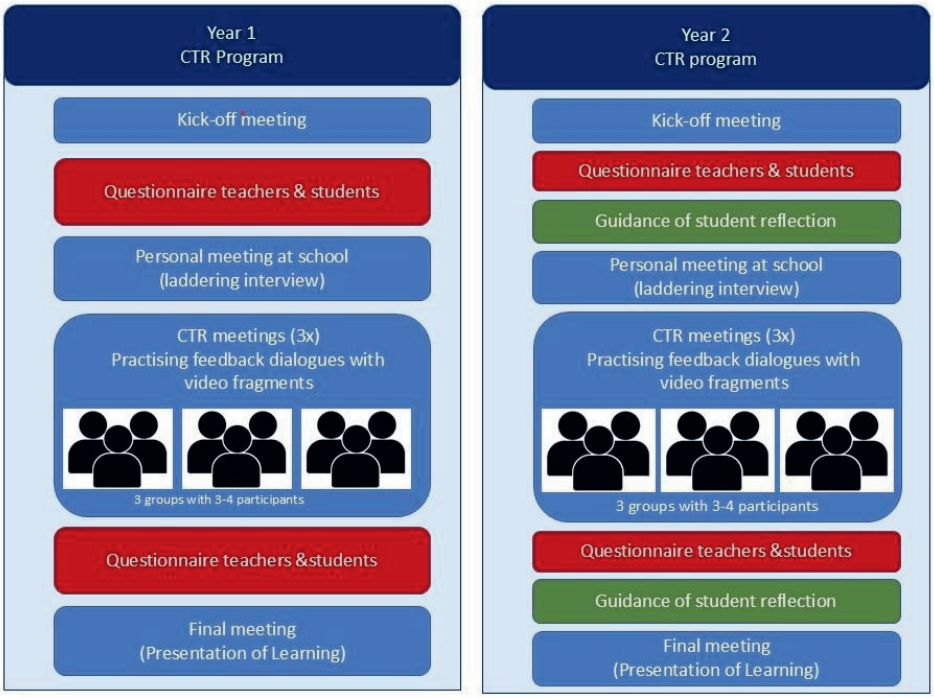
In both years, the program comprised five collaborative group meetings and one personal meeting. The program was carried out by the first researcher, taking a dual role as facilitator and researcher. Figure 6.1 presents the program's main components. These components are described in more detail below, including their substantiation by the eight DPs.

Kick-off meetings

The kick-off meetings were joint sessions for all participants, organized to establish a psychologically safe (DP1) and collaborative (DP5) professional learning community, while laying the foundation for implementing feedback dialogues (Year 1+ Year 2) and guiding student reflection (Year 2) in classroom practice (DP2). Teachers were introduced to relevant research literature on feedback and reflection, which was jointly discussed to develop a shared understanding of key concepts and their relevance to practice (DP7). To make teachers' existing practices and assumptions explicit, they created individual mind maps to visualise their current classroom practices and identify areas for development. Collaborative reflection on these mind maps supported the translation of theory into practice (DP7), helping teachers to use theoretical insights in their own classroom contexts.

Figure 6.1

Components of the CTR program per year



Note: Blue indicates CTR meetings; red indicates teacher and student questionnaires on perceived feedback practices; green indicates implementation of the five reflection-guidance actions.

Between the kick-off meetings and the CTR meetings, a personal meeting was held at each teacher's school. During this meeting, teachers worked individually with the facilitator-researcher to formulate their personal learning goals using a laddering interview (van Veen & Janssen, 2016). Setting individual learning goals supported a differentiated approach (DP8) tailored to each teacher's experience and needs.

CTR meetings

CTR meetings enacted the DPs of collaborative (DP5), practice-based (DP2), and iterative professional development (DP3), supporting self-directed learning and integration of theory and practice (Knowles, 1980; Kolb, 2014). The participants of the CTR program were organised into three separate learning communities, each of three to four teachers. Each community met independently on three occasions, for approximately three hours per session. Across meetings, teachers engaged in a recurring three-phase cycle consisting of (1) classroom enactment and video preparation, (2) collaborative video-based reflection during the CTR meeting, and (3) classroom experimentation and refinement.

Phase 1. Classroom enactment and video preparation: Teachers implemented feedback dialogues in their classrooms (DP2) and recorded entire feedback interactions with students. From these full recordings, they selected specific video fragments (DP4) that illustrated either effective practice or situations that raised questions for reflection. This allowed teachers to revisit and closely analyse complex classroom episodes, supporting their reflection on classroom interactions and enabling more accurate assessments of their own practice.

Phase 2. Collaborative video-based reflection (CTR meeting): During the CTR meeting, teachers shared selected video clips within their learning communities (DP5). Together with the facilitator-researcher, they systematically analysed the recordings using a viewing guide that connected classroom events to relevant research concepts (DP7). Through structured peer dialogue, teachers posed questions and practised feedback dialogues, fostering collaborative sense-making and mutual support (DP5). Each meeting concluded with an individual reflection task in which teachers used peer and researcher feedback to evaluate their personal learning goals and formulate concrete next steps, thereby engaging in experiential and iterative learning cycles (DP3).

Phase 3. Classroom experimentation and refinement. Following the meeting, teachers applied insights gained from the discussion in their classrooms (DP2). These revised practices were again recorded to inform the next cycle of video selection and collaborative reflection (DP4). In this way, the program enacted sustained, iterative practice and feedback-informed improvement, ensuring continuity across meetings and gradual refinement of teaching practices (DP3).

Final meetings

In the final meetings, teachers delivered a presentation of learning (PoL), a reflection format commonly used in R&D lessons (Schalk & Bruning, 2014), in which they revisited personal learning goals, summarised actions taken, and reflected on their personal learning goal (DP3). The PoL also operationalised DP7, as teachers articulated how theoretical program insights informed their classroom practice. Public sharing of reflections promoted collaborative sense-making, reinforced peer recognition (DP5), and modelled the reflective processes they aim to foster in students (DP2). To assess the

feasibility of the CTR program (SQ3), the final session additionally included an in-depth focus group interview with all participating teachers, facilitated by the first researcher who had been involved in the design and implementation of the program. The sessions further supported continuity in professional growth (DP6) by encouraging teachers to formulate new goals for the following school year (DP8) and sustaining iterative development over time (DP3).

6.2.3 Evaluation of the CTR program

The design of the CTR program was evaluated through a 2-year pilot study addressing SQ2 and SQ3. To examine the effects of the PD program (SQ2) on teachers' professional learning and students' reflective practices, outcomes were analysed at (a) the teacher level, focusing on changes in teachers' facilitation of feedback dialogues and guidance of student reflection, and (b) the student level, examining how these changes were reflected in students' perceptions of feedback practices and the depth of their reflections. This article presents a synthesis of the main findings, while more detailed analyses were documented in an internal research report (Görtzen et al., 2026b). The feasibility of the PD program (SQ3) was assessed through an analysis of participants' experiences with the program in practice, drawing on a focus group discussion conducted with all participating teachers during the final CTR meeting. Together, these evaluations informed judgements regarding the robustness of the CTR program and guided the evidence-informed refinement of its DPs.

Participants in the CTR program

Ten R&D teachers from nine Technasium schools responded to an open invitation in a national newsletter distributed by the Dutch Technasium Foundation. Ethical clearance was obtained prior to the CTR program. Teachers freely selected one class in which feedback dialogues (Year One) and guidance of students' reflection (Year Two) would be practised. These classes varied in both their size and the age of the students. In the first year, 10 teachers participated; seven of them continued into the second year, joined by one new participant. In the second year, all eight participating teachers were assigned to new classes, which required them to work with different groups of students when practising feedback dialogues and facilitating reflective tasks. Participant information is presented in Table 6.2.

Table 6.2

Participant information.

		CTR Year 1 (22-23 Class)		CTR Year 2 (23-24 Class)	
Name*	Teaching Experience R&D (years)	Number of students	Student age (years)	Number of students	Student age (years)
Rick	0-5	24	12-13	12	15-16
Sarah	6-10	21	16-17	31	16-17
Norah	11-15	10	16-18	8	15-16
Lian**	6-10	12	15-16	-	-
Esther**	6-10	-	-	23	16-18
Marit	0-5	21	14-15	19	15-17
John	6-10	24	16-18	13	15-17
Irene	0-5	13	16-18	17	15-16
Robert	11-15	10	15-16	25	13-14
Karel	6-10	20	15-17	-	-

** Names are pseudonyms*

*** worked at same school*

Program outcomes

Teacher-level outcomes: facilitating feedback dialogues (SQ2a). By the end of the second year, most participating teachers reported professional growth in facilitating feedback dialogues. Teachers' professional learning was examined through reflexive thematic analysis of 78 hours of interviews and group discussion transcripts, resulting in individual vignettes (described in the longer report) that captured professional growth over the two-year period. These vignettes focused on five key areas: teacher readiness, attention to student readiness, feedback content, interaction mode, and the use of behavioural observations to substantiate feedback. Eight of the 10 teachers showed development in at least two of these areas. Nearly all teachers had integrated feedback dialogues into their classroom practice, including several for whom this approach was entirely new. Throughout the CTR meeting discussions, teachers' understanding of feedback evolved. They became better able to interpret students' responses and were more aware of the emotional dimensions of feedback, enabling more adaptive facilitation (Ajjawi et al., 2022; van der Kleij & Adie, 2020). Teachers with prior experience refined their practice, for instance, by differentiating between individual and group dialogues, while less experienced teachers implemented feedback dialogues more systematically in their routines. This combination of conceptual development and practical enactment contributed not only to improved teacher confidence and skills but also appeared to

strengthen teacher–student relationships (Görtzen et al., 2026b). The CTR program thus fostered both understanding of what effective feedback dialogues entail and the ability to enact them in practice.

Teacher- and student-level outcomes: Perceptions of feedback practices (SQ2a and SQ2b). Additional positive outcomes emerged from questionnaire data examining changes in perceptions of feedback practices among the teachers and their students. The questionnaire consisted of two scales evaluating feedback *about* the student, representing teacher-led feedback, and feedback *with* the student, representing dialogic practices involving students (van der Kleij et al., 2019). Student responses showed an increase in "*About the student"*-scale in both years. A statistical significant increase (p = .017) in *'With the student'*scale was observed in the second year, suggesting a shift towards more student-centred feedback practices as teachers gained experience with facilitating feedback dialogues. Teachers' questionnaire results showed a more mixed pattern. Some perceived increased dialogic engagement, while others reported little change or a slight decline. Comparisons between teacher and student ratings in the second year revealed both convergence and divergence on "'With the student'" Scale. Overall, the questionnaire findings suggest that teachers' professional learning within the CTR program was accompanied by increased student participation in feedback conversations, although this development was not evident in the first year and was not uniform (Görtzen et al., 2026a).

Teacher- and student-level outcomes: Guiding reflection and reflective depth (SQ2a and SQ2b). Further indications of the program's strength were found in teachers' development about the use of student reflection tasks and changes in the depth of students' written reflections. Teachers increasingly clarified the purpose of reflection tasks and supported students in formulating achievable personal learning goals. Reflection was embedded more consistently through iterative tasks, and teachers became increasingly proficient in assessing students' written reflections and offering feedback aimed at deepening reflective thinking. Engagement in feedback dialogues also became a more stable element of practice, reflecting a growing understanding of how dialogue could support students in interpreting and using feedback meaningfully for reflection (Carless & Winstone, 2020; Moon, 2013). Teachers reported increased confidence in facilitating students' reflection and greater awareness of their role as facilitators. Several teachers noted that guiding student reflection required developing their own reflective competence, highlighting the reciprocal relationship between teacher and student reflection (Veine et al., 2020; Welch, 1999). At the student level, their written reflections showed a clear increase in reflective depth (across all classes) as assessed by the researcher using Wallman et al.'s (2008) reflection levels.

Program feasibility

To assess SQ3, the feasibility of the CTR program, the final meeting included an in-depth focus group interview with the participating teachers. The interview was facilitated by the first researcher, who had been involved in the design and implementation of the program. The discussion was structured using the model proposed by Ter Beek et al., (2022), which distinguishes three interrelated domains influencing PD outcomes: PD characteristics (e.g., active participation, pedagogy, program structure), teacher characteristics (e.g., prior knowledge, beliefs, motivation), and organisational characteristics (e.g., leadership, institutional vision, support for innovation). While the PD characteristics were reflected in the DPs, teacher and organisational characteristics provided important context for understanding the conditions under which the CTR program was experienced as feasible. The following text presents the evaluation findings with respect to these three domains.

PD characteristics. Overall**,** teachers valued the CTR program for its clear relevance to their classroom practice. In their responses, they spontaneously referred positively to most design principles (DPs), showing appreciation for the way these principles were enacted in practice. They particularly emphasised the program's practical orientation (DP2) and its strong connection between theory and practice (DP7), noting that scientific insights became meaningfully applicable in their classrooms. As Sarah and Robert reported in sequence, co-constructing their response, *"It was nice that the scientific insights were translated into the R&D practice."* Irene added: "Josine *(facilitator-researcher) translated the theory into small, manageable steps and provided tools to understand it."*

Teachers appreciated the active and varied learning exercises. Collaborative reflection (DP5), hands-on exercises (DP2), and video analysis (DP4) were experienced as both challenging and highly meaningful. They noted that the program was deliberately structured to follow the reflective processes they would later facilitate with their students (DP3). As Irene noted: *"What you learned could be immediately applied in practice. Your own teaching was central, you had to film your lessons, and the theory could be put into practice right away. We went through all the steps that students themselves must complete".* Receiving and discussing feedback on their own feedback conversations was described as *"very concrete and immediately applicable"* (Lian), reinforcing the program's hands-on, practice-based approach (DP2).

Formulating concrete personal learning goals gave teachers direction and ownership over their development (DP8). The laddering interviews were considered particularly insightful. As Robert reflected, *"We formulated our own learning goals, and the laddering interview held up a mirror for us. This could also be used with students to help them formulate their own goals."*

Teachers valued the two-year duration of the CTR program (DP6), which allowed theoretical concepts and practical skills to become consolidated and integrated into daily practice (van Veen et al., 2010). Esther and Irene contributed consecutively, building on

each other's comments: *"Two years is just right and logical because it requires a lot of practice. Learning happens through repetition."* Rick added, *"In the first year, I wasn't sure what I was going to learn; by the second year, I knew what I needed to do and what I was going to learn"."* The extended timeframe enabled confidence-building, repeated engagement with tasks, and more lasting change. Norah emphasised the value of regular practice, noting that three CTR meetings per year was *"really the minimum to keep your learning goals alive."*

Unexpectedly, a new DP appeared: teachers highlighted the important role of the facilitator-researcher in the program's design, providing guidance while allowing space for reflection. Irene explained, *"The dual role of facilitator-researcher was great during reflection moments. She (facilitator-researcher) added tips at the end, complementing our discussion of what we observed and felt."* Rick added, "*The role of the facilitator is very important. Her ability to highlight what goes well greatly influenced how we responded to each other as a group."* The facilitator-researcher's presence and input were therefore seen as essential in supporting teachers' learning, fostering constructive dialogue, and reinforcing the collaborative learning environment.

Teacher characteristics. In general, teachers' individual characteristics acted as important enablers, supporting the implementation of the CTR program's DPs and creating the conditions necessary for meaningful learning. In particular, teachers' reflective disposition and readiness to examine their own practice played a central role in their personal professional growth. Participants emphasised the importance of personal openness to learning and self-examination as a prerequisite for development. As Irene noted, "*We all had a good mindset to begin with, and that is probably the basis for making progress in reflection and steps forward. You need to be open to it."*

In addition to individual dispositions, teachers highlighted the importance of interpersonal characteristics at the group level, such as trust and psychological safety (DP1), and willingness to share practices (DP5). These conditions were seen as essential for creating a supportive learning environment in which reflection and feedback could occur openly. Norah emphasised the importance of psychological safety (DP1): "*Safety is very important to be able to say and learn what you want. This safety was definitely present during the CTR program."* Teachers also valued collaborative learning with colleagues (DP5). As Robert explained, "*You can really work together and learn from each other. In groups, you pick things up faster*," and John added, "*I really enjoyed sharing video fragments, discussing feedback and reflecting together with colleagues*."

Motivation was another key teacher characteristic shaping engagement in the program. Teachers emphasised that their belief in the value of feedback and reflection supported sustained involvement (DP6), particularly when pursuing longer-term goals (DP8). They appreciated working in small, manageable steps, which reinforced gradual progress and a sense of personal competence (DP2). As Rick explained, "*Starting from what already goes*

well really helped me stay motivated." Esther added, "*Those small steps gave me success experiences, and that kept me going,"* further emphasising that recognising gradual improvement is essential not only for students but also for teachers themselves: *"We also need to experience those small successes to keep moving forward."* Teachers acknowledged that personal circumstances and workload sometimes constrained their engagement, illustrating how contextual factors interact with readiness and motivation. Participation in the CTR program strengthened teachers' awareness of their own feedback practices (DP2), particularly written feedback, and encouraged deeper reflection on their classroom actions. John reflected, "*This course made me aware that offering written feedback was being overlooked. I can now start small and build up."*
Finally, teachers differed in their learning preferences and approaches to professional growth (DP8). Some required an initial theoretical overview, while others preferred to start with practical experimentation. John noted, "*Frequent repetition helped me stay motivated and embed the theory in practice,"* whereas Irene added, *"Normally I would want the theory first, but learning-by-doing also worked for me."*

Organisational characteristics. Alongside teacher characteristics, organisational characteristics also functioned as important enablers. During the final meeting, participants also thought about how practices from the CTR program could be implemented and sustained within their schools. Teachers reported considerable variation in school support for the R&D curriculum. In settings where leadership attention was limited, feedback and reflection practices might tend to disappear from daily routines. John highlighted the consequences of minimal coordination within the school: "*There is no consultation with all R&D teachers; we just teach and hardly see each other. As a result, attention to feedback and reflection fades into the background."* Similarly, Esther noted declining commitment from her school: *"The Technasium component in my school is increasingly less supported by the school leader, so innovation in my school is difficult."*
Teachers emphasised that embedding CTR practices in school routines requires schools to actively create enabling conditions, particularly adequate time and organisational space for conducting feedback dialogues and reflection activities. Without such conditions, participants noted, sustained use of these practices remains difficult regardless of individual teachers' motivation. At the same time, they recognised that institutional uptake depends on gradual cultural change rather than individual effort alone.
Teachers further stressed that visible changes in classroom practice and student outcomes play a key role in motivating colleagues to engage in feedback dialogues for students' reflection. Teachers who participated in the CTR program could assume an expert role within their teams, acting as ambassadors for the practice. "*By jointly discussing the rationale behind feedback and reflection practices and agreeing on manageable steps for implementation, teams can develop a shared understanding and a coordinated approach"* (Norah). Such structurally supported collaboration helps align individual initiatives with

school priorities and creates the organisational conditions necessary to sustain reflective practices beyond the CTR program. In all, these organisational characteristics appeared to be so important that an additional DP could be formulated.

6.3 Conclusion and discussion

This study addressed three SQs to address the overarching design-oriented research question. The corroboration of literature-based DPs by teachers' experiences (SQ1) resulted in eight final DPs to inform the program. SQ2 examined the effects of the program. At the teacher level (SQ2a), teachers grew in their facilitation of feedback dialogues and guidance of student reflection, while their own reflective competence and confidence was strengthened. At the student level (SQ2b), students reported experiencing more feedback dialogues, and their written reflection tasks demonstrated increased depth of reflection. The feasibility or success of the program (SQ3) relied on extended program duration, repeated cycles of practice, and collaborative teacher groups, which enabled teachers to adopt new practices and embed them sustainably into daily routines.

Answering the main research question

Taken together, the findings regarding each of the SQs that were investigated indicate that effective PD depends not only on well-designed, research-informed activities but also on skilled facilitation of the PD program and enabling organisational conditions. The study provides support for 10 DPs underpinning PD programs that strengthen teachers' ability to facilitate feedback dialogues and guide student reflection:

- Eight refined DPs derived from the literature and validated in practice (DP1–DP8).
- Two additional principles identified in practice: DP9, the facilitator's role and DP10, organisational conditions.

DP's and practical advice

The following section distils insights from the design, enactment, and evaluation of the CTR program, highlighting what can be learned from the facilitator's role in enacting the design principles. Lessons are presented according to the refined design principles and include practical guidance for PD designers.

1. Psychologically safe learning environment

A psychologically safe learning environment is a prerequisite for meaningful professional learning and should be actively created throughout the program.

- Actively invest in psychological safety from the outset, using low-risk, non-evaluative activities, and adopt an approach that builds on teachers' existing strengths to sustain motivation and professional confidence.

- Recognise the facilitator's central role in establishing and maintaining safety through a supportive stance, sensitivity to group dynamics, and responsiveness to participants' needs.
- Begin with face-to-face sessions (e.g., intake interviews) to build trust before meeting as a group, and ensure facilitators are well prepared (e.g., through a train-the-trainer program).

2. Grounding in teachers' own classroom practice

PD is most effective when learning activities are closely connected with teachers' everyday classroom practice and can be translated into immediate action.

- Explore and understand teachers' classroom and school contexts (e.g., through visits or conversations) to adapt professional learning activities and use relevant examples.
- Design exercises as small, concrete steps that can be applied directly in teachers' own classrooms, using context-specific illustrations.
- Sequence feedback dialogues and student reflection as distinct but connected practices over at least two years, so teachers can develop understanding while students experience these practices as linked and mutually reinforcing.

3. Experiential and iterative learning

Professional learning is strengthened when teachers experience in an iterative way the same learning processes they are expected to facilitate with their students.

- Design PD activities in which teachers themselves enact the full cycle of feedback and reflection, so they develop a deeper understanding of how these processes interrelate and function in classroom practice.
- Structure programs iteratively and over a sufficient timespan, allowing teachers to refine and deepen practices, rather than treating learning as a one-off intervention.
- Create opportunities for participants to share PD experiences with colleagues not involved in the program, as these exchanges help make both the feasibility and the value of iterative approaches visible within schools.

4. Video-supported reflection

Video can be a powerful tool to enhance teachers' reflection on feedback and student learning, but its use requires careful support and enough time for adaptation.

- Give teachers ownership over which video fragments to analyse or share, allowing them to focus on moments most relevant for their development.
- Provide structured guidance in selecting and analysing video fragments, gradually reducing support as teachers become more confident and proficient in using video for reflection.

- Allow time for both teachers and students to become familiar with video-based observation.
- Use video not just for critique, but as a support for dialogue and reflection, helping teachers connect classroom practices with student learning.

5. Collaborative teacher groups

Collaborative learning in small teacher groups accelerates professional growth.

- Organise teachers into small, stable groups to build and sustain trust, openness, and collaboration.
- Ensure adequate time for teachers to share experiences and discuss classroom practices and feedback processes and actively promote inclusive participation to ensure that all teachers, including quieter or more hesitant members, have the opportunity to contribute.
- Support motivation and relevance by allowing teachers to select topics or challenges that are meaningful for their own development.

6. Adequate time

Having enough time is essential for teachers to experiment, repeat, and embed new practices effectively, enabling confidence building and sustainable change.

- Allocate extended time for professional learning, ideally spreading the program over multiple years, to enable teachers to engage in successive cycles of enactment, reflection, and refinement.
- Schedule regular sessions or checkpoints (e.g., three or more meetings per year) to maintain teachers' engagement and ensure continuity in their professional learning process.

7. Connecting scientific literature with practice

PD is most effective when scientific insights are translated into actionable, classroom-relevant practices that teachers can immediately apply.

- Ensure that facilitators are knowledgeable about the relevant literature and experienced in classroom practice, enabling them to translate theory into concrete, manageable steps and maintain equal professional status with teachers.
- Provide teachers with practical tools, frameworks, or checklists that make scientific concepts accessible and directly applicable to their own classrooms.
- Ensure that CTR meetings include structured time for joint discussion of theoretical concepts, enabling teachers to develop a shared professional language and to clarify how these concepts can be enacted in practice.

8. Differentiated approach

PD is most effective when it accommodates teachers' individual learning needs and

classroom contexts, allowing for personalised goal setting and learning pathways.

- Use tools or methods (e.g., laddering interviews) to clarify teachers' personal learning goals and classroom context.
- Balance theory and practice flexibly, adapting the sequence of learning activities to teachers' preferences and prior knowledge.
- Support teachers in guiding students to collaboratively formulate their own personal learning goals, building on teachers' first-hand experience of the process.

Two additional DPs

In addition to the eight refined DPs, the feasibility evaluation yielded two additional principles that proved critical for sustainable enactment in practice.

9. Facilitator's role

Moreover, the evaluation revealed that the facilitator-researcher played a mediating role in translating design intentions into classroom enactment. Teachers emphasised that skilled facilitation supported reflective dialogue, fostered motivation and trust, and helped connect research-based insights with practical application.

- Adopt a positive, supportive stance that builds on teachers' existing strengths and fosters trust and motivation.
- Actively reinforce collaborative sense-making and constructive dialogue within the learning community.
- Remain attuned to participants' needs and respond adaptively to emerging group dynamics.

10. Role of organisational conditions

The feasibility evaluation showed that the impact of the CTR program was contingent upon enabling organisational conditions. Although PD must be well-designed and differentiated, its enactment depends on structural and cultural support within the school context. Organisational conditions functioned as enabling or constraining factors for teachers' ability to engage in iterative practice and sustain newly developed classroom routines.

- Secure active leadership support and coordination to prevent feedback and reflection practices from becoming isolated or fading from routine practice.
- Designate protected time and organisational space for conducting feedback dialogues and reflective activities, recognising that sustained enactment requires structural embedding rather than relying solely on teacher motivation.
- Promote collective ownership by facilitating team-level dialogue about the rationale and implementation of feedback and reflection practices, enabling participating teachers to act as ambassadors and fostering gradual cultural change within the school.

Directions for further research

Several considerations frame the scope of these findings and point to future research. Although multiple instruments were used, some measures, such as the teacher and student questionnaires, captured only participants' perceptions of feedback practices rather than objective classroom interactions. Additionally, the differences found between teacher and student perceptions warrant further investigation, for example, through systematic classroom observations.

While eight teachers demonstrated professional growth, two showed limited development due to constrained organisational support, echoing the constrained group identified in our exploratory study (Görtzen et al., 2025) and underscoring the critical influence of school-level conditions, such as leadership, culture, and resources. Future research should examine how these organisational conditions (or DP10) affect the enactment and sustainability of PD programs, particularly the transfer of feedback and reflection practices into classroom routines.

Future research could examine the transfer of the refined DPs to other educational contexts, explore the program's effectiveness with different facilitators, and further investigate the facilitator's role as an explicit design component. Such studies would support continued refinement of the DPs and contribute to cumulative, practice-oriented knowledge regarding PD for feedback and reflection.

In conclusion, this study articulated 10 evidence-informed DPs that highlight, among other things, the importance of attentive facilitation, experiential and collaborative learning, sustained duration, and sensitivity to classroom and organisational contexts. With the help of the CTR program, teacher competences to implement meaningful feedback dialogues that enhance their students' reflection were strengthened.



Chapter 7

Conclusion and discussion

7.1 introduction

This dissertation was driven by a practical need, identified in earlier research (Görtzen, 2019), to support Technasium R&D teachers in learning how to guide students' reflection through feedback dialogues. A challenge faced by these teachers that proved both theoretically complex and difficult to enact in everyday classroom practice. As highlighted in Chapter 1, feedback and reflection are widely understood as mutually reinforcing processes: feedback provides external perspectives that can challenge learners' interpretations, whilst reflection enables students to interpret, integrate, and act upon this information over time (Carless & Winstone, 2020; Hattie & Timperley, 2007; Winstone et al., 2017). Teachers play a central role in orchestrating these processes through facilitation of feedback dialogues and guidance for reflective learning (Korthagen & Nuijten, 2022), but they struggle to enact these processes in classroom practice. Feedback is often reduced to one-way transmission of information, at the same time students' reflective activities remain superficial or fragmented, limiting their contribution to learning (Korthagen & Nuijten, 2022; van der Kleij et al., 2019). These empirical challenges highlight the need to better understand how teachers can be supported in integrating these processes in meaningful ways especially in the context of Technasium. Students' reflection at their learning processes and their personal growth is one of the main objectives of its curriculum (see section 1.2). This dissertation therefore addressed the following central research question: *What should professional development encompass to enable teachers to facilitate feedback dialogues and support students' reflective processes?*

This overarching question was explored through five interrelated studies. Each study addressed a specific aspect of feedback, reflection, and professional development within these processes. The ultimate aim was to design a professional development program (Collaborative Teachers Reflection, CTR) for Research and Development (R&D) teachers in Technasium schools for secondary education.

Study 1: Inventory

1. What conceptions and experiences do Dutch R&D teachers report regarding their process-oriented feedback practices to stimulate students' reflection processes?
2. What learning needs do Dutch R&D teachers have regarding process-oriented feedback practices to stimulate their students' reflection processes?

Study 2: Exploring teachers' growth on feedback processes

3. What growth do teachers show across the five key areas of feedback dialogues during the CTR program?

Study 3: Exploring perceptions of feedback practices

4. Do students rate their teachers' feedback behaviour different pre and post teachers' participation in the CTR program?

5. Do teachers rate their classroom behaviour different pre and post teachers' participation in the CTR program?
6. How do student and teacher perceptions of feedback dialogues correspond?

Study 4: Exploring students' reflection

7. Do students show deeper levels of reflection after their teachers have completed the CTR program?
8. Do the teachers' perceived changes in guidance practices relate to students' levels of reflection?

Study 5: Design, enactment and evaluation of the CTR program

9. What design principles characterise a PD program that supports teachers in facilitating feedback dialogues for student reflection in secondary education?

This final chapter first synthesises the findings across these studies and presents the main conclusions, followed by a discussion of the theoretical contributions. The chapter concludes with directions for future research and recommendations for practice.

7.2 Main findings and conclusions

In the first study (Chapter 2), we examined 23 R&D teachers' conceptions and experiences (RQ1) and learning needs (RQ2) regarding process-oriented feedback and student reflection, since teachers indicated that they struggle especially with discussing process-oriented feedback (Görtzen, 2019). Data were collected through focus group interviews. The analysis of teachers' conceptions and experiences (RQ1) resulted in four teacher profiles; basic, intermediate, advanced, and constrained, indicating how feedback and reflection were understood and enacted in practice. Teachers in the basic group (n = 3) demonstrated a limited understanding of process-oriented feedback and reflection, with feedback remaining largely product-oriented and reflection tasks used infrequently and without clear structure. Teachers in the intermediate group (n = 10) showed a more sophisticated approach, combining product- and process-oriented feedback with reflection tasks, although these practices were not yet implemented in an iterative manner. Teachers in the advanced group (n = 7) integrated feedback and reflection in a more coherent and iterative manner, characterised by ongoing feedback dialogues, continuous monitoring of progress, and a stronger emphasis on student responsibility. A fourth group, labelled as constrained (n = 3), reported that structural barriers such as limited time and insufficient organisational support restricted their ability to implement these practices, regardless of their conceptual understanding. The observed differences in how teachers enacted feedback and reflection (i.e. the four groups) were reflected in the learning needs (RQ2) they articulated. Teachers in the basic group primarily sought support in structuring and implementing reflection tasks, whereas intermediate teachers

want to strengthen the iterative and dialogic nature of their practices. Advanced teachers asked for further refinement and alignment across school years and teaching teams, meanwhile constrained teachers emphasised learning to cope with organisational conditions that would enable enactment. The findings also prompted a reconceptualization of process-oriented feedback. Whereas it was initially conceptualised as a form of feedback information referring to the content communicated to students about their learning processes, the findings suggested it is better understood as an integral element of feedback dialogues. This reconceptualization informed the conceptual framework used in the subsequent studies. To avoid ambiguity, the CTR programme and these studies consistently distinguish between 'feedback information' (the content of feedback) and 'feedback dialogues' (the way feedback is communicated). Taken together, the findings of this study suggested that differences in teachers' enactment of feedback and reflection are shaped not only by their conceptual understanding, but also by their experience with iterative practice and the organisational conditions in which they work.

In the second study (Chapter 3), the professional growth of ten R&D teachers in facilitating feedback dialogues was examined within the context of the two-year CTR program (RQ3). One teacher had also participated in the first study. Given the relatively small sample size, the differentiation into teacher profiles from Study 1 was not applied. Instead, teachers formulated individual learning goals, allowing attention for personal learning needs. The CTR program was designed based on eight evidence-informed design principles from the literature and the inventory study, and it applied a feedback dialogue framework comprising five key areas: teacher readiness, monitoring student readiness, feedback content, interaction mode, and the use of verified observations. These areas served a dual purpose: they informed the professional development activities within the CTR program and provided the analytical framework used to examine teachers' growth.
Teachers were organised into three learning communities and participated in structured discussions of video-recorded classroom feedback dialogues. These discussions were audio-recorded, transcribed verbatim, and analysed using reflexive thematic analysis. Professional growth was captured through individual vignettes, describing developments across the five key areas. By the end of the program, eight teachers demonstrated professional growth in at least two of the five areas, yet two showed no observable change. Teachers reported that the first year of the program was primarily needed to develop conceptual understanding, whereas the second year allowed them to put this understanding into practice.
Growth in teacher readiness was reflected in increased confidence, greater awareness of personal demeanour, and more deliberate efforts to create psychologically safe learning environments. Teachers also became more attentive to student readiness, addressing both cognitive and affective aspects of students' engagement. Improvements in feedback content were evident in a more balanced integration of process-oriented and product-

oriented information. In terms of interaction mode, teachers shifted towards a more facilitative, student-centred approach, characterised by using follow-up questions and differentiation between groups and individual students. The use of verified observations became more systematic, enabling students to compare external observations with their own perspectives. Overall, the findings of study 2 suggested that teacher growth in facilitating feedback dialogues involved both the development of conceptual understanding and changes in classroom enactment, with progress occurring across multiple interrelated dimensions. Notably, teacher readiness emerged as a key condition for effective feedback interactions, referring to teachers' awareness of their own behaviour, their sensitivity to students' responses, and their ability to create a psychologically safe environment for dialogue.

In the third study (Chapter 4), changes in teachers' (n=8) and students' (n=155) perceptions of feedback practices were examined (RQ 4, 5, and 6) using a questionnaire consisting of 16 feedback statements for teachers and students. A five-point Likert-scale was used to rate the statements. Data were collected at four measurement points during the two-year CTR program, with two measurement points within each program year. Student questionnaire data were analysed using principal component analysis with Oblimin rotation, resulting in two reliable scales: *'About the Student'*, reflecting teacher-led feedback, and *'With the student'*, reflecting more dialogic feedback practices. Paired t-tests were conducted to examine changes over time at two levels: at class level, comparing the two measurement points within each school year, and at program level, combining data across all students to examine overall trends. On the *'About the Student'* scale, students generally reported increases in teacher-led feedback in both years of the program, suggesting that teachers maintained or strengthened more traditional forms of feedback. Increases on the *'With the Student'* scale were observed only in the second CTR year. As this scale captures dialogic feedback, it was the primary focus of the analysis. In the second year, four classes reported increases in dialogic feedback behaviours, whilst the remaining four showed slight declines or no change. For the teachers' questionnaire data, descriptive analysis of mean scores was used rather than statistical testing, given the small sample size. Four teachers reported positive shifts on the "'With the student'" scale, three showed minimal change, and one reported a slight decline. Noticeably comparisons between teacher and student ratings indicated alignment in only one class but discrepancies in the other classes. This suggests that teachers may find it difficult to accurately assess the extent to which their feedback practices are experienced as dialogic by their students. The findings indicated that the transition from the provision of feedback to the facilitation of feedback dialogues was only partially achieved. Although student involvement increased in several classes, variation in both teacher and student perceptions suggests that dialogic forms of feedback were experienced differently across classroom contexts. Since discrepancies between teachers' self-perceptions and students'

experiences of feedback were evident in most classes, this disparity warranted explicit attention within PD initiatives.

In the fourth study (Chapter 5), the relationship between participation in the CTR program, teachers' guidance practices (RQ7), and the depth of students' written reflections (RQ8) was explored. Eight teachers and 135 students participated in the second year of the CTR program. The study introduced a literature-based framework of five guidance actions: clarifying the purpose of reflection, co-formulating personal learning goals, structuring reflection tasks, assessing reflective depth, and conducting feedback dialogues. The teachers implemented this framework in their R&D lessons. Teachers' guidance practices (RQ7) were examined through coding of transcripts from CTR meetings using this five-action framework, that resulted individual case descriptions. Teachers reported that engaging with the guidance framework, combined with opportunities to practise and discuss its use in CTR meetings, helped them to make their students' reflection more concrete and purposeful in their teaching. Teachers also described increased confidence in facilitating reflection, which they partly attributed to experiencing reflective activities themselves during the program. Differences in how teachers enacted the framework were visible in the case descriptions. For example, prior experience, classroom context, and student characteristics appeared to influence both the pace and nature of change. Students' written reflections, collected at the beginning and end of the second program year, were analysed using a coding scheme based to examine changes in reflective depth. Students' written reflections showed a shift towards more analytical forms of reflection. Whereas initial reflections were often descriptive in nature, later reflections more frequently included consideration of actions, underlying processes, and possible alternatives. This development appeared most pronounced among students who initially demonstrated lower levels of reflection, suggesting that progression from descriptive to analytical reflection may be more readily achieved than movement towards more complex forms of reflective thinking. The findings suggested that a structured guidance framework supports teachers in developing more iterative and confident guidance of student reflection, contributing to deep levels of reflection in students' written work. At the same time, the enactment of the framework appeared to be influenced by the context, including teacher characteristics, student characteristics, and the quality of teacher–student interaction.

The fifth study (Chapter 6) examined the design, enactment, and evaluation of the two-year CTR program, aimed at supporting teachers in facilitating feedback dialogues and guiding student reflection (RQ9). Ten teachers from nine schools and their students (N = 303) participated. The design of the program was informed by eight evidence-informed design principles derived from literature on dialogic feedback, reflective thinking, and professional development. These principles were subsequently compared with the teachers' responses in the inventory study (study 1). Six principles were confirmed, and two were refined Building on these refined principles, the CTR program was developed as a structured professional learning trajectory in which teachers engaged as learners in the same feedback and reflection processes, they were expected to facilitate in their classrooms. Teachers progressed through iterative experiential cycles, testing, adapting, and consolidating their professional learning over time. The evaluation phase consisted of a focus group interview during the final CTR meeting, in which teachers reflected on the program as a whole. Teachers reported that the structured, experiential, and collaborative design supported them in developing a deeper understanding of feedback dialogues and guidance of reflection, applying new practices in their classroom contexts, and building confidence in their facilitative role. The evaluation also identified two additional design principles. First, the facilitator played an important mediating role in translating the professional development (PD) objectives into classroom practice. Second, organisational conditions emerged as factors that either enabled or constrained teachers' enactment of these practices. The findings suggested that an evidence-informed, experiential, and collaborative PD program can support teachers in integrating feedback dialogues and the guidance of student reflection into their teaching practice. In conclusion, in particular, experiencing feedback and reflection processes from a learners' perspective, supported by a skilled facilitator who modelled these practices and fostered trust within the learning community, appeared to be an important condition for teachers' professional growth.

This dissertation set out to examine what teacher professional development should encompass to enable teachers to facilitate feedback dialogues and support students' reflective processes within the Technasium context. Across the five studies, the findings demonstrated that facilitating meaningful feedback and reflection is a complex practice that required more than the provision of feedback information or the assignment of reflective tasks. Rather, effective professional development needed to address two interrelated conditions: supporting teachers in developing a conceptual understanding of feedback dialogues and reflective guidance and engaging them in structured and experiential learning that connects theory to classroom practice.

7.3 Discussion

The discussion is organised around five interrelated themes that appeared when integrating the five studies: refining conceptual frameworks; the importance of teacher readiness, relational aspects, and the role of emotions; the integration of feedback and reflection; resourcing teachers with tools and facilitation; and organisational and personal constraints. Whilst these themes are addressed separately for clarity reasons, the findings consistently point to their interdependence in practice.

7.3.1 Refining Conceptual Frameworks for Feedback and Student Reflection

The findings of the studies in this dissertation suggest that greater conceptual clarity is needed in distinguishing between feedback information and feedback processes (Carless & Winstone, 2020). In Study 1, process-oriented feedback was conceptualised as a form of feedback information, referring to the content communicated to students about their learning processes (Winstone et al., 2017). However, this conceptualisation introduced ambiguity in the conceptualisation itself, particularly regarding the distinction between process-oriented feedback and the broader ways in which feedback is discussed and enacted in teacher–student interactions. From Study 2 onwards, the focus therefore shifted towards the broader concept of feedback dialogues, to better capture the interactive and relational nature of feedback in classroom practice (de Kleijn, 2021; van der Kleij et al., 2019). Building on these insights, an adapted model of feedback dialogues was developed (see figure 3.5), drawing on the work of Carless and Winstone (2020), Moon (2013), and Boud and Dawson (2021), in which a clearer distinction is made between feedback information and the enactment of feedback. Within this model, process-oriented feedback is positioned as part of feedback content, alongside product-oriented information. In addition, the broader notion of feedback processes is reconceptualised as **feedback competences**, referring to the skills required by teachers and students to actively engage in obtaining, interpreting, and using feedback (Carless & Winstone, 2020). This reconceptualization clarifies that effective feedback dialogues depend not only on the information provided, but also on the competences required to engage in meaningful dialogic interaction.

Another theoretical contribution concerns the conceptualisation of student reflection. In literature, reflection is commonly approached from two complementary perspectives: as a cyclical learning process and as a hierarchical construct capturing the depth of reflection in written reflection tasks. The ALACT model, used in the studies (Korthagen & Vasalos, 2005) provides a framework for structuring the cyclical process of reflection, supporting the transformation of experience into learning (Korthagen & Nuijten, 2022). Complementing this perspective, Wallman et al. (2008), conceptualise reflection in terms of depth, describing a progression from descriptive accounts to more analytical engagement with underlying assumptions. Although both perspectives are well

established, in practice, they are typically applied separately. The findings of this dissertation suggest that integrating them provides a more robust approach to guiding students' reflection. The conceptual contributions on feedback and reflection also supported the translation of theory into classroom practice. By refining these concepts and adding associated competences and actions, teachers also demonstrated conceptual growth.

7.3.2 Importance of teacher readiness, relational aspects, and the role of emotions

Feedback literature makes a case for students' readiness to engage with feedback (Boud & Molloy, 2013; Winstone et al., 2022). The findings of this dissertation highlight the importance of considering **teacher readiness** as an equally significant condition for effective feedback dialogues. In Study 2, teacher readiness refers to teachers' awareness of their own behaviour, their sensitivity to students' responses, and their ability to create a psychologically safe environment for dialogue (Adarkwah, 2021; Evans, 2015; Garino, 2020).

Across subsequent studies, teacher readiness appeared in broader forms, suggesting that it extends beyond momentary preparedness for feedback dialogues. For instance, when guiding students' reflection (Study 4), teachers indicated that they first needed to develop their own reflective competence to be prepared to support students. In the evaluation of the CTR program (Study 5), teacher readiness was reflected in teachers' willingness to participate in collaborative inquiry, their openness to share classroom experiences, and their capacity to engage with uncertainties and challenges within the professional learning community. All these observations suggested that teacher readiness could be understood as a broader professional disposition, encompassing emotional regulation, relational awareness, pedagogical judgement, and reflective competence (Evans, 2015). Teacher readiness could also be related to the teacher profiles identified in Study 1: teachers in the basic and intermediate profiles may have demonstrated more limited forms of readiness, whereas advanced teachers appeared to enact this disposition more consistently.

Despite its apparent importance across our studies, teacher readiness has received relatively limited attention in feedback literature. This may stem from a traditional positioning of teachers primarily as providers of feedback information (van der Kleij & Adie, 2020) rather than as dialogic partners (Carless & Boud, 2018; Winstone et al., 2022). Although some feedback models refer to aspects such as responsiveness or timing (Tielemans et al., 2023), these are rarely conceptualised as part of broader professional skills. As feedback dialogues are not yet fully embedded in educational practice (Ajjawi et al., 2022; Carless & Winstone, 2020), the role of teachers as active participants in feedback interactions with their students, and the readiness this requires, might be under-theorised. From this perspective, teacher readiness functions as a foundational condition that enables teachers to engage productively in feedback dialogues, guide students' reflective learning, and participate meaningfully in professional development.

Closely related to teacher readiness is the role of emotions in feedback dialogues. Feedback inherently evokes emotional responses, which shape how feedback information is interpreted and acted upon (Ajjawi et al., 2022). The findings of our studies reinforced the view that emotions were not peripheral to feedback and reflection, but integral to how these processes unfolded in practice. At the beginning of the CTR program, teachers observed that students often struggled to articulate their emotions or hesitated to share their perspectives during feedback dialogues. Supporting meaningful dialogue and deep reflection therefore required active teacher guidance in creating a relationship in which students feel able to express personal thoughts, feelings, and assumptions (Esser-Noethlichs et al., 2024; Korthagen & Nuijten, 2022).In a safe environment, feedback dialogues appeared to be more effective when teachers attended explicitly to students' emotional responses, for example by recognising non-verbal cues, acknowledging students' perspectives, and sensitively responding (Ajjawi et al., 2022; Ryan & Henderson, 2018). The use of verified observations supported the acceptance and actionability of the feedback information. Relating the feedback to concrete observations, enabled teachers to establish a shared point of reference, to reduce ambiguity and to support students in relating external feedback to their own experiences. This appeared not only to enhance the credibility and acceptance of feedback (Boodt, 2014; Voerman et al., 2015), but also to contribute to the quality of the teacher-student interpersonal relationship (Hoogendijk et al., 2020).

The studies in this dissertation suggested that teacher readiness, attentiveness to emotions, and the quality of relational aspects were interconnected dimensions that shaped the ways how feedback and reflection practices actually unfolded. As such, these dimensions warranted greater attention in both conceptual frameworks and empirical research.

7.3.3 Learning to integrate feedback dialogues and reflection

As described before, feedback and reflection are theoretically conceptualised as closely interconnected processes (Carless & Winstone, 2020; Moon, 2013). However, the findings of our studies indicated that these processes were not initially experienced as an integrated whole in classroom practice. Reflection tasks supported students in structuring their experiences, identifying relevant aspects, and considering alternative actions, while feedback dialogues provided opportunities to discuss this information and deepen understanding (Grossman, 2009; Korthagen & Nuijten, 2022). In this sense, reflection tasks functioned as preparation for feedback dialogues, whereas feedback dialogues, in turn, extended and refined students' reflective thinking.

In the CTR program, feedback dialogues and the guidance of reflection were introduced sequentially rather than simultaneously. This design choice reflected teachers' varying levels of prior experience and learning needs. In practice, teachers did not always experience feedback and reflection as closely interconnected processes. Several teachers

reported difficulties in facilitating feedback dialogues and in guiding students' reflection tasks.

To address this, the program made the rationale for this sequencing explicit, linking theoretical insights on the relationship between feedback and reflection to classroom practice. A key principle was that teachers needed to be able to facilitate feedback dialogues before they could effectively support guided reflection. While this staged approach supported teacher learning, it also highlighted a tension between the theoretical coherence of feedback and reflection as interconnected processes and their practical separation within a professional development program. As noted in previous research (Desimone, 2023; van Veen et al., 2010), complex theory needs to be unpacked in small, manageable steps.

In contrast to the staged and iterative nature of reflection, learning from feedback does not follow a linear sequence but is better understood as ongoing and dynamic (Torrance, 2012). In classroom practice, teachers and students therefore moved back and forth between discussing feedback, interpreting it, and reflecting on actions. To address this complexity, teachers engaged in the same feedback and reflection practices that they were expected to facilitate. This enabled them to develop understanding through experience rather than through abstract explanation alone (Desimone, 2023; Kolb, 2014), consistent with research emphasising that professional learning is most effective when embedded in practice and connected to teachers' routines (Guskey, 2002; van Veen et al., 2010).

Adopting the role of learner appeared to be particularly important for guiding student reflection and was embedded in the CTR program in two ways. First, by completing reflection tasks themselves, teachers developed greater awareness of the cognitive and emotional challenges involved in articulating and making sense of experiences (Korthagen & Nuijten, 2022). This enabled them to recognise similar challenges in their students and respond more sensitively, while also modelling reflective practice (Moon, 2013). Second, by engaging in feedback dialogues with students about written reflections, teachers gained deeper insight into students' intended meanings and the emotional dimensions of their experiences. These dialogues supported the clarification and further development of students' reflections, contributing to more nuanced and analytical accounts over time (Ajjawi & Boud, 2017).

In conclusion, these findings suggest that integrating feedback dialogues and reflection in practice requires not only conceptual alignment, but also opportunities for teachers to experience these processes from a learner perspective, thereby strengthening their ability to guide them in classroom practice (Korthagen & Nuijten, 2022; Moon, 2013).

7.3.4 Resourcing teachers with tools and facilitation

In Study 1, teachers indicated that abstract principles of feedback and reflection were difficult to enact without concrete guidance, a challenge often recognised in literature about PD (Lipnevich & Panadero, 2021; Louws et al., 2017). The interviewed teachers mentioned the need for practical tools that could support them directly in their classroom practice, reflecting what Doyle and Ponder (1977) describe as the practicality ethic: teachers tend to favour resources that are directly applicable to their specific teaching situations. This finding from study 1 informed a deliberate effort across the subsequent studies to develop frameworks and tools that were theoretically grounded as well as directly usable in teaching practice.

Across the studies, four tools were developed in response to this need. First, the adapted feedback dialogue framework (Study 2) provided teachers with a structure for facilitating feedback dialogues, offering guidance across five key areas: teacher readiness, monitoring student readiness, feedback content, interaction mode, and the use of verified observations. For each area, the framework included concrete descriptions and illustrative examples to support classroom application (see Table 3.2). Second, the framework of five teacher guidance actions was designed to support teachers in structuring students' reflective processes (see Table 5.3), drawing on established literature on reflective practice. Third, the coding scheme for reflective depth enabled teachers to assess the quality of students' written reflections and to provide written prompts in the form of open-ended questions (see Appendix 3). Fourth, an exemplar reflection task based on the ALACT model was provided, offering teachers a concrete illustration of how a reflection task structured around the phases of the ALACT model can be designed and used (see Appendix 2).

These resources were introduced and used in different ways within the CTR program. The feedback dialogue framework and the guidance framework were introduced through explanation and structured practice, enabling teachers to become familiar with the underlying principles while experimenting with their application in classroom settings. The coding scheme functioned as a more hands-on instrument, which teachers applied directly to analyse students' written reflections. The exemplar of the reflection task also informed teachers' own design of student reflection activities, inspiring how such tasks could be structured and enacted in their classroom practice. Across the program, teachers reported that access to these concrete resources helped them to structure feedback and reflection more purposefully in their teaching practice.

Next to the tools, the evaluation of the CTR program (Study 5) highlighted the importance of the facilitator in shaping teachers' engagement. Teachers indicated that the facilitator played a key role in fostering reflective dialogue, building trust and motivation within the group, and connecting research-based insights on feedback and reflection to classroom practice. This was particularly relevant given the central role of emotions in feedback and reflection processes (see 7.3.2), which require a psychologically safe environment in which

teachers feel able to share experiences and uncertainties. Research on professional learning communities similarly emphasises the link between such conditions and the quality of facilitation (Gonzalez, 2024; Lapidot-Lefler & Israel, 2024).
In addition to establishing these conditions, the facilitator also modelled the practices that teachers were expected to develop. Within the CTR program, this included attentiveness to participants' readiness as learners, fostering psychological safety, grounding observations in concrete and verified descriptions, and differentiating responses to individual needs (Korthagen & Nuijten, 2022). Facilitation thus functioned not only as a condition for learning, but also as an enactment of the program's core principles of feedback and reflection, with the facilitator serving as a role model that made these principles visible in practice.
It is important to note that the researcher-facilitator in this study held a dual role as an R&D teacher, which allowed examples from classroom practice to be integrated directly into facilitation. While this may have strengthened the authenticity of the program, it also represents a potential limitation, as familiarity with the context may have influenced how the program was experienced and evaluated. This is further addressed in the limitations section.
Taken together, these findings suggested that supporting teachers with feedback and reflection practices involved more than the provision of resources. Rather, the studies indicated that well-designed tools are most effective when introduced in a staged manner and embedded within a supportive professional learning community in which facilitation actively models the practices being developed. In this way, teachers are better able to develop their understanding of feedback and reflection and translate this understanding into classroom practice (Antoniou & Kyriakides, 2013; Korthagen & Nuijten, 2022; van Veen et al., 2010).

7.3.5 Organisational and personal constraints

Across the studies, school organisational conditions emerged as an important factor shaping teachers' ability to engage in feedback dialogues and guide student reflection. This was already apparent in Study 1, where a group of teachers, labelled as constrained, reported that structural barriers such as limited time and insufficient support from colleagues and school leadership restricted their ability to implement these practices, regardless of their conceptual understanding. A similar pattern was observed during the CTR program, where four of the ten participating teachers operated under school conditions that were less than optimal.
At these schools, the enactment of feedback and reflection practices was shaped by a combination of organisational constraints and personal circumstances. Organisational factors included limited R&D hours, a lack of opportunities for consultation with colleagues in similar roles, and discontinuities in school leadership, all of which reduced institutional support for sustained implementation. Teachers emphasised that embedding

CTR practices in school routines requires schools to create enabling conditions, particularly sufficient time and organisational space for feedback dialogues and reflection activities. Without such conditions, sustained use of these practices remained difficult, regardless of teachers' motivation or conceptual understanding.
Personal circumstances further influenced engagement with the program, including periods of illness and other disruptions affecting continuity. These constraints were also reflected in students' experiences, with variation in whether written reflections were followed up with prompts, written feedback, or feedback dialogues. Together, these examples illustrate how organisational and personal factors can disrupt the enactment of feedback and reflection practices, even when teachers intend to implement them consistently (Ter Beek et al., 2022).
The influence of school-level conditions on the sustainability of professional learning is well-documented, particularly the role of leadership support, shared ownership, and protected time in embedding new practices in school routines (Desimone, 2023; van Veen et al., 2010; Antoniou & Kyriakides, 2013; Guskey, 2002). Although these conditions were discussed within CTR program meetings and reflected in vignettes and case descriptions, the program was not designed to address them directly. This limitation led to an additional design principle emphasizing the importance of active leadership support, protected time, and collective ownership as conditions for sustaining these practices beyond the program.

7.4 Follow-up research

The findings of the five studies, point towards several directions for follow-up research direction, concerning the long-term embedding of feedback and reflection practices, the methodological approaches used, the dual role of the researcher, the transfer of the program to other educational contexts, and teacher readiness.
A first research direction concerns the long-term embedding of feedback and reflection practices in schools. Although the studies indicate that teachers developed competences in facilitating feedback dialogues and guiding student reflection during the program, it remains a question to what extent these practices are sustained. The findings from both Study 1 and Study 5 suggest that organisational conditions (play an important role in whether teachers can maintain and further develop newly acquired practices. As the constrained teacher profile in Study 1 and the evaluation findings in Study 5 both illustrate, structural barriers can restrict enactment even where teachers have the intention and knowledge to implement these practices. From an ecological perspective, the sustainability of newly acquired practices depends not only on individual teacher competences, but also on the structural and cultural conditions within which teachers work (Priestley & Drew, 2019). Follow-up research could therefore examine how different organisational conditions support the long-term integration of feedback and reflection

practices within everyday teaching routines, and what forms of continued support are needed after a professional development program is finished.

A second direction for follow-up research concerns the methodological approaches used to investigate teachers' and students' experiences. The studies in this dissertation relied predominantly on data from teachers, including mind maps, vignettes, case descriptions, and interview data from focus groups. The student questionnaire (study 3) provided a complementary perspective but captured perceived rather than directly observed classroom practices. Teachers' self-reports may be influenced by tacit standards or discrepancies between intended and enacted behaviour, whereas student perceptions may be shaped by personal, contextual and relational factors. Although data were collected from multiple sources (teachers, students, and the researcher) regarding the same practices, the absence of systematic classroom observations limits the conclusions that can be drawn about how feedback dialogues and the guidance of reflection actually unfolded in classroom interaction. It is worth noting that video recordings were made of individual classroom events, providing a partial indication of enacted practices, though these did not capture a complete picture of classroom interaction over time. Follow-up research could complement perception-based data with more comprehensive observations and student interview data. Besides, further research could also examine whether questionnaire instruments can be more closely aligned with the specific tools and frameworks used in the program.

A third direction concerns the dual role of the researcher as both facilitator and investigator, which may have introduced interpretive bias, despite the use of strategies such as member checking, team discussions, and external auditing. Within Educational Design Research, teachers can take on different roles, ranging from practitioners to collaborators and teacher-researchers, each entailing varying degrees of responsibility and engagement (McKenney & Reeves, 2019). In this study, the researcher-facilitator combined practical knowledge of classroom practice with research expertise, which supported the translation of theoretical insights into concrete program activities. Future research could examine how this dual role influences program enactment and outcomes, for example by investigating whether programs facilitated by independent researchers, teacher-researchers, or combinations of both lead to different learning experiences and results.

A fourth direction concerns the transfer of the CTR program to other educational contexts. The present studies were conducted within a specific setting involving Technasium schools, where the R&D course has particular curricular aims and emphasises project-based learning. Even within this relatively experienced group of R&D teachers, considerable variation was found in how teachers enacted feedback dialogues and guided student reflection. This variation within a relatively familiar context suggests that caution is needed when considering the transfer of the program's approach to other educational settings or teacher groups, where prior experience and contexts may differ more

substantially (Priestley & Drew, 2019). Follow-up research could investigate how the design of the CTR program functions when implemented in other educational contexts, and how its core elements may prove robust or require adaptation while maintaining the conditions that support meaningful professional learning.

Finally, the findings point to a need for further conceptual and empirical work on teacher readiness within feedback and reflection practices. As discussed in section 7.3.2, teacher readiness emerged across the studies as a broader professional disposition, yet it remains under-theorised in the existing literature. Follow-up research could examine how teacher readiness develops over time and how professional development programs can more explicitly attend to this dimension.

7.5 Implications for practice

The findings of this dissertation have several implications for the professional development of both pre-service and in-service teachers seeking to support feedback dialogues and students' reflective learning in secondary education.

A first implication concerns the integrated treatment of feedback and reflection in teacher education and professional development programs. Although these processes are closely interconnected, they are often addressed separately in both initial teacher education and continuing professional development. Providing opportunities for teachers to experience how feedback information can stimulate reflective learning, and how reflection can support the interpretation and use of feedback, may help them develop a more coherent understanding of these processes and their role in classroom learning. The frameworks and tools developed within this dissertation offer evidence-informed starting points for designing such integrated approaches.

Developing competence in these practices also requires time and structural support, which has implications for both professional development programs and schools. Programs should provide sustained opportunities for experimentation, reflection, and refinement, rather than one-off training or isolated interventions. At the school level, feedback dialogues and the guidance of student reflection require dedicated time and space within classroom schedules, as well as collegial collaboration and leadership support. Where these conditions are absent, even motivated and knowledgeable teachers may find it difficult to sustain these practices consistently. Creating and protecting the structural conditions needed for feedback and reflection to become part of regular teaching practice is therefore a shared responsibility that extends beyond the individual teacher.

A further implication concerns the role of students in teachers' professional development. Students are often the first to notice changes in their teachers' practice, and their perspectives can provide valuable insights into the impact of newly developed approaches. In this study, several teachers received responses from students indicating that feedback dialogues were experienced positively. Students reported feeling seen and

valued, and some indicated that “this new way of working” had strengthened their relationship with their teacher. These observations suggest that incorporating student feedback and perceptions of classroom practice into professional development programs may enrich teachers’ understanding of their own development and contribute to more meaningful and responsive teaching.
Finally, the findings of this dissertation carry implications for curriculum policy within the Technasium context. The research has shown that weekly reflection tasks and regular feedback dialogues require dedicated time and consistent embedding within the R&D curriculum. Current developments, in which the hourly norm for R&D may be relaxed, introduce a risk that school leaders reduce contact hours, thereby undermining the conditions that this research has shown to be necessary for sustaining these practices. The findings suggest that Technasium, and its curriculum framework, would benefit from continuing to safeguard sufficient time for reflection and feedback dialogues as structural components of the R&D course, rather than leaving this to the interpretation of individual schools.

In conclusion this dissertation has sought to address what professional development needs to encompass to enable teachers to facilitate feedback dialogues and support students’ reflective processes. The findings across the five studies suggest a set of interrelated features and conditions that together shape this development.
Teachers benefited first from developing a clear conceptual understanding of feedback dialogues and reflective guidance, supported by concrete tools that translate these ideas into everyday classroom practice. At the same time, engaging in feedback and reflection as learners themselves appeared to deepen their awareness of both the cognitive and emotional dimensions involved, and strengthened their ability to guide similar processes with students. Professional development that is experiential, collaborative, and actively facilitated further supported this growth, as it helped teachers connect theory to practice and built confidence in their facilitative role.
However, these individual and program-level features are not sufficient on their own. Sustaining new practices beyond the professional development context requires organisational support and giving voices to all participants (students, teachers, facilitators and researchers). Realising the potential of feedback dialogues and reflective guidance therefore requires a shared commitment from practitioners and researchers to create and sustain the professional development features as well as
companying conditions in under which these practices can take root in everyday teaching.

References

Adarkwah, M. A. (2021). The power of assessment feedback in teaching and learning: A narrative review and synthesis of the literature. *SN Social Sciences, 1*, 75. https://doi.org/10.1007/s43545-021-00086-w

Airasian, P. W., & Gullickson, A. (1994). Teacher self-assessment: Potential and barriers. *Kappa Delta Pi Record, 31*(1), 6–10. https://doi.org/10.1080/00228958.1994.10531885

Ajjawi, R., & Boud, D. (2017). Researching feedback dialogue: An interactional analysis approach. *Assessment and Evaluation in Higher Education, 42*(2), 252–265. https://doi.org/10.1080/02602938.2015.1102863

Ajjawi, R., Olson, R. E., & McNaughton, N. (2022). Emotion as reflexive practice: A new discourse for feedback practice and research. *Medical Education, 56*(5), 480–488. https://doi.org/10.1111/medu.14700

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology and Health, 26*(9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995

Akkerman, S., Admiraal, W., Brekelmans, M., & Oost, H. (2008). Auditing quality of research in social sciences. *Quality and Quantity, 42*(2), 257–274. https://doi.org/10.1007/s11135-006-9044-4

Ananiadou, K., & Claro, M. (2009). 21st century skills and competences for new millennium learners in OECD countries. *OECD Education Working Papers, 41*. https://doi.org/10.1787/218525261154

Antoniou, P., & Kyriakides, L. (2013). A dynamic integrated approach to teacher professional development: Impact and sustainability of the effects on improving teacher behaviour and student outcomes. *Teaching and Teacher Education, 29*(1), 1–12. https://doi.org/10.1016/j.tate.2012.08.001

Barr, N., Hartley, K., Lopata, J. A., McFarlane, B., & Mcnamara, M. J. (2022). Learning in an uncertain world: Transforming higher education for the Anthropocene. In R. A. Beghetto & G. J. Jaeger (Eds.), *Uncertainty: A catalyst for creativity, learning and development* (pp. 337–357). Springer International Publishing. https://doi.org/10.1007/978-3-030-98729-9_18

Black, S., & Allen, J. D. (2017). Part 2: Goals, mindset, and self-regulation. *Reference Librarian, 58*(2), 159–173. https://doi.org/10.1080/02763877.2016.1221787

Bock, T., Thomm, E., Bauer, J., & Gold, B. (2024). Fostering student teachers' research-based knowledge of effective feedback. *European Journal of Teacher Education, 47*(2), 389–407. https://doi.org/10.1080/02619768.2024.2338841

Boodt, S. (2014). Making observation feedback effective. *The ESOL Journal, 25*(1), 9–15.

Borko, H., Jacobs, J., & Koellner, K. (2010). Contemporary approaches to teacher professional development. In P. Peterson, E. Baker, & B. McGaw (Eds.),

International encyclopedia of education (3rd ed., pp. 548–556). Elsevier. https://doi.org/10.1016/B978-0-08-044894-7.00654-0

Boud, D., & Dawson, P. (2021). What feedback literate teachers do: An empirically-derived competency framework. *Assessment and Evaluation in Higher Education, 48*(2), 158–171. https://doi.org/10.1080/02602938.2021.1910928

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment and Evaluation in Higher Education, 38*(6), 698–712. https://doi.org/10.1080/02602938.2012.691462

Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology, 18*(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Broekkamp, H., & van Hout-Wolters, B. (2007). The gap between educational research and practice: A literature review, symposium, and questionnaire. *Educational Research and Evaluation, 13*(3), 203–220. https://doi.org/10.1080/13803610701626127

Cañas, A. J., Novak, J. D., & Reiska, P. (2015). How good is my concept map? Am I a good Cmapper? *Knowledge Management & E-Learning: An International Journal, 7*(1), 6–19. https://doi.org/10.34105/j.kmel.2015.07.002

Carless, D., & Boud, D. (2018). The development of student feedback literacy: Enabling uptake of feedback. *Assessment & Evaluation in Higher Education, 43*(8), 1315–1325. https://doi.org/10.1080/02602938.2018.1463354

Carless, D., & Winstone, N. (2020). Teacher feedback literacy and its interplay with student feedback literacy. *Teaching in Higher Education, 28*(1), 150–163. https://doi.org/10.1080/13562517.2020.1782372

Coulson, D., & Harvey, M. (2013). Scaffolding student reflection for experience-based learning: A framework. *Teaching in Higher Education, 18*(4), 401–413. https://doi.org/10.1080/13562517.2012.752726

Creswell, J. W. (2014). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson.

Dai, W., Tsai, Y. S., Gašević, D., & Chen, G. (2025). Designing relational feedback: A rapid review and qualitative synthesis. *Assessment and Evaluation in Higher Education, 50*(1), 16–30. https://doi.org/10.1080/02602938.2024.2361166

Dam, M. (2014). *Making educational reforms practical for teachers: Using a modular, success-oriented approach to make a context-based educational reform practical for implementation in Dutch biology education* [Doctoral dissertation, Leiden University]. Leiden University Repository.

de Kleijn, R. A. M. (2021). Supporting student and teacher feedback literacy: An instructional model for student feedback processes. *Assessment and Evaluation in Higher Education, 48*(2), 186–200. https://doi.org/10.1080/02602938.2021.1967283

den Brok, P., Bergen, T., Stahl, R. J., & Brekelmans, M. (2004). Students' perceptions of teacher control behaviours. *Learning and Instruction, 14*(4), 425–443. https://doi.org/10.1016/j.learninstruc.2004.01.004

Desimone, L. M. (2023). Rethinking teacher PD: A focus on how to improve student learning. *Professional Development in Education, 49*(1), 1–3. https://doi.org/10.1080/19415257.2023.2162746

Doulougeri, K., Vermunt, J. D., Bombaerts, G., & Bots, M. (2024). Challenge-based learning implementation in engineering education: A systematic literature review. *Journal of Engineering Education, 113*, 1076–1106. https://doi.org/10.1002/jee.20588

Doyle, W., & Ponder, G. A. (1977). The practicality ethic in teacher decision-making. *Interchange, 8*(3), 1–12. https://doi.org/10.1007/BF01189290

Dutch Inspectorate of Education. (2022). *De staat van het onderwijs 2022* [The state of education 2022]. Ministry of Education, Culture and Science. https://www.rijksoverheid.nl/documenten/rapporten/2022/04/13/de-staat-van-het-onderwijs-2022

Esser-Noethlichs, M., Lund, S., & Bjørke, L. (2024). 'Facilitating change from within': Investigating students' experiences of using core reflection in physical education teacher education. *Physical Education and Sport Pedagogy*. https://doi.org/10.1080/17408989.2024.2400069

European Parliament & Council of the European Union. (2016). Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation). *Official Journal of the European Union, L 119*, 1–88. https://eur-lex.europa.eu/eli/reg/2016/679/oj

Evans, C. (2015). Exploring students' emotions and emotional regulation of feedback in the context of learning to teach. In V. Donche, S. De Maeyer, D. Gijbels, & H. van den Bergh (Eds.), *Methodological challenges in research on student learning* (pp. 107–160). Garant.

Gadsby, H. (2022). Fostering reflective practice in Post Graduate Certificate in Education students through the use of reflective journals: Developing a typology for reflection. *Reflective Practice, 23*(3), 357–368. https://doi.org/10.1080/14623943.2022.2028612

Garino, A. (2020). Ready, willing and able: A model to explain successful use of feedback. *Advances in Health Sciences Education, 25*(2), 337–361. https://doi.org/10.1007/s10459-019-09924-2

Gonzalez, L. (2024). Exploring teachers' experiences of a professional learning community. *Teacher Development*. https://doi.org/10.1080/13664530.2024.2366475

Gordijn, F., Eernstman, N., Helder, J., & Brouwer, H. (2018). *Reflection methods: Practical guide for trainers and facilitators*. Wageningen Centre for Development Innovation. https://doi.org/10.18174/439461

Görtzen, J. (2019). *Reflecteren moet dat echt? Het effect van een video verrijkte rubriek voor de vaardigheid samenwerken, ter ondersteuning van de doeloriëntatie, op de motivatie voor en het niveau van reflecteren van technasium leerlingen* [Is reflecting really necessary? Effects of a video-enriched rubric on collaboration skills, goal orientation, and motivation to reflect] [Master's thesis, Open University].

Görtzen, J. J. H., Schellings, G. L. M., & Nieveen, N. M. (2026a, April 19). *Discrepancies in feedback perceptions of STEM teachers and their students: Giving or discussing feedback* [Paper presentation]. NARST 2026 Annual International Conference, Seattle.

Görtzen, J. J. H., Schellings, G. L. M., & Nieveen, N. M. (2026b). *Leerlingen leren reflecteren, hoe begeleid je dat* [Learning to reflect, how do you guide that?] Internal report. Eindhoven University of Technology.

Görtzen, J. J. H., Stollman, S. H. M., Schellings, G. L. M., Vermunt, J. D., & Nieveen, N. M. (2025). Promoting students' reflection through process-oriented feedback: Teachers' conceptions, practices and learning needs. *Studies in Educational Evaluation, 86*, 101483. https://doi.org/10.1016/j.stueduc.2025.101483

Grossman, R. (2009). Structures for facilitating student reflection. *College Teaching, 57*(1), 15–22. https://doi.org/10.3200/CTCH.57.1.15-22

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice, 8*(3), 381–391. https://doi.org/10.1080/135406002100000512

Harvey, M., Coulson, D., & McMaugh, A. (2016). Towards a theory of the ecology of reflection: Reflective practice for experiential learning in higher education. *Journal of University Teaching and Learning Practice, 13*(2). https://doi.org/10.53761/1.13.2.2

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112.

Hattie, J., & Yates, G. (2014). Using feedback to promote learning. In V. A. Benassi, C. E. Overson, & C. M. Hakala (Eds.), *Applying science of learning in education: Infusing psychological science into the curriculum* (pp. 45–58). Society for Teaching of Psychology.

Heemsoth, T., & Heinze, A. (2016). Secondary school students learning from reflections on the rationale behind self-made errors: A field experiment. *Journal of Experimental Education, 84*(1), 98–118. https://doi.org/10.1080/00220973.2014.963215

Hilden, S., & Tikkamäki, K. (2013). Reflective practice as a fuel for organizational learning. *Administrative Sciences, 3*(3), 76–95. https://doi.org/10.3390/admsci3030076

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16(3), 235–266.

Hoogendijk, K., Holland, J. G., Tick, N. T., Hofman, A. W. H., Severiens, S. E., Vuijk, P.,

Maras, A., & van Veen, D. (2020). Effect of Key2Teach on Dutch teachers' relationships with students with externalizing problem behaviour: A randomized controlled trial. *European Journal of Psychology of Education, 35*(1), 111–135. https://doi.org/10.1007/s10212-019-00415-x

Kangas-Dick, K., & O'Shaughnessy, E. (2020). Interventions that promote resilience among teachers: A systematic review of the literature. *International Journal of School and Educational Psychology, 8*(2), 131–146. https://doi.org/10.1080/21683603.2020.1734125

Karamane, E., Vatou, A., Tsigilis, N., & Gregoriadis, A. (2023). Comparing students' and teachers' perceptions about teachers' interpersonal behaviour in Greek secondary education. *Learning Environments Research, 26*(3), 899–914. https://doi.org/10.1007/s10984-023-09459-9

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*(2), 254–284. https://doi.org/10.1037/0033-2909.119.2.254

Knowles, M. S. (1980). The modern practice of adult education: From pedagogy to andragogy. *Religious Education, 75*(4), 202–211.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall. https://doi.org/10.1002/job.4030080408

Korthagen, F., & Nuijten, E. (2022). *The power of reflection in teacher education and professional development: Strategies for in-depth teacher learning*. Routledge.

Korthagen, F., & Vasalos, A. (2005). Levels in reflection: Core reflection as a means to enhance professional growth. *Teachers and Teaching: Theory and Practice, 11*(1), 47–71. https://doi.org/10.1080/1354060042000337093

Lapidot-Lefler, N., & Israel, L. (2024). Listening to my own and others' voices: The experience of participants in teacher-education learning communities. *Teacher Development*. https://doi.org/10.1080/13664530.2024.2435883

Lipnevich, A. A., & Panadero, E. (2021). A review of feedback models and theories: Descriptions, definitions, and conclusions. *Frontiers in Education, 6*, Article 720195. https://doi.org/10.3389/feduc.2021.720195

Louws, M. L. (2016). *Professional learning: What teachers want to learn*. Leiden University https://scholarlypublications.universiteitleiden.nl/access/item%3A2886864/view

Louws, M. L., Meirink, J. A., van Veen, K., & van Driel, J. H. (2017). Teachers' self-directed learning and teaching experience: What, how, and why teachers want to learn. *Teaching and Teacher Education, 66*, 171–183. https://doi.org/10.1016/j.tate.2017.04.004

Marsh, B., & Mitchell, N. (2014). The role of video in teacher professional development. *Teacher Development, 18*(3), 403–417. https://doi.org/10.1080/13664530.2014.938106

McKenney, S., & Reeves, T. (2019). *Conducting Educational Design Research*. Routledge.
McKenney, S., & Reeves, T. C. (2025). Educational design research for relevant & robust scholarship. *Journal of Computing in Higher Education, 37*(2), 614–638. https://doi.org/10.1007/s12528-025-09456-2
Mezirow, J. (1997). Transformative learning: Theory to practise. *New Directions for Adult and Continuing Education, 1997*(74), 5–12. https://doi.org/10.1002/ace.7401
Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: An expanded sourcebook* (3rd ed.). Sage.
Moon, J. A. (2013). *A handbook of reflective and experiential learning: Theory and practice*. Routledge. https://doi.org/10.4324/9780203416150
Nguyen, Q. N. (2022). Postlesson affordance-based reflective discussion in ELT classes. *TESOL Journal, 13*(4). https://doi.org/10.1002/tesj.677
Nicol, D. (2021). The power of internal feedback: Exploiting natural comparison processes. *Assessment & Evaluation in Higher Education, 46*(5), 756–778.
Nieminen, J. H., & Carless, D. (2023). Feedback literacy: A critical review of an emerging concept. *Higher Education, 85*(6), 1381–1400. https://doi.org/10.1007/s10734-022-00895-9
OECD. (2025). Skills that matter for success and well-being in adulthood (OECD Skills Studies). OECD Publishing. https://doi.org/10.1787/6e318286-en
Overman, M., Vermunt, J. D., Meijer, P. C., Bulte, A. M. W., & Brekelmans, M. (2014). Students' perceptions of teaching in context-based and traditional chemistry classrooms: Comparing content, learning activities, and interpersonal perspectives. *International Journal of Science Education, 36*(11), 1871–1901. https://doi.org/10.1080/09500693.2013.880004
Paulson Gjerde, K., Padgett, M. Y., & Skinner, D. (2017). The impact of process vs. outcome feedback on student performance and perceptions. *Journal of Learning in Higher Education, 13*(1), 73–82.
Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. Educational Psychology Review, 16(4), 385–407.
Priestley, M., & Drew, V. (2019). Professional Enquiry: An ecological approach to developing teacher agency. In *An ecosystem for research-engaged schools.* (pp. 154–169). Rouledge.
Robson, C., & McCartan, K. (2016). *Real world research* (4th ed.). John Wiley & Sons.
Ryan, T., & Henderson, M. (2018). Feeling feedback: Students' emotional responses to educator feedback. *Assessment and Evaluation in Higher Education, 43*(6), 880–892. https://doi.org/10.1080/02602938.2017.1416456
Saks, K. (2024). The effect of self-efficacy and self-set grade goals on academic outcomes. *Frontiers in Psychology, 15*. https://doi.org/10.3389/fpsyg.2024.1324007
Schalk, H., & Bruning, L. (2014). *Handreiking schoolexamen onderzoek & ontwerpen in de tweede fase* [Guidelines for the school examination of research and design in

upper secondary education] (S. L. O., Ed.). SLO. https://www.slo.nl/downloads/2014/handreiking-schoolexamen-onderzoek-en-ontwerpen-havo-vwo.pdf/

Schön, D. A. (1983). *The reflective practitioner*. Taylor & Francis.

Sheeran, P., & Webb, T. L. (2016). The intention–behaviour gap. *Social and Personality Psychology Compass, 10*(9), 503–518. https://doi.org/10.1111/spc3.12265

Sherin, M. G., & van Es, E. A. (2009). Effects of video club participation on teachers' professional vision. *Journal of Teacher Education, 60*(1), 20–37. https://doi.org/10.1177/0022487108328155

Skilling, K., & Stylianides, G. J. (2020). Using vignettes in educational research: A framework for vignette construction. *International Journal of Research and Method in Education, 43*(5), 541–556. https://doi.org/10.1080/1743727X.2019.1704243

Sluijsmans, D. M. A., Joosten-ten Brinke, D., & Van der Vleuten, C. P. M. (2013). *Toetsen met leerwaarde: Een reviewstudie naar de effectieve kenmerken van formatief toetsen* [Tests with learning value: A review study on the effective characteristics of formative assessment]. NWO-PROO.

Svojanovsky, P. (2017). Supporting student teachers' reflection as a paradigm shift process. *Teaching and Teacher Education, 66*, 338–348. https://doi.org/10.1016/j.tate.2017.05.001

Technasium. (n.d.). *Onderzoek & ontwerpen*. Retrieved April 6, 2026, from https://www.technasium.nl/onderzoek-ontwerpen/

ter Beek, M., Wopereis, I., & Schildkamp, K. (2022). Don't wait, innovate! Preparing students and lecturers in higher education for the future labor market. *Education Sciences, 12*(9). https://doi.org/10.3390/educsci12090620

Thurlings, M., Vermeulen, M., Bastiaens, T., & Stijnen, S. (2013). Understanding feedback: A learning theory perspective. *Educational Research Review, 9*, 1–15. https://doi.org/10.1016/j.edurev.2012.11.004

Tielemans, C., de Kleijn, R., van der Schaaf, M., van den Broek, S., & Westerveld, T. (2023). The Westerveld framework for interprofessional feedback dialogues in health professions education. *Assessment & Evaluation in Higher Education, 48*(2), 41–57. https://doi.org/10.1080/02602938.2021.1967285

Torrance, H. (2012). Formative assessment at the crossroads: Conformative, deformative and transformative assessment. *Oxford Review of Education, 38*(3), 323–342. https://doi.org/10.1080/03054985.2012.689693

Trimasse, N. (2024). The use of reflective reports in higher education. *Reflective Practice, 26*(1), 154–171. https://doi.org/10.1080/14623943.2024.2424520

van Beek, L. (2024). *Cracking the code: Investigating feedback perceptions in large computer science education classes* [Doctoral dissertation, Delft University of Technology]. https://doi.org/10.4233/uuid:294f0e8b-9162-4606-8d38-

375d331d1442
van der Kleij, F., & Adie, L. (2020). Towards effective feedback: An investigation of teachers' and students' perceptions of oral feedback in classroom practice. *Assessment in Education: Principles, Policy and Practice, 27*(3), 252–270. https://doi.org/10.1080/0969594X.2020.1748871
van der Kleij, F., Adie, L. E., & Cumming, J. J. (2019). A meta-review of the student role in feedback. *International Journal of Educational Research, 98*, 303–323. https://doi.org/10.1016/j.ijer.2019.09.005
van der Linden, S., Papadopoulos, P. M., Nieveen, N., & McKenney, S. (2023). ReflAct: Formative assessment for teacher reflection in video-coaching settings. *Computers and Education, 203*. https://doi.org/10.1016/j.compedu.2023.104843
van Veen, K., & Janssen, F. (2016). Praktijkkennis van leraren [Teachers' practical knowledge]. In D. Beijaard (Ed.), *Weten wat werkt* (pp. 26–36). Ten Brinke Publishers.
van Veen, K., Zwart, R. C., & Meirink, J. (2010). *Professional development of teachers: A review study on effective characteristics of professionalization interventions for teachers*. ICLON/Expertisecentrum leren van docenten.
Veine, S., Anderson, M. K., Andersen, N. H., Espenes, T. C., Søyland, T. B., Wallin, P., & Reams, J. (2020). Reflection as a core student learning activity in higher education: Insights from nearly two decades of academic development. *International Journal for Academic Development, 25*(2), 147–161. https://doi.org/10.1080/1360144X.2019.1659797
Vieites-Casado, M., León-Jiménez, S., & Serra, H. (2025). "Making new horizons possible": The impacts of dialogic policies in Portugal promoting teacher's trainer's education based on scientific evidence of social impact. *Social Sciences & Humanities Open, 12*, 101971. https://doi.org/10.1016/j.ssaho.2025.101971
Voerman, L., & Faber, F. (2016). *Didactisch coachen: Hoge verwachtingen concreet maken met behulp van feedback, vragen en aanwijzingen* [Didactic coaching: Making high expectations concrete with the help of feedback, questions and instructions] (5th ed.). De Weijer Uitgeverij.
Voerman, L., Meijer, P. C., Korthagen, F. A. J., & Simons, R. J. (2012). Types and frequencies of feedback interventions in classroom interaction in secondary education. *Teaching and Teacher Education, 28*(8), 1107–1115. https://doi.org/10.1016/j.tate.2012.06.006
Voerman, L., Meijer, P. C., Korthagen, F., & Simons, R. J. (2015). Promoting effective teacher-feedback: From theory to practice through a multiple component trajectory for professional development. *Teachers and Teaching, 21*(8), 990–1009. https://doi.org/10.1080/13540602.2015.1005868
Wallman, A., Lindblad, A. K., Hall, S., Lundmark, A., & Ring, L. (2008). A categorization scheme for assessing pharmacy students' levels of reflection during internships.

American Journal of Pharmaceutical Education, 72(1), 5.

Welch, M. (1999). The ABCs of reflection: A template for students and instructors to implement written reflection in service-learning. *NSEE Quarterly, 2*(25). https://digitalcommons.unomaha.edu/slceeval

Wharton, S. (2012). Presenting a united front: Assessed reflective writing on a group experience. *Reflective Practice, 13*(4), 489–501. https://doi.org/10.1080/14623943.2012.670622

Winstone, N., Boud, D., Dawson, P., & Heron, M. (2022). From feedback-as-information to feedback-as-process: A linguistic analysis of the feedback literature. *Assessment & Evaluation in Higher Education, 47*(2), 213–230. https://doi.org/10.1080/02602938.2021.1902467

Winstone, N., Nash, R. A., Parker, M., & Rowntree, J. (2017). Supporting learners' agentic engagement with feedback: A systematic review and a taxonomy of recipience processes. *Educational Psychologist, 52*(1), 17–37. https://doi.org/10.1080/00461520.2016.1207538

Wisniewski, B., Zierer, K., & Hattie, J. (2020). The power of feedback revisited: A meta-analysis of educational feedback research. *Frontiers in Psychology, 10*, Article 487662. https://doi.org/10.3389/fpsyg.2019.03087

Wolff, C. E., Jarodzka, H., & Boshuizen, H. P. A. (2021). Classroom management scripts: A theoretical model contrasting expert and novice teachers' knowledge and awareness of classroom events. *Educational Psychology Review, 33*(1), 131–148. https://doi.org/10.1007/s10648-020-09542-0

Wu, Y., Gilligan-Lee, K., Ng-Knight, T., & Tenenbaum, H. R. (2024). Student-perceived parents' and teachers' expectancies and feedback influence homework motivation and effort. *Journal of Educational Research*. https://doi.org/10.1080/00220671.2024.2385405

Appendices

Appendix 1 Student and teacher questionnaire

Versie leerlingen

Items schaal 1 "over mij"

4 Mijn docente vertelt bij feedback ook wat zij voor gedrag heeft gezien
6 Door de feedback van mijn docente leer ik hoe ik mijn werk zelf kan beoordelen
7 Mijn docente verwijst in haar feedback naar beoordelingscriteria
8 Mijn docente verwijst in haar feedback naar mijn leerdoel
9 Mijn docente vraagt waar ik graag feedback op wil hebben
11 Mijn docente onderbouwt de feedback door te verwijzen naar wat zij in de klas heeft gezien
12 Mijn docente vertelt mij wat er al duidelijk beter ging dan de vorige keer
14 Mijn docente controleert of ik de feedback goed heb begrepen
15 Mijn docente checkt of ik wat van de feedback leer
17 Mijn docente gaat na of ik de feedback gebruik

Items schaal 2 "met mij"

10 Mijn docente onderbouwt de feedback door goed uit te leggen wat ze goed of niet goed vindt
13 Mijn docente geeft in de feedback voorbeelden van hoe ik het project beter kan aanpakken
16 Mijn docente laat ons (de leerlingen) praten of de feedback die we hebben gekregen
25 Mijn O&O docente gebruikt in haar feedback begrijpelijke taal
26 Mijn O&O docente laat mij reageren op de feedback
30 Ik kan met mijn O&O docente in gesprek als ik de feedback onterecht vind

Versie docenten

Items schaal 1 “over mij”

4 Mijn feedback koppel ik aan concreet geobserveerd gedrag

6 Door mijn feedback leren leerlingen hoe ze hun werk zelf kunnen beoordelen

7 Ik verwijs in mijn feedback naar beoordelingscriteria

8 Ik verwijs in mijn feedback naar een leerdoel van de leerling

9 Ik vraag leerlingen waarop ze zelf graag feedback willen hebben

11 Ik onderbouw mijn feedback aan leerlingen door te verwijzen naar mijn observaties

12 Ik vertel mijn leerlingen wat al duidelijk beter ging dan de vorige keer

14 Ik ga na of leerlingen mijn feedback begrijpen

15 Ik ga na wat leerlingen van mijn feedback leren

17 Ik ga na of leerlingen mijn feedback gebruiken

Items schaal 2 “met mij”

10 Ik onderbouw mijn feedback door uit te leggen waarom ik iets goed of niet goed vind

13 Ik geef in mijn feedback voorbeelden van hoe een leerling het project beter kan aanpakken

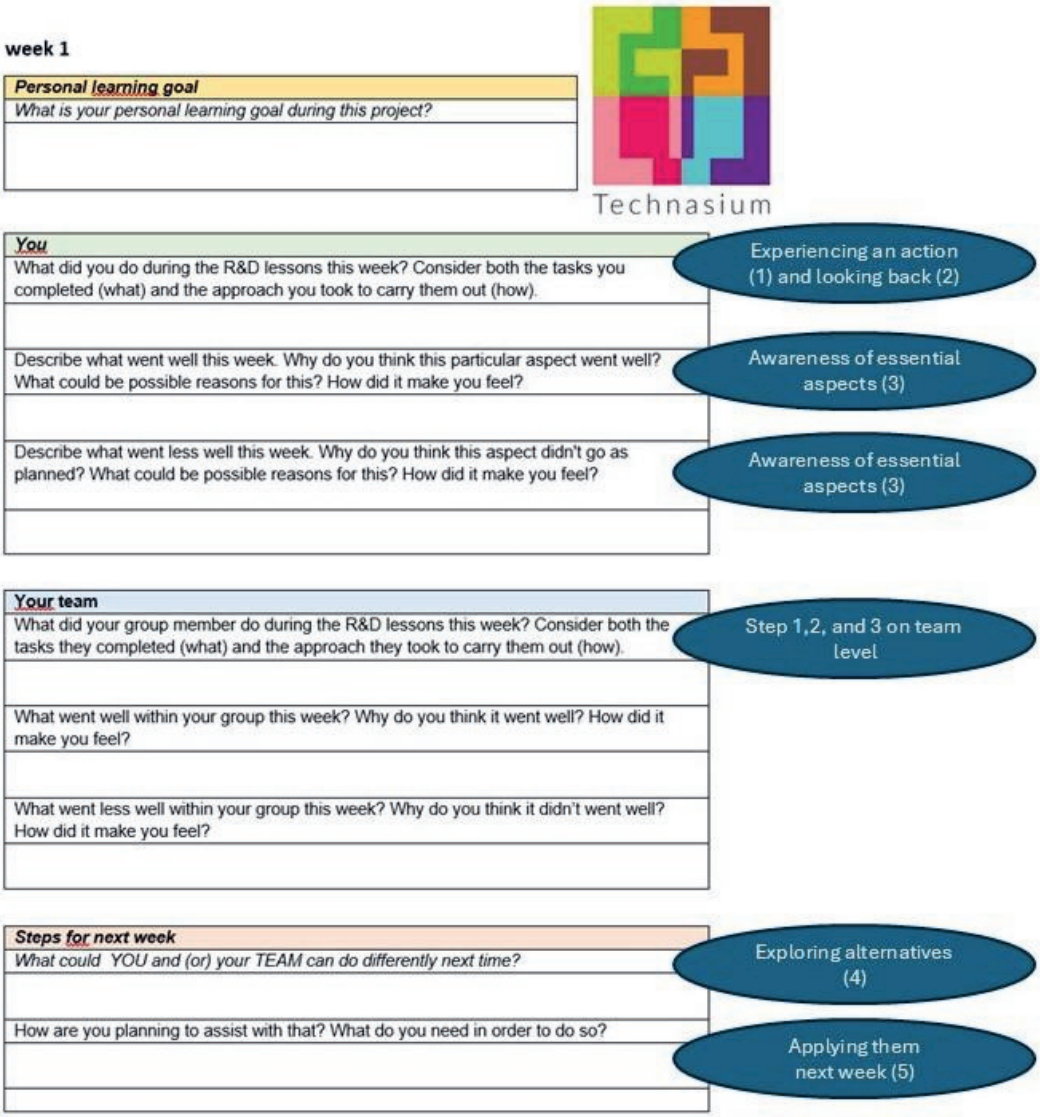
16 Ik laat leerlingen met elkaar praten over mijn feedback

25 Ik gebruik in mijn feedback eenduidige taal

26 Ik bied ruimte om de leerling te laten reageren

30 Ik ga in gesprek met leerlingen als zij mijn feedback onterecht vinden

Appendix 2 Exemplar of a reflection task



Appendix 3

Coding scheme for reflection levels and example prompts.

Levels	Description	Subject to reach next level	Example prompts
1 Habitual action	Purely factual, listing events in a sequence without deeper analysis or consideration.	On action	Can you tell us a bit more about what you've been working on?
2 Thoughtful action	Action described as learned behaviour without a thought or feeling.	On thoughts and feelings	What were your thoughts? How did it make you feel?
3 Introspection	Behaviour with thoughts or feelings, without looking at cause of the behaviour or results.	On cause and effect	What was the cause of your behaviour? What was the result of your behaviour?
4 Content reflection	Behaviour with thoughts or feelings, cause and results. Student consciously thinks about what he/she does.	On consequences	How does your behaviour influence or affect others?
5 Process reflection	Behaviour with thoughts or feelings, consciously thinks about what he/she does and considers how behaviour affects others.	On reasons why	What is the reason reasons behind your thoughts, feelings, and actions?
6 Premise reflection	Behaviour with thoughts or feelings, consciously thinks about what he/she does, considers how behaviour affects others and indicates reason for why he/she thinks, acts and feels the way he/she does.		

Summary

This dissertation reports on research into the question what professional development needs to encompass to enable teachers to facilitate feedback dialogues and support students' reflection. Despite their widely recognised importance, feedback and reflection have largely been studied apart from one another. This study aimed to bridge this gap by examining how secondary school teachers can be supported in facilitating feedback dialogues and guiding students' deep reflection through a professional development program.

The research was situated within a constructivist feedback paradigm, which conceptualises feedback as a dialogic and socially constructive process that supports meaning-making and learning. Within this paradigm, feedback dialogues and reflection are understood as mutually reinforcing processes: feedback dialogues deepen students' reflection, while structured reflection enhances the impact of feedback. Reflection is primarily understood as a means of personal learning and growth. In secondary education, and particularly within the Technasium context, where student reflection and personal development are explicit learning objectives, many teachers experience difficulties in implementing feedback as an interactive process. Feedback often remains a one-way transmission of information, while reflective activities are fragmented and superficial. This dissertation is aiming at dialogic feedback to deepen the level of students' reflection.

Five interrelated studies were conducted, embedded within the design, enactment, and evaluation of a two-year professional development program: the Collaborative Teacher Reflection (CTR) program.

The first study explored teachers' conceptions, experiences, and learning needs regarding process-oriented feedback aimed at promoting student reflection. Focus group interviews with 23 teachers revealed four profiles (basic, intermediate, advanced, and constrained) indicating variation in how feedback and reflection are understood and enacted in practice. These findings provided insight into teachers' prior knowledge and professional learning needs and directly informed the design of the program. A further insight was the reconceptualization of process-oriented feedback. In this study it is understood as an integral element of feedback dialogues concerned with students' learning processes and personal development.

The second study examined professional growth in facilitating feedback dialogues among ten teachers participating in the CTR program. Growth was captured through individual vignettes describing developments across five areas: teacher readiness, monitoring student readiness, interaction mode, feedback content, and the use of verified observations. By the end of the program, eight teachers demonstrated professional growth in at least two of these areas. Particularly noteworthy was the important role of teacher readiness, which encompasses awareness of one's own behaviour, sensitivity to students' responses, and the ability to create a psychologically safe environment for

dialogue.

The third study investigated changes in teachers' and students' perceptions of feedback practices over the course of the CTR program. Questionnaire data from eight teachers and 155 students were collected at four time points. The findings indicate that teacher-led feedback was generally maintained or strengthened in the first year; however, the transition towards more dialogic feedback practices was partially realised in the second year; with considerable variation across classrooms. Notably, discrepancies between teachers' and students' perceptions of feedback practices were apparent in most classes, with students generally reporting more positive experiences of dialogic feedback than their teachers. This suggests that including student perspectives in the evaluation of professional development programs may provide valuable complementary insights.

The fourth study examined the relationship between teachers' participation in the CTR program, their guidance practices, and the depth of students' written reflections. Eight teachers implemented a literature-based framework of five guidance actions: clarifying the purpose of reflection, co-formulating students' personal learning goals, structuring reflection tasks, monitoring reflective depth, and conducting feedback dialogues. After using the framework, teachers reported increased confidence and a deeper understanding of their facilitative role. Students' written reflections showed a shift towards more analytical forms of thinking over time, with the most pronounced development observed among students who initially demonstrated lower levels of reflection.

The fifth study examined the design, enactment, and evaluation of the CTR program in its entirety. Eight evidence-informed design principles were initially identified. Teachers reconceptualised their role as facilitators, made increasing use of structured feedback dialogues, and demonstrated enhanced reflective competence. The evaluation further yielded two additional design principles: the mediating role of the facilitator in translating program intentions into classroom practice, and the significance of organisational conditions as factors that enable or constrain implementation.

In conclusion, the findings of all studies indicate that professional development aimed at enabling teachers to facilitate feedback dialogues and support students' reflection should integrate conceptual understanding, practical pedagogical tools, and experiential learning opportunities. Rather than treating feedback and reflection as separate domains, professional development should support teachers in understanding how feedback can stimulate reflection and how reflection, in turn, deepens the interpretation and uptake of feedback. This coherent understanding of both processes as interconnected and dialogic forms the foundation for their effective enactment in classroom practice. These elements also enable teachers to engage with feedback and reflection from both a teacher and learner perspective.

The role of students in professional development also warrants attention, as they are

often the first to signal changes in classroom practice and can provide valuable insights into their impact. Finally, the analysis of the CTR program shows that effective professional development requires a coherent integration of conceptual understanding, experiential learning, practical support, and enabling structural conditions. Only within an environment in which these elements are aligned can participating teachers sustainably develop and enact dialogic feedback practices and reflective guidance.

Samenvatting

Dit proefschrift rapporteert over onderzoek naar de professionele ontwikkeling van docenten, gericht op het voeren van feedbackgesprekken met leerlingen met als doel bij te dragen aan het verdiepen van hun reflecties. Zowel feedbackgesprekken als reflectie worden algemeen belangrijk gevonden voor het leren en de persoonlijke ontwikkeling van leerlingen, maar beide onderwerpen worden vaak los van elkaar bestudeerd. Het onderzoek in dit proefschrift beoogt deze kloof te overbruggen.
Het onderzoek is gesitueerd binnen het constructivistisch feedbackparadigma, waarin feedback wordt opgevat als een dialogisch en sociaal-constructief proces dat gericht is op het vragen, begrijpen en toepassen van feedback ter ondersteuning van leren. Binnen dit paradigma worden feedbackgesprekken en reflectie beschouwd als wederzijds versterkende processen: feedbackgesprekken verdiepen de reflectie van leerlingen, terwijl gestructureerde reflectie de invloed van feedback vergroot. Reflectie wordt in dit proefschrift opgevat als een middel voor persoonlijke ontwikkeling en groei.
In het voortgezet onderwijs, en met name binnen het vak Onderzoek en Ontwerpen (O&O, Technasium) waar leren reflecteren en persoonlijke ontwikkeling expliciete leerdoelen zijn, ervaren docenten problemen bij het vormgeven van feedback- en reflectieprocessen. Feedback blijft vaak beperkt tot eenrichtingscommunicatie, terwijl reflectietaken fragmentarisch en oppervlakkig blijven. Dit proefschrift richtte zich op het vinden van een oplossingsrichting voor deze problematiek.

Het onderzoek bestond uit vijf onderling samenhangende studies, waarbij tevens het tweejarige Collaborative Teacher Reflection (CTR)-professionaliseringprogram is ontworpen en geëvalueerd.

De eerste studie onderzocht de opvattingen, ervaringen en leerbehoeften van docenten met betrekking tot procesgerichte feedback ter bevordering van leerling reflectie. Focusgroep-interviews met 23 docenten resulteerden in vier profielen: basis, intermediair, gevorderd en gehinderd. Deze profielen laten verschillen zien in de manier waarop docenten feedback en reflectie opvatten en toepassen. De bevindingen gaven inzicht in de professionele leerbehoeften van docenten en vormden de basis voor het ontwerp van het CTR-program. Daarnaast leidde de studie tot een herinterpretatie van het begrip procesgerichte feedback als integraal onderdeel van feedbackgesprekken gericht op leerprocessen en persoonlijke ontwikkeling.

De tweede studie onderzocht de professionele groei in het begeleiden van feedbackgesprekken bij tien Technasium docenten die deelnamen aan het CTR-program. Hun professionele groei werd beschreven in individuele vignetten op de vijf dimensies: teacher readiness, monitoren of leerlingen klaar zijn voor de feedbackdialoog (student readiness), interactiemodus, feedbackinhoud en het gebruik van geverifieerde observaties. Aan het einde van het program lieten acht docenten groei zien op ten minste twee van deze dimensies. Vooral de ‘teacher readiness’ bleek van belang. Deze vorm van

‘readiness’ omvat het bewustzijn van docenten van hun eigen handelen, de sensitiviteit voor de reacties van leerlingen en het vermogen om een veilige leeromgeving te creëren.

De derde studie onderzocht veranderingen in ervaringen van docenten en leerlingen met feedbackpraktijken tijdens het CTR-program. Op vier meetmomenten werden vragenlijsten afgenomen bij acht docenten en 155 leerlingen. De resultaten laten zien dat in het eerste jaar de docent gestuurde feedback grotendeels behouden bleef of zelfs werd versterkt. De verschuiving naar meer dialogische feedbackpraktijken werd vooral in het tweede jaar zichtbaar. In de meeste klassen rapporteerden leerlingen een toename te ervaren in dialogische feedback. Daarbij werd duidelijk dat de ervaringen van docenten en leerlingen niet altijd met elkaar overeenkwamen: leerlingen beoordeelden de dialogische feedbackpraktijken over het algemeen positiever dan de docenten zichzelf beoordeelden. Dit suggereert dat het meenemen van leerling perspectieven bij de evaluatie van professionaliseringsprogramma's waardevolle aanvullende inzichten kan opleveren.

De vierde studie onderzocht de relatie tussen deelname aan het CTR-program, de begeleidingspraktijken van docenten en de diepte van schriftelijke leerling reflecties. Acht docenten pasten een op literatuur gebaseerd raamwerk toe met vijf begeleidingsstrategieën: het verduidelijken van het doel van reflectie, het samen formuleren van persoonlijke leerdoelen, het structureren van reflectietaken, het monitoren van reflectiediepte en het voeren van feedbackgesprekken. Na gebruik van het raamwerk rapporteerden docenten meer vertrouwen in en een beter begrip van hun begeleidende rol. Met de geschreven reflecties verdiepten leerlingen hun reflectie richting analytisch niveau, met de sterkste ontwikkeling bij leerlingen die aanvankelijk op een minder diep niveau reflecteerden.

De vijfde studie richtte zich op het ontwerp, de uitvoering en evaluatie van het CTR-program als geheel. In de inventarisatiefase werden acht ontwerpprincipes geïdentificeerd, getoetst en aangescherpt ter ondersteuning van het ontwerp van het professionaliseringsprogram. Deze principes zijn gebruikt als basis voor het ontwerp en de uitvoering van het tweejarige CTR-program.
Na afloop van het CTR-program vond een evaluatie plaats met de deelnemende docenten. De resultaten lieten zien dat docenten hun rol als begeleider hadden geherdefinieerd, vaker feedbackgesprekken voerden en hun begeleidingsvaardigheden hadden ontwikkelden. Daarnaast leidde de evaluatie tot twee aanvullende ontwerpprincipes: de bemiddelende rol van de begeleider bij het vertalen van programma-intenties naar de klassenpraktijk, en het belang van organisatorische randvoorwaarden als factoren die duurzame implementatie mogelijk maken of belemmeren.

De bevindingen van dit proefschrift laten zien hoe feedback en reflectie in samenhang kunnen worden behandeld. Bovendien hebben de bevindingen geleid tot een set van onderling samenhangende kenmerken en voorwaarden voor de professionele

ontwikkeling van docenten die feedback en reflectie is samenhang willen toepassen binnen het vak O&O op Technasium scholen. Door docenten te laten ervaren hoe feedback reflectie kan stimuleren en hoe reflectie de interpretatie van feedback verdiept, kan een consistenter begrip van beide processen ontstaan. Daarnaast vraagt het ontwikkelen van deze competenties om structurele tijd en ondersteuning. Een professionaliseringstraject dat dit ondersteunt moet ruimte bieden voor experimenteren, reflecteren en bijstellen. Op schoolniveau zijn tijd, collegiale samenwerking en steun van de schoolleiding noodzakelijk om feedbackgesprekken en reflectieve begeleiding duurzaam te integreren in de onderwijspraktijk. Bovendien blijkt de rol van leerlingen eveneens van belang in de professionele ontwikkeling van docenten. Leerlingen signaleren vaak als eerste veranderingen in de onderwijspraktijk en kunnen waardevolle inzichten geven in de invloed daarvan. Hun ervaringen met feedbackgesprekken en reflectie vormen daarmee een belangrijke bron voor het begrijpen en verdiepen van professionele groei van docenten. Dit onderzoek implicaties voor het O&O-curriculum. Diepgaande reflectie en feedbackgesprekken vragen om structurele inbedding en voldoende onderwijstijd binnen het O&O-vak. Ontwikkelingen waarbij deze tijd onder druk komt te staan, kunnen de condities ondermijnen die nodig zijn om deze praktijken duurzaam te laten slagen. Samenvattend laat dit proefschrift zien dat effectieve professionele ontwikkeling om een samenhangend geheel vraagt van conceptuele helderheid, ervaringsgericht leren, praktische ondersteuning en structurele condities. Alleen in een omgeving waarin deze elementen op elkaar zijn afgestemd, kunnen docenten zich professionaliseren in het voeren van feedbackgesprekken die ondersteunend zijn aan diepe leerling reflectie.

List of publications

Görtzen, J. J. H. (2019). *Reflecteren moet dat echt? Het Effect van een Video Verrijkte Rubriek voor de Vaardigheid Samenwerken, ter Ondersteuning van de Doeloriëntatie, op de Motivatie voor en het Niveau van Reflecteren van Technasiumleerlingen.* [Master of educational sciences, Open Universiteit]. Heerlen.

Görtzen, J. J. H., Stollman, S. H. M., Schellings, G. L. M., & Vermunt, J.D.H.M. (2022, March 17-18). Learning to reflect, how do you guide that? [Poster presentation]. ICO spring school, online.

Görtzen, J. J. H., Stollman, S.H.M., Schellings, G.L.M., & Vermunt, J.D.H.M. (2022, July 6-8) Van visie tot uitvoering: Leren reflecteren, hoe begeleid je dat? [Discussion table]. Onderwijs Research Dagen, Hasselt, België.

Görtzen, J. J. H., Stollman, S.H.M., Schellings, G.L.M., & Vermunt, J.D.H.M. (2023, July 5–7). Leerlingen leren reflecteren, hoe begeleid je dat? [Paper presentation]. Onderwijs Research Dagen, Amsterdam, Nederland.

Görtzen, J. J. H., Stollman, S.H.M., Schellings, G.L.M., & Vermunt, J.D.H.M. (2023, Juli) Collaboratieve Docent Reflectie traject: Leren procesgerichte feedback geven [Discussion table]. Onderwijs Research Dagen, Amsterdam, Nederland.

Görtzen, J. J. H., Schellings, G.L.M., & Nieveen, N. M. (2024, July 10–12). Feedback op reflectieprocessen van leerlingen: Kloof tussen theorie en praktijk [Discussion table]. Onderwijs Research Dagen, Tilburg, Nederland.

Görtzen, J. J. H., Stollman, S. H. M., Schellings, G. L. M., Vermunt, J. D., & Nieveen, N. M. (2025). Promoting students' reflection through process-oriented feedback: Teachers' conceptions, practices and learning needs. Studies in Educational Evaluation, 86, 101483. https://doi.org/10.1016/j.stueduc.2025.101483

Görtzen, J. J. H., Schellings, G. L. M., van de Vossenberg, N., & Nieveen, N. M. (2025, March 10–11). Leerlingen leren reflecteren: Bespreken van procesgerichte feedback [Workshop]. VELON, Rotterdam, Nederland.

Görtzen, J. J. H., Schellings, G. L. M., & Nieveen, N. M. (2025, June 4–6). Overgang van feedback geven naar een feedbackdialoog: Professionele groei van VO-docenten op vijf kerngebieden [Paper presentation]. Onderwijs Research Dagen, Leuven, België.

Görtzen, J. J. H., Schellings, G. L. M., Schellekens, A., & Nieveen, N. M. (2026, March 16–17). Feedbackdialoog en reflectie binnen het Technasium: een eye-opener voor alle onderwijscontexten [Workshop]. VELON, Amsterdam, Nederland.

Görtzen, J. J. H., Schellings, G.L.M., & Nieveen, N. M. (2023, April 19-22). Discrepancies in Feedback Perceptions of STEM Teachers and their Students: Giving or Discussing Feedback [Paper presentation]. NARST Annual International Conference, Seattle, USA.

Curriculum vitae

Josine Görtzen was born on 16-03-1972 in Zevenaar, the Netherlands.

After completing her havo diploma in 1989 at Groenewald in Stein, she was educated as a design and technology teacher for secondary education at the Pedagogische Technische Hogeschool in Eindhoven. She subsequently acquired a qualification for teaching students with special needs at the Seminarium voor Orthopedagogiek, part of Utrecht University of applied sciences.

In 2016, she began a master's program in Onderwijswetenschappen at the Open University in Heerlen, graduating in 2020 with a thesis on the guidance of students' reflection. Her thesis, *Reflecteren: Het effect van een video verrijkte rubriek voor de vaardigheid samenwerken, ter ondersteuning van de doeloriëntatie, op de motivatie voor en het niveau van reflecteren van Technasiumleerlingen*, was awarded a grade of 8 (out of 10) and became a starting document for this PhD-trajectory.

In the academic year 2020–2021, she was awarded a research scholarship funded by the Dutch Research Council (NWO). Combined with a scholarship from the school board Ons Middelbaar Onderwijs, this enabled her to pursue a part-time PhD whilst remaining employed at her secondary school as a Research and Design (R&D) teacher.

In September 2021, she started her doctoral research at the Eindhoven School of Education of Eindhoven University of Technology, the results of which are presented in this dissertation.

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