IJVES

International Journal of Vocational Education Studies

Focus

VET Teacher and Trainer Education

eISSN: 2940-3790

[transcript] Vol. 1 | 2024 | Issue 2

IJVES

International Journal of Vocational Education Studies

Vol. 1, Issue No. 2/2024: VET Teacher and Trainer Education

The journal is edited by
Dietmar Frommberger and Silke Lange

Indexed in EBSCOhost databases.

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.dnb.de

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First published 2024 by transcript Verlag, Bielefeld
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Cover Layout: Maria Arndt, Bielefeld
PDF-ISBN: 978-3-8394- 6593-6
eISSN: 2940-3790

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https://doi.org/10.14361/ijves-2024-010201

Editorial: VET Teacher and Trainer Education

International Approaches and Perspectives

Silke Lange & Dietmar Frommberger

Learning in vocational education and training institutions and in-company training settings play a vital role in preparing individuals for the workforce and fostering lifelong learning and social inclusion. The teaching and training staff involved are of high importance in the educational processes and results. Empirical studies confirm the close connection between vocational education and training personnel and the quality of VET (e.g. Blom & Meyers, 2003 ; Ebbinghaus & Krewerth, 2014).

Personnel in VET face a variety of challenges: they teach and train groups of students who are particularly heterogeneous in terms of age, socio-economic and social background as well as educational biography. Such a diverse student body requires differentiated adaptation from the teachers and trainers so that the teaching content can be conveyed at the different student levels and the development of the students can be promoted. The teaching and training content itself is subject to continuous change, which is caused by scientific progress as well as economic and social developments. For example, sustainability-related aspects are now much more important in education and training, while other topics are disappearing in the wake of digitalization.

Qualification, further development and promotion of vocational training staff in schools and companies is the focus of attention worldwide when it comes to the further development of vocational education and training structures. Since the 1980s, in Europe there are efforts to improve the quality of trainers and teachers training through a European vocational training policy. One result of the European vocational educational research demonstrates the typification of vocational education and training staff on the basis of country studies. Here it becomes clear that teaching staff can be relatively well identified and differentiated, while in-company trainers are difficult to differentiate (Bahl et al., 2008). In addition, the work of trainers is not recognised in many cases and

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therefore, vocational educational identity cannot be developed. However, there is expressed a growing interest in basic and additional training up to academic qualifications for training staff in companies (Bahl et al., 2008).

With the second issue of the International Journal of Vocational Education Studies we shed light on teachers and trainers in VET. Training the trainers and teaching the teachers differ regarding to their settings, contents and didactical approaches. For the thematic section we invited papers to explore and advance our understanding of the roles, challenges, and opportunities that VET teachers and trainers encounter. The focus of the contributions is on the personnel in VET-schools as is common in the research landscape.

Chris Zirkle, Eli Smeplass and **Arve Leraand** provide insights into the teacher training programs in the USA and Norway. Based on a qualitative comparison, they identify key elements of VET teacher training programs and discuss the importance of those programs for upcoming challenges of prospective teachers and overcoming the challenge of practice-oriented training.

Niklas Sänger deals with the modeling and measurement of teachers' digital skills. The TPACK model frequently used in this context does not take sufficient account of the particular challenges of VET teaching, as it relates primarily to digital skills for the use and application of learning technologies. With a further development of the model, he would like to integrate the digital skills related to the world of work into the TPACK model and presents a corresponding measurement instrument.

Robert Hantsch and **Harald Hantke** present an approach to overcoming the fragmentation and discontinuities in German VET-teacher education. Using a design-based research approach, a prototype for cross-level and cross-institutional cooperation in VET-teacher education is presented and the importance of cooperation in teacher education is discussed.

Mareike Beer, Alexandra Ritters and **Martin Thieme-Hack** address the topic of sustainability and Vocational Education for Sustainable Development and present an approach for the didactic design and organizational embedding of measures aimed at developing and expanding the skills of VET personnel related to sustainability.

Irina Rommel, Monserrat Vargas Méndez and **Daniel Láscarez Smith** present forms of qualification and entry pathways to the VET teaching profession in Costa Rica and discuss the different requirements as well as the level of professionalization.

Tina Gryson, Katrien Strubbe, Tony Valcke, and **Ruben Vanderlinde** deal with teacher cooperation as an approach to the further development of secondary education teaching. They present a project that investigates the influence of teacher design teams on teachers' attitudes, beliefs, and instructional practices in general subjects for vocational secondary education.

In the general section of this issue, there are two papers that deal with other topics relating to VET.

Junmin Li and **Firat Deniz** take a look at the textbook as a teaching medium. Despite digitalization, it is still very important in lessons in Germany today. Against the background of linguistic challenges in vocational education and training, the authors present an analysis of textbooks from a language-sensitive perspective.

Susanne Peters and **Christine Siemer** apply a behavioral economics approach to VET in their paper and examine the relationship between money and investment in VET in different European countries.

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Thematic Section

International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010202

VET Teacher Training: A Comparison of University Programs in the U.S. and Norway

Chris Zirkle, Eli Smeplass & Arve Leraand

Abstract *This article is a study of Vocational Education and Training (VET) teacher training in considerably different societal contexts. Vocational education teachers contribute to the growth and development of a country's future workforce, as they bridge the gap between formal schooling and the workplace. Their training is critical, since their pedagogical knowledge and technical expertise can result in students prepared to enter their chosen field of employment. Through case studies analyzing qualitative data on 1) program entry requirements, 2) curricular and course components, 3) implementation of practical elements in the training and 4) definitions of formal qualifications, the researchers identify joint key elements in VET teacher training programs in the U.S. and Norway. The discussion highlights how quality VET teacher training programs play a pivotal role in bridging between the practical elements in vocational education and professional futures as teachers.*

Title *VET Teacher Training: A Comparison of University Programs in the U.S. and Norway*

Keywords *vocational, technical, career, teacher, training*

1 Introduction

The aim of this study was to compare and contrast the vocational teacher training programs of two universities, within Norway and the U.S., with a primary focus on identifying and understanding key aspects of vocational teacher training programs. Similar components or distinct differences between programs from different continents

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contribute to identifying such key aspects of VET teacher training. Comparing vocational teacher training across different countries can be challenging, as the requirements for, and training of these individuals are diverse and can vary significantly. This is especially prevalent when underpinning assumptions of what constitutes an effective education system and productive labor market can be significantly different. The training of vocational education teachers across the world has several similar pedagogical components and technical skill requirements (Zirkle, Laukia, Mauffret & Prudent-Vilches, 2022). However, the manner in which these individuals are vetted to qualify as a vocational education teacher and then prepared can vary significantly (Organization for Economic Cooperation and Development, 2021). Quality vocational education programs require well-prepared teachers in order to produce students ready to enter the world of work or to pursue further education and training. There are a significant number of subject matter disciplines within vocational education, and perhaps in contrast with teachers of purely academic subjects, vocational teachers must not only possess pedagogical knowledge and abilities but also high levels of technical skills. These requirements are evident on both sides. In the U.S., the prerequisite for vocational teachers to have relevant work experience has existed since the earliest government legislation supporting vocational education, the Smith-Hughes Act of 1917. This act also required each state to provide vocational teacher training (Zirkle, 2018). In Norway, the practical aspect (work skills and experience) has been a pivotal part of the VET training since the system was formalized in 1937 (Grande, et al., 2014).

These skills must be updated and refined in response to changes within society, as evidenced by the challenges presented by variables such as rapidly shifting technology and evolving workplace requirements.

This study is a comparison of important elements of how two universities design and organize their VET teacher training programs. Norway is a country with relatively high investments in education compared to other nations (OECD, 2020), and clear strategies for promoting teacher quality as a means to strengthen their workforce (Smith, 2021). In the US, education is decentralized, and each state has its own responsibility for educating its citizens. The state of Ohio has a strong reputation of supporting vocational education programming.

2 Comparative Research

Educational research of a comparative nature has a long history as well as many definitions and explanations. While there is no universal definition of comparative education research, many have been postulated over time. Some of the definitions that are aligned with this study include:

- Seeking to understand the differences and similarities among educational systems (Getao, 1996).
- Attention directed at educational ideas, process and practices in other societies (Trethewey, 1976).

- "Tracing the movement of a current educational idea from one culture to another […] movement of ideas or practices from one country to another" (Good, 1963, p. 184).
- "A comparison of variant philosophies of education based not only on theories but the actual practices that prevail" (Kandel, 1930, p. 4).

While these definitions provide a starting point for undertaking a comparative study, challenges emerge. Schleicher (1996) identified several issues with comparing various characteristics of educational systems from an international perspective. The population(s) being compared may be different in significant ways, the methods chosen for analysis may result in unintended or unreliable results, and the manner in which the criteria for comparison are analyzed can lead to some of the same unintended or unreliable results. According to Kosmützky and Wöhlert (2015) any international comparison invites questions about the equivalence of the study populations and the data material, and also prompts a concern with "interpretative equivalence" (p.7), or the comparability of the results of a study, such as this one, between a university in Norway and one in the U.S.

As a result, comparing the processes involved with vocational teacher training between different countries is a significant challenge. In fact, only a few scattered studies have attempted comparisons, and all of them were conducted for different comparative purposes. Grollman (2008) examined differences in the way in which vocational teacher's tasks change, depending on the institutional framework and country in which they teach. A study by Dehmel (2011) compared the vocational education systems in Germany and England with a focus on teacher training. Barabasch and Watt-Malcolm (2013) examined the German system for vocational teacher education and used it as a basis for suggesting changes in the way Canada prepared its vocational teachers, while a 2019 study (Keller et al.) compared vocational teacher training between the U.S. and Switzerland. In Europe, Misra (2011) found significant differences in how defining teachers and trainers can occur, including the learning context, i.e., whether someone works in educational institutions (Denmark, Norway), or trainers in industry or commerce (Germany, Ireland) or if someone works in initial VET or CVET system (France). Misra also found differences in terms of content where teachers are responsible for theoretical training, and trainers provide the practical pieces (e.g. Spain). However, even after comparing VET teacher training based on different policies, core VET teacher training and challenges in professionalization, Misra concluded that more attention to VET teachers is needed. More recently, Isacsson et al. (2021) examined the duration and content of vocational education teacher education programs in Finland, Germany, Norway, and Spain. Hoppe & Kaizer (2021) argued VET teacher training must be seen in context of the larger VET system, even though certain models for standardization of education in Europe are in place, such as the European Qualifications Framework (Méhaut & Winch, 2012). In general, an understanding of VET teacher training comparisons, including contextual factors, are highly relevant while variation and adaptations, even within systems that share commonalities, should be expected and further investigated. Leraand and Smeplass (2022) found that local VET teacher curriculums were different between providers within the same national context as Norway – even though national legislation is binding for educational providers. The study of Leraand et al. demonstrated how local room for maneuver-

ability can create solutions and practices that further complicate ideal type comparisons based solely on the national level. Zirkle, et al. (2022), examined differences in vocational teacher training requirements between Finland and one state within the U.S. None of the aforementioned studies attempted to examine vocational teacher training through the lens of the universities offering the program. Hence, in this study we have chosen to conduct a comparison of two selected VET teacher training programs in Norway and the U.S. to examine how differences and similarities at the university level can give insights into central aspects for these programs' quality.

The two universities selected for the comparative analysis of this study are both significant in terms of student enrollment, curricular and degree offerings, and have esteemed status within their respective country.

3 University Context

The Norwegian University of Science and Technology (NTNU) dates to 1900 with a main campus in Trondheim. Several mergers between higher education institutions in the region, in 1968, 1996 and lastly 2016 – has resulted in NTNU being the largest university in Norway with a student population of 43,000 students divided between three main campuses (Norwegian University of Science and Technology, 2024a). Fourteen percent of all students in Norway attend this university which offer 398 different study programs. The university is home to the largest teacher education department in the country, where 4400 students attend a variety of teacher training programs. The university has offered training in the nationally regulated practical pedagogical training for vocational teachers since 2005 (The Directorate for Higher Education and Skills, 2024) and the bachelor's program since 2007 (Rokkones et al., 2014). The department yearly graduates on average 40 bachelor's students and 40 students with the shorter practical pedagogical training (Norwegian Directorate for Higher Education and Skills, 2024).

The Ohio State University (OSU), based in Columbus, Ohio, was founded in 1870 and is currently the third-largest university in the United States with over 56,000 students. The university offers more than 200 undergraduate majors, 278 graduate and professional programs, and over 500 specializations. OSU has one primary campus and five regional campuses across the state of Ohio and has more than half a million alumni across the globe (Ohio State University, 2024). Teacher training programs reside in five different colleges: Education and Human Ecology, Arts and Sciences, Food, Agriculture and Environmental Sciences, Nursing and Social Work. In total, approximately 1,000 students are enrolled in teacher training programs each year and over 150 of these students are in a VET teacher training program (The Ohio State University College of Education and Human Ecology, 2024). The university has a history of involvement with vocational teacher training dating back to the early 1920's as a result of federal policy legislation.

Both universities offer vocational teacher training as part of broad study portfolios and have embedded systems for quality assurance as well as answer to external agencies, ensuring their standards and relevance. In Norway, NTNU has a system that builds on the University strategy – and uses a system of evaluation and development of courses in connection with the development of their study portfolio to ensure systematic develop-

ment of program quality (Norwegian University of Science and Technology, 2024d). The system is a response to Government initiated reforms to improve education quality (Ministry of Education and Research, 2024). The University is closely evaluated by external national agencies such as the *Norwegian Agency for Quality Assurance in Education* (NOKUT) and *The Norwegian Directorate for Higher Education and Skills* (HK-dir), as required through the European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). In the U.S., The Ohio State University must meet university requirements, established by the Ohio Department of Higher Education (ODHE) for the awarding of university degrees. Teacher training programs such as those in VET, must meet further standards and requirements set by ODHE in order to offer these programs. The alignment with these standards is evaluated every seven years through a state review process. In addition, university teacher training programs in many states, Ohio included must undergo periodic national peer review through the Council for the Accreditation of Educator Preparation (CAEP). This review requires universities to self-assess and conduct evidence-based analyses of their programs and their efficacy (Council for the Accreditation of Educator Preparation [CAEP], 2024).

These systems for quality dictate that the study programs in both of our cases for this study are constantly evaluated through indicators such as completion rates and curriculum quality – providing publicly known figures and information available for analysis. Furthermore, we have included information in our study regarding student populations and student assessments from prior and ongoing quality work and scientific analyses. This enables a holistic, yet in depth approach to addressing questions of how key elements of the study programs impact the education of VET teachers in the two contexts.

4 A Brief Discussion of VET Teacher Training in Norway and the United States

One of the main objectives of VET teacher education is to find new or improved ways to develop quality vocational education programs (UNESCO-UNEVOC, n.d.). While the U.S. has a significant history of VET programming over the last 100 years and thus, involvement with VET teacher education, Norway was much later in establishing systems for formal competence for teachers.

In Norway the formal formation of study programs for vocational teachers came after 1945, with formal requirements being implemented as late as 1967 (Frøyland, 1997). Vocational education and training became embedded in upper-secondary schools after a new national reform in 1974 (Rokkones et al., 2018), creating needs for formally qualified personnel in schools. The requirements for formal qualifications for teachers can be seen in connection to a long historical development of Norway investing in education in general (Smeplass, 2018), with vocational education being an integral part of an institutionalized system of tripart collaboration (Bjørndal, 2005; Nyen & Tønder, 2014). The contemporary education programs for VET teachers in Norway are regulated through a national legislation act implemented in 2000, revised in 2013 and 2023 (Norwegian Ministry of Education and Research, 2023a; 2023b). To become a certified vocational teacher, it is a prerequisite that the teaching competence is built upon a journeyman's or crafts-

man's certificate. Additionally, the individual must have experience in the profession, or other relevant practice that provides a foundation for further studies. Vocational teachers often have a diverse professional background, so their areas of competence can vary, especially in terms of their specialization. As an alternative, universities and colleges assess obtained work life competence of applicants for admission in accordance with the regulation on admission to higher education § 3–1 (Norwegian Ministry of Education and Research, 2017). The definition of higher education in Norway corresponds with the European Qualification Framework level 6 (EQF6) (Norwegian Ministry of Education and Research, 2022a).

A vocational teacher has after certification competencies in vocational subjects at a higher level than secondary education (Norwegian Ministry of Education and Research, 2023a). They are educated in facilitating relevant learning processes in schools and businesses that lead to certification of students in the vocational subjects in the relevant program area of their expertise. Currently there are 10 clusters for VET, and a VET teacher is certified to teach in one of the clusters. A vocational teacher is also expected to have in-depth knowledge of vocational training, learning processes, practical teaching methods, and how the professions are performed in the workforce.

One can become a vocational teacher in Norway through two different pathways, either by taking higher vocational education at a technical college followed by one year of practical pedagogical education (called PPU in Norway), or by obtaining a bachelor's degree in vocational teacher education at a higher education institution. Common to these programs is that they combine what is termed *vocational pedagogy*, *vocational didactics*, and various forms of formal *practice* training. All programs that qualify for a vocational teacher are governed by the mentioned national framework, which is designed to ensure broad competence to teach in the vocational program areas, all leading to one of 204 vocational certificates (The Norwegian Directorate for Education and training, 2024a). There are a substantial number of vocational teachers working in schools who do not have the formal requirements to teach, i.e. lacking formal pedagogical training (Turmo & Aamodt, 2008). Because vocational education is an area of strong policy interest in Norway and there is a shortage of teachers in technical subjects, the government is also signaling increased investments in vocational teacher training as one of several means to support the labor market (Norwegian Government, 2022). Yearly around 200 students complete a bachelor's degree as vocational education teacher– which is offered at three universities in Norway, while 80–100 people complete the practical pedagogical training for vocational teachers (The Directorate for Higher Education and Skills, 2024a). At the same time, there are uncertainties to how many actually work as vocational teachers in schools, as available statistics are poorly designed to separate between various types of teachers (Grande et al, 2014; Gunnes et al., 2023).

The United States "official" beginnings of VET started in 1917 with the federal passage of the Smith-Hughes Act, which provided funding for vocational training in the areas of agriculture, trade and industry and home economics. The act also provided funding for teachers, supervisors and directors in each of the three areas. Training of vocational teachers was a specific focus of the act, and federal funding for vocational education continues to this day, with the most recent act, The *Strengthening Career* and *Technical Education* for the *21st Century Act* having been signed into law in 2018. Individual states are free

to determine how much of the federal funding is utilized for teacher training; some states place considerable emphasis in this area, while others do not, which has led to variations in teacher quality (Zirkle, 2018). These variances in the training of vocational teachers have also led to issues with the quality of some vocational programs at the secondary level across the U.S. (Zirkle, 2021). Public perceptions of the training of vocational education teachers, the resulting quality of teachers, and thus the abilities of these individuals to prepare students for the workplace or further education and training have long been a source of concern for educational leaders involved with VET (Zirkle & Martin, 2012; Bruening, et al, 2001; Lynch, 1996; Cramer, 1994).

According to the United States Department of Labor (2024), there were 212,100 VET teachers at the secondary (middle and high school) and postsecondary (two-year community or technical college) level in the U.S. in 2022. In the state of Ohio there are approximately 1,800 vocational teachers employed at the secondary level (Ohio Department of Education, 2023), teaching a broad range of subjects from agriculture production to nurse assisting to carpentry and welding. At the present time, there are shortages of VET teachers in Ohio and across the country (Frost, 2022; Petrus, 2022) due to a variety of factors, with the primary issue being salary disparities between schools and the private sector. These disparities have increased in recent years, as a strong job market and an aging workforce in many areas associated with skill trades, has increased private sectors salaries in many areas. Other reasons for teacher shortages include a lack of professional development, funding challenges leading to vocational programs being discontinued, and a lack of prestige associated with teaching (Zirkle, 2005; Zirkle, et al., 2022). These factors have affected both the recruitment and retention of VET teachers.

With 50 states, and each one responsible for their own educational system(s), drawing generalizations regarding teacher training in the U.S. can be challenging, particularly with VET. However, VET teacher training across the U.S. does share some significant commonalities in this area. Historically, there have been two pathways to vocational teacher certification/licensure (Zirkle, 2018). The first pathway requires a university degree consisting of general education, technical content, and teacher pedagogy, including field experiences (observations in a VET setting), student teaching, and in most states, passage of some type of written examination over teaching or technical content, or both. An alternative pathway has relied on significant work experience in the discipline in which a teaching credential is sought, supplemented by either a modified teacher education program at a university or some type of state-approved teacher professional development and training. As with Norway, both of these pathways require pedagogy focused on vocational subjects, vocational didactics, and some type of teaching practice. These differing pathways have existed for over 100 years with numerous variations, particularly in the alternative pathway.

5 Method

While the literature has identified several issues with comparing educational systems from an international perspective, this comparative study seeks to align with Rojewski (2004) who cited the need for exploring and describing a given nation's progress toward

vocational-technical education goals within the context of other developed countries. This study compared the vocational teacher training programs at two universities: The Norwegian University of Science and Technology in Trondheim, Norway, and The Ohio State University in Columbus, Ohio, USA.

The researchers involved in this study are program managers at their respective universities. As such, they adhered to their roles as "insider-researchers" (Breen, 2007). This role provided the researchers with unique perspectives with respect to the comparative analysis, specifically having an explicit understanding (Bonner & Tolhurst, 2002) of the vocational teacher training programs.

Through document analysis and webpage descriptions, program entry requirements as defined by various government legislation and university administrative regulations were examined, as were university curriculum (courses, credit hours), faculty qualifications, and program exit criteria (exams, tests, etc.). Interviews were also held with university faculty and government officials in both countries. Responses across these various data sources were cross-checked to ensure the reliability of the findings. In the following analysis, our main findings are presented through a narrative approach, first explaining core components of the NTNU programs, followed by the OSU programs supplemented by explanations to how these elements can be understood in light of each other.

6 Comparative Aspects of the Two Universities

6.1 University and Program Entry Requirements

At NTNU there are three VET training programs have different requirements for admission. One is a master's program in vocational didactics designed for certified teachers (Smeplass, 2023), and will not be substantiated further here. The two others are the practical pedagogical training (PPE) program, equivalent to a year of full-time studies (but taught over two years), and a three-year bachelor's program.

To become a teacher, the university conducts a suitability assessment throughout the entire program, and students must provide an official statement from the police proving no records of illegal conduct at the beginning of their studies. The two-year parttime program requires either a three-year higher degree from a university or two-year higher VET training in addition to two years of documented vocational practice after obtaining a certificate or students can be assessed based on their work experience and obtained formal competences at an upper secondary level (EQ3) (Norwegian University of Science and Technology, 2024b). The latter entry requirement is termed 'competence assessment' and is done through an evaluation process conducted by an administrative representative, and in some cases after obtaining advice from a scientific staff member.

For the bachelor's program (BVET) the students must have a documented VET certificate, a minimum of two years professional practice in the field of their certificate, as well as either an upper-secondary diploma or they would go through the same process of 'competence assessment' as mentioned in the other study program (Norwegian University of Science and Technology, 2024c).

In Norway, higher education is for the most-part free and open to all who are qualified. This means that each institution has a limited number of spaces for students, decided through considerations between the universities and Ministry of Education and Research. These limited spaces are part of a larger system for producing the 'right amount' of qualified personnel (Gunnes et al., 2023). However, this also puts pressure on the university, who have to provide rather small cohort groups with specialized training to ensure quality. As a result, NTNU clusters students between VET study programs under the umbrellas 'vocational pedagogy' and 'vocational didactics'. These terms are also used in the national curriculum (Norwegian Ministry of Education and Research, 2023a) to signal that there is a need for a specialized approach to vocational learning and teaching for these teachers (Hiim & Hippe, 1999). While the PPE program has more than 200 applicants for 50 places each year, the BVET program has five different cluster programs, whereas the health and youth development has 150 % more applicants than study places (20), the other four programs of building and construction, electrical trades, restaurant and food processing and technical and industrial production in general have fewer students than the predefined quota. The yearly cohorts are separated by cluster for higher vocational training and joined together for general courses in vocational pedagogy and vocational didactics, referred to as 'teacher profession subjects'. In the PPE program, students have multiple courses in even larger groups, together with students from general teacher tracks. This entails that student groups are multidisciplinary in a significant part of their studies.

At The Ohio State University there are also three VET training program options. One is based on completion of bachelor's degree. The second requires prospective teachers to have significant work experience for initial qualification as a VET teacher but does not require a bachelor's degree for admission, and a third option which is also a master's degree program. This third option will also not be part of this comparative research as it is not widely attended. Both of the two VET teacher training programs at OSU have different requirements for admission. Students in the degree-seeking option must submit an application, transcripts from their high school, test scores from either the American College Testing (ACT) or Scholastic Assessment Test (SAT) and an optional letter of recommendation from a school official. The Ohio State University is classified as a "highly selective" university (The Princeton Review, 2024), meaning admission to the university for the purpose of completing a bachelor's degree is not guaranteed, and admission to the university is competitive. In each yearly admission cycle, approximately 55–60 % of total applicants are accepted for admission across all of the more than 200 undergraduate programs.

Once a student is admitted to the university as a degree-seeking student, admission to the VET bachelor's degree teacher training program is a separate process, and there are specific requirements for admission. An application for admission to VET teacher training program must be completed. A minimum grade-point average (GPA) of 2.75 on a 4-point scale is required. A criminal background check must be completed, and a writing sample must be submitted. The admission process culminates with an interview with program faculty and the faculty make the final decision based on the required components.

Individuals entering the VET program based on their work experience have a different admissions process. For admission to the university, they are excluded from supplying test scores and letters of recommendation and only need to provide evidence of a high school diploma, although many already hold bachelor's and master's degrees in various technical disciplines. They may also hold other types of credentials, such as the completion of a registered apprenticeship program through the U.S. Department of Labor or credentials earned through military service. These lesser admission requirements are as a result of being "non-degree" students, and their course-taking requirements are significantly less (discussed in the next section). As a result of their work experiences, as a group they are significantly older than the degree-seeking students. Their admission to the teacher training program is automatic: they are admitted as a result of their employment as a VET teacher in a local school district and are exempt from the many processes the bachelor's degree students must complete for both admission to the university and to a teacher training program.

Overall, when comparing the entry requirements for the university programs for VET teacher training, we find that admission to the NTNU programs follows a nationally adapted system, while the OSU admission system is more selective and locally-based within the university. In either case, these methods ensure that students have sufficient prerequisites to complete their courses, as well as holds certain formal requirements to be regarded as a 'suitable candidate. In Norway the certificate from a VET track is a requirement, while in the U.S. students must pass the standardized tests to a specific level to be found suited as a candidate. In both cases, these entry requirements are a central aspect of only allowing suitable candidates into the existing programs.

6.2 Curricular and Course Components

At NTNU, the training programs are required to follow the national legislation for the two programs. The small cohorts at NTNU requires that the training is efficiently organized, while at the same time contributes to specialized training in the specific cluster programs. This is done by having few courses per semester, but specialized tasks for different groups within the cohort. In the PPE program, students are required to have at 30 European Student Credit Points (ECTS) in pedagogy and 30 ECTS in vocational pedagogy (Norwegian Ministry of Education and Research, 2023b). The program provides a total of 60 ECTSs. The pedagogical training is provided through one course with key pedagogical topics running over all four semesters (Norwegian University of Science and Technology, 2024b). The course is designed to provide students with theoretical and scientific tools to function as teachers in a Norwegian education setting – where pedagogical skills are highly valued. Furthermore, students have a course in vocational didactics focusing on leadership in learning processes and connections between education and society. The students are in this course trained to translate issues from the vocational profession into the field of teaching through Research and development (R&D) projects.

In the BVET program consisting of a total of 180 ECTS, the pedagogical and didactical training is complemented by a requirement of 60 ECTS in broader vocational subjects (i.e. the other professions in their cluster) as well as 60 ECTS in vocational specialization, meaning that they will be required to further develop their vocational skills. In total six

courses are taught students, ensuring both the requirements for broader and specialized 'higher VET training'. The BVET students attend six semesters and start with a course in 30 ECTS that integrates the vocational subjects with professional training (Norwegian University of Science and Technology, 2024c). They continue to learn about central pedagogical themes and youth culture second semester, and industries and business knowledge the third. Fourth semester involves a course to develop their own vocational specialization in combination with adapted training, which is pivotal for all teacher programs in Norway. The last year, students have a subject of 30 ETCS in a course containing societal perspectives on vocational pedagogy, while a bachelor thesis (30 ETCS) is the culmination of the training – a research and development project where students work in groups and gather data on a chosen subject with supervision from a university teacher. Through the training students are exposed to a variety of tasks and assignments often designed to combine their prior knowledge with new insights from either practice or course curriculum and combine these to support the professional development and a professional identity as vocational teacher. Students are required to attend a minimum of 80 % of the sessions in all courses and are required to complete all obligatory assignments prior to any of their exams.

At The Ohio State University, both of the training programs are required to follow the state of Ohio Department of Higher Education standards (Ohio Department of Higher Education, 2024), as well as Ohio State University policies for program completion. The bachelor's degree program requires 120 semester hours of study (approximately 30 per year). In the U.S., one semester hour is equal to 15 hours of lecture time in a course, and most courses are three semester credits. The degree also requires completion of general education (courses in mathematics, English, natural sciences, humanities, etc.), vocational courses in the subject to be taught (such as agriculture, business or family and consumer sciences), pedagogy, and practical training. In the second year, students begin taking both vocational courses and courses focused on pedagogy, and these include such courses as educational psychology, teaching methods and assessment, educational technology and working with special-needs students. In year three, this course-taking pattern continues and includes the beginnings of practical training (see the next section for a discussion of practical training). At the conclusion of the fourth year, students take state-required written assessments of their vocational subject knowledge and their knowledge of pedagogy and receive a diploma from the university. They also receive a teaching license from the state of Ohio upon payment of a small fee ($80 USD). At this point, they are able to seek employment as a VET teacher. This type of teacher training program is known as a pre-service type of training, as the students must complete all aspects before they receive a teaching credential and a potential teaching position.

In the VET program based on work experience, when students are hired as fully licensed teachers, and enroll in the teacher training program, they are granted a teaching license "up-front" and begin to take courses at the same time they begin teaching. The process is completely opposite of the bachelor's degree students and is known as an in-service teacher training program, as the teachers are completing the courses while they are beginning their teaching employment. Teachers are hired in the summer and attend a summer "bootcamp" for 2.5 weeks designed to provide basic pedagogical knowledge and to provide an opportunity to perform some actual teaching in front of their

peers. During their first year of teaching, these individuals are supervised by a university teacher educator, who observes and provides constructive feedback as part of practical training. The teachers continue teaching full-time and attend one course a semester for three more years, for a total of 27 semester hours, all focused on pedagogy. These students take many of the same pedagogy courses as the bachelor's degree students, including teaching methods, curriculum and assessment, educational technology, as well as a course on the foundations of workforce development and education, and a course on work-based learning. These courses are populated by both groups of students and the networking and sharing of knowledge and experiences is beneficial to both groups.

When comparing the curricular and course components, we find similarities in how the programs all are designed to provide students with tools to understand and orient themselves in the world of education – as well as build upon technical and practical training they have either completed prior to the study program or will be exposed to during their studies. In general, there seems to be more explicit pedagogical and didactic focus in the Norwegian programs than in the U.S. case – however, these differences are mostly related to how Norwegian teacher training contains quite specific references to pedagogical ideals from profession debates and a VET curriculum in Norwegian schools that is also focusing on social missions in education. When we look at the concrete components of the training the university provides, the educational programs are in both cases built upon the existing scientific evidence of how teachers can work with youth and learners in the context of vocational education and training. Therefore, we see that the universities can offer programs that have what can be termed 'scientific authority', meaning that topics and literature for VET teachers are substantiated with evidence-based insights and are designed to provide students with abilities of critical assessment and individual authority as professional teachers in the contexts they will work.

6.3 Practical Training Elements

Both of the NTNU study programs in focus have minimum requirements for the number of days the students must have in practical training. The PPE program has 60 days of practice spread between the four semesters. Practice training is carried out in the student's own vocational cluster. All practice is mandatory and supervised and occurs in authentic vocational situations with students/apprentices in schools, or possibly in a training office (Norwegian University of Science and Technology, 2024e). Students must undergo practice training both in middle school and in secondary education, since they will be certified to teach at grade levels 8–13. Their practice in middle school is 10 days. Up to 20 practice hours can be conducted in a training office. Further, students who are already employed in schools must have a minimum of 20 hours in a different school than their workplace. All practice is required to be documented, and students often have tasks and reports connected to their practice.

At the BVET program the legislation upholds that 'The practice study should consist of at least 130 days of supervised, varied, and assessed practice and be an integrated part of the education. The practice study should be distributed over all semesters of the education, with 70 days of supervised vocational pedagogical practice in school and 60 days of supervised vocational practice related to the workforce' (Norwegian Ministry of Educa-

tion and Research, 2023c). At NTNU, this is operationalized through obligatory courses. Students have practice periods all semesters, starting with 20 days in upper secondary, 10 days in secondary and 15 days in a company (year 1), 20 days in upper secondary and 25 days in a company (year 2) and 20 days school practice and 20 days in a company (year 3). Since the practice is integrated in the other courses, students are obligated to follow the schedule. The main principle of the training is, however, that each student acquires new experiences from various educational and practical contexts where they can build their knowledge and skills to support their professional development. Nevertheless, since students have different professional backgrounds and life situations, as well as live in various parts of the country, the organization of the practice periods require individually adapted plans as well as extensive bureaucracy to ensure that every student meet the requirements during their training. Because the practical training elements are adapted to the individual learner, and the program caters five different vocational clusters, each cohort has a designated cohort coordinator – who keeps an overview of the progress of all students practice training. Through digital platforms, advisors in schools, the students themselves and the practice supervisors register and approve the students' practice throughout their training. This coordination is important, since students have multiple practices and 'follow up teachers' through their training.

The two licensure pathways available through The Ohio State University also contain practical training elements. The licensure pathway culminating in a four-year bachelor's degree requires two "field experiences" in the student's third year of university. These field experiences consist of 75 clock hours each, of observation and participation in a VET classroom and lab. The two field experiences are in different situations, either by grade level (one field experience in a middle grades school, the other in a high school) or by school location (one field experience in a rural school, the other in an urban or suburban school). The field experiences are designed in this way because the teaching license is for grades 7–12 and in Ohio, there are more than 600 school districts, split between rural, urban and suburban areas. As a result, students are required to complete practical training in a diversity of settings. This is helpful to the students, as they have an opportunity to experience different environments before they begin their job search.

In the student's fourth year, they complete student teaching (sometimes referred to as "clinical practice"). The student is the teacher of record for the class for 12 weeks and is supervised by both a university faculty member and the hosting mentor teacher. Student teaching is typically completed in the student's last semester of university study, just prior to graduation. It should be noted that both the field experiences and the student teaching are considered part of the student's university course requirement, and thus, the students pay tuition to the university as part of their completion of these components. In addition, they are not financially compensated for their participation in either field experiences or student teaching.

As previously mentioned, students in the VET program based on work experience are employed as full-time teachers and receive a full salary, but as part of the program at The Ohio State University, the teachers are observed by a university teacher educator in their first year, three times in the autumn semester and three in the spring semester and provided with feedback. This feedback is not provided to school administrators, as the teacher educator functions as a mentor providing constructive feedback only to the

teacher and is not involved with the actual teacher evaluation process conducted by the school. Teachers also attend a once-a-month seminar on campus for the entire year as part of the practical training, where topics such as classroom/lab management, parent-teacher relationships and teacher professionalism are discussed.

We find that although the practice is somewhat differently organized, some of the components are similar, and could be regarded as key for the programs analyzed. In Norway, the practice is designed to give both student groups experiences that expand on their already achieved certificate – and prepare them for various teaching positions related to their vocational cluster. The requirements are formulated in the national curriculum as 'days', but the framework states little detail to how the practice should be conducted. This gives some room for flexibility for the university and the students, but also creates conflict in some cases, since students in many cases lose income in practice periods. In Ohio, the practice is perhaps more structured, as students in both the bachelor's degree and work experience options have fairly prescriptive standards for how the practice must be conducted and what skills and knowledge the student must demonstrate. Achievement of these standards is documented through teaching observation via validated checklists and rubrics for each student.

In both cases, the practical training elements are integrated requirements for becoming a teacher yet have different ways of standardizing in terms of days and hours. The Norwegian NTNU model has more hours than the OSU version (60 and 130 days is equivalent to 450 and 975 hours of practice), but since the students often teach only around 30–50 % of their time in schools, whereas students in the Ohio system are generally teaching for about 70 % of the time they are in school – the models are difficult to compare in a quantitative logic. What we do see, however is that the practical training requires integration with the other parts of the training, as well as is conducted in collaboration with schools and companies. Both universities use a combination of learning arenas to ensure that the teacher students are equipped with directly relevant experiences for their present and future jobs, as well as have systematically conducted teaching and documentation tasks connected to their practice to ensure quality and relevance (Rokkones et al., 2018; The Ohio State University, 2023). In both cases, university teachers with specialized academic profiles within VET teacher training follow up on students to ensure that the training is not only a mechanical obligation but contributes to preparing teachers for concrete requirements of planning, leading and documenting learning processes either for students or themselves. This necessitates that the programs all use the formal requirements as tools to empower students to tackle the practical aspects of being a vocational teacher in a labour market that requires professionalism and systematic approaches to education and training.

6.4 Definitions of Formal Qualifications

The standardized national legislation ensures that students with a degree from either of the Norwegian programs are approved to teach in their vocational cluster after completing their training, and no further qualification is needed after obtaining the diploma. Students at these programs are recruited from all parts of the geographically spread nation, and students can use their degree to work as teachers nationwide. The PPE pro-

gram builds upon a specialization that the students have already completed, either as a diploma in higher education – or higher vocational education (Norwegian University of Science and Technology 2024b). Because of this – the training is shorter and is designed to ensure that the vocational teachers first and foremost are provided with pedagogical, didactical and practical training.

The BVET program on the other hand, provides students with more comprehensive training, and results in a bachelor's degree after completion. Both NTNU student groups are after completion qualified to teach students from class 8–13. Because of the different entry requirements, the programs attract different student groups in terms of prior qualifications but provides students with similar forms of training. Both groups can continue towards a master's degree afterwards, given that they have a bachelor.

A completed teacher training program gives the student a diploma as 'vocational teachers', which is a formal requirement for permanent positions in Norwegian schools. While there is a national requirement in Norway that teachers working in schools have completed formal training, the legally responsible provider can decide to hire staff without the formal training (The Norwegian Directorate of Education and Training, 2024b). To dampen a teacher shortage in schools, principals have an option to hire necessary staff with the proper certifications from the vocations – demanding that they are formally qualified after three years. There are many uncertainties regarding how many teachers are needed for the future in Norway, and there are some indications that there will be too many teachers with the PPE educations within 2040 (Gunnes et al. 2023).

The bachelor's degree program at The Ohio State University concludes with both a degree and a teaching license recognized by the state of Ohio. This license is effective for two years, during which time a new teacher must complete the Ohio Resident Educator Program (RESA), a comprehensive, two-year initiative to assist beginning teachers with mentoring and professional development as they start their education careers (Ohio Department of Education, 2024). After successfully completing RESA, the teacher is eligible for a five-year license. During that five-year period, the teacher develops and implements an Individualized Professional Development Plan (IPDP), which is designed to allow the teacher to continue their professional development and improve their teaching skills and knowledge through workshops, university courses, technical update training and other self-improvement activities. This plan is mutually developed between the teacher and either a school administrator or mentor teacher. It is important to note that this requirement for a five-year Individualized Professional Development Plan requirement continues for the duration of the teacher's career. This requirement is designed to ensure teachers are on a cycle of continuous improvement.

VET teachers in the program based on work experience receive the initial two-year teaching license when they are initially employed. During these first two years of teaching, they must make satisfactory progress on the university courses by completing approximately half of the 27 semester hours. At that point, the license can be renewed for two more years, and all remaining courses must be completed. These teachers do not participate in the Ohio Resident Educator Program (RESA), instead they complete a university conducted Performance-Based Assessment (PBA), where the university completes one final teaching observation and the teacher constructs a teacher portfolio. At that point, the teacher is eligible for a five-year license. During that five-year period, the

teacher develops and implements the same Individualized Professional Development Plan as the bachelor's degree-based teachers

In Norway, there is currently a requirement of having a master's degree to be an upper secondary teacher in all other fields, than vocational subjects. Other teacher training programs equivalent to the PPE program, have recently also implemented a requirement of a master's degree prior to admission. These differences are important contextual factors, as they illustrate how the Norwegian teacher training in general is becoming longer and more academic. At the same time, the requirements for entry into VET teacher programs, and requirements for degree level is kept at the same level, equivalent to an EQF 6 level. This is intentional and reflects how Norwegian VET training is designed to build upon former certification and training. While there is no requirement in the state of Ohio for teachers to obtain a master's degree to retain a teaching position, the majority of teachers in Ohio continue their education and obtain a master's degree. According to the National Center for Educational Statistics (2022), 60.8 % of all Ohio teachers have a master's degree. In addition to using credits earned during a master's degree to renew a teaching license, the degree can also provide a salary increase, or if the degree is in a specific area, such as educational administration, it can be a springboard to a principal or other administrative position.

On the theme of formal qualifications, we find that the programs provide acknowledged certification for teachers to work in schools and companies where vocational education and training is provided. The diplomas functions as stamps of approval to VET providers in the sector, and signals that students have obtained formal qualifications essential to plan, conduct and continuously improve training for students in the specific VET cluster they are specialized in. At the same time, students are not guaranteed employment as teachers, and in both contexts, there are uncertainties regarding VET teacher retention and turnover. One reason for this is that the attractiveness of teacher positions in formal educational settings is influenced by other opportunity structures in society. If the students have managed to obtain a teaching degree, they might find relevant work outside of the formal systems too, meaning that salary differences between private and public sector, or other factors related to work conditions, can influence the careers of VET teacher students. The reputation of the university and the formalized requirements to complete the programs ensures that students with the formal degrees from both universities have accomplished all aspects of their training and through completion of the various requirements of the programs, have proven their abilities to employers in multiple fields.

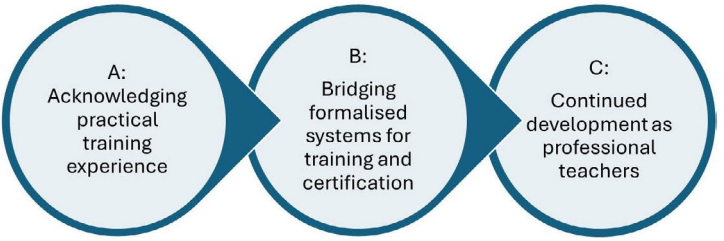
7 Discussion: Designing Programs that Acknowledge and Prepare

We have now detailed and explained some of the central characteristics of the VET teacher programs at the two universities in Norway and the U.S. We find that although some of the organizational principles may vary, there are also important similarities to discuss. Our analysis of the programs is also based on our in-depth knowledge of each of the national and organizational features that constitute the institutional landscape that defines the core functions the programs are designed to serve. Since higher education

in Norway is part of a welfare state's system for decommodification (Willemsen & De Beer, 2021), students at NTNU do not pay tuition for their studies. However, many have personal costs connected to loss of income during training weeks and practice as well as travel to campus for week-long gathering sessions for some demanding both travel and accommodation. In the U.S. students, particularly those in the bachelor's degree program, must pay tuition as part of their studies, although scholarships and financial aid may be available. For the students who are already VET teachers, and in the program based on work experience, they may have tuition reimbursement or waivers from their employing school. However, they have some of the same financial costs as students from Norway, with travel to campus for classes. In general, to understand the attractiveness of these training programs comparatively – one should include information regarding the investments done by students and how this affects the recruitment process. In both cases, we see that student's investments in their education is significant, even though Norwegian students do not pay tuition like in the US. This 'investment' from the students' side might be an important aspect of understanding the dynamic and relevance of these programs. In both university cases, students have high expectations to how the courses they take should be useful and relevant for their future profession.

Based on insights from our comparative study, we have developed a model illustrating what we find to be core elements of VET teacher training programs. The ABC's of VET teacher training is focused on connecting different logics in the world of vocational work and production, the formalized systems that universities can offer, and the future development for our VET teachers through continued development. See Figure 1.

Figure 1: The ABC's of VET teacher training



The first aspect of *acknowledging* practical training and experience is evident in all of the four programs we have described, but in different ways and as different parts of the education. At the Norwegian university, having prior vocational certification is an entry requirement. This can be seen in connection to how Norway has designed several pathways into higher education as part of a national system for documentation and appreciation of adult' non-formal and informal competence (Orr & Hovdhagen, 2014). In the OSU programs, prior vocational/work experience is an entry requirement for one program, but not for both. However, practical training is highly focused in the program that does not require work experience. In all four of the programs, the practical training elements are pivotal to not only train teachers with theoretical skills relevant for administrative aspects of teacher professionalism, but also to give insights into the world of

vocational learning, which is also to a large extent influenced by physical elements, production procedures, routines and a changing world of work. In Norway, prior studies have documented that even though VET teacher students often have ample experience, they are less comfortable with traditional academic practices such as written exams, documented in several studies conducted at the BVET program (Hylander & Smeplass, 2022; Smeplass & Hylander, 2021). In the OSU bachelor's degree training program, while the students may lack experience, their orientation to traditional academic practices is not an issue, as admission to the university is significantly competitive and a high percentage of students are academically focused and prepared. In both university cases, the meeting between vocational worlds and the systems of teacher training, entails that universities and educators must find the right balance between acknowledging VET systems as a source for knowledge and skills with students' new roles as future educators.

The similarities between how the two universities incorporate both curricular and practical elements in their programs show the next important joint feature of VET teacher training. By using a series of formalized systems such as obligatory school and vocational practice and systems for assessing students' suitability upon entry and through the programs, both universities *bridge* between various competence systems at the higher levels of education to the professional worlds where definitions of quality are continuously evolving. In VET teacher literature, this can be referred to as a form of professional duality, where VET teacher identity is developed in relation to both occupations and school (Andersson & Köpsén, 2019; Köpsen, 2014). It might be that since both universities are subject to external systems for quality assurance, a focus on relevance ensures that the programs at focus constantly are adjusted to be relevant to both funders, students and those stakeholders who employ them after their training. VET teacher training models that intentionally incorporate vocational elements must constantly evolve in accordance with VET systems development. Both universities therefore have models that ensure students are not only formally qualified, but also have tools and strategies to handle their jobs in the double practice field.

This brings us to the last aspect of the model, where *continued* development as professional teachers seem to be incorporated into the programs through training students to critically evaluate curriculum, adopt their teaching to various situations and develop their teaching through systematic evaluation and utilization of research. Perspectives on lifelong learning and professional development is important for many professions but proves key to vocational teacher training as students are expected to maneuver evolving vocational demands in their clusters, not single vocations. The broader nature of the programs investigated mirror how the educational systems in both Ohio and Norway have structured their vocational training for youth. This entails that professional VET teachers always must work in a space balancing between specialization and generalization, where what is regarded key components not only can, but is likely to change over time.

Designing consistent VET teacher training programs is complicated as universities must find balance between labor market needs, their own student recruitment, legislation, internal and external standards, and ideals for professionalism. Therefore, we find that flexibility also is key to ensure that VET teacher programs cater to the diverse world of VET.

The ABC's of vocational teacher training illustrates that even though the two VET teacher training programs are situated in different political and economic surroundings, they can also incorporate similar elements that likely contributed to their creation, core functions and maintenance. None of the programs in focus are mere certification systems, they also incorporate science in combination with experience and craftmanship to provide students with a professional competence where the "the whole is greater than the sum of its parts".

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010203

Evaluation of Digital Competencies

Development of an Instrument for Vocational Teacher Training

Niklas Sänger

Abstract *Approaches to modeling and evaluating teachers' digital competencies are often based on the TPACK model. However, in-depth analyses of the conceptualization of the model show that the specificities of the so-called dual subject matter of vocational education are not sufficiently represented. This article provides insights into the development and testing of an instrument for teachers' self-assessment of digital competencies in vocational education. The instrument is based on the structure of TPACK but is adapted in various ways to reflect the specificities of vocational education. The aim of this article is to transfer a conceptual extension of the TPACK model into an initial instrument and to analyze it as part of an initial exploration.*

Title *Evaluation of Digital Competencies. Development of an Instrument for Vocational Teacher Training*

Keywords *Digital Competencies, Dual Subject Matter, Evaluation, TPACK, Vocational Teacher Training*

1 Introduction

When we talk about digital competencies, it is important to determine the competency requirements for educators, especially with regard to teacher training (Kultusministerkonferenz [KMK], 2021, pp. 23–26). Digital competencies for teachers encompass the use of media for teaching and learning (media didactics), education for responsible media use (media education) and the reflection of digital technologies for the subject matter to be taught. A frequently cited model that structurally depicts these requirements is the TPACK model by Koehler, Mishra and Cain (2013). The TPACK model is used not only for

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conceptualizing the digital competencies of teachers but also as a theoretical framework for developing instruments to evaluate digital competencies (see, among others, Chai, Ng, Li, Hong & Koh, 2013; Kusaini, Mahamod & Mohammad, 2022; Schmidt et al., 2009; Sofyan et al., 2023). The model also provides a theoretical framework in research on digital competencies in the context of vocational education and training (VET) (e.g. Seufert, Guggemos, Tarantini & Schumann, 2019). However, in previous approaches, the transfer of the model to the context of VET (in Germany) did not sufficiently reflect the conceptualization of the model. A specific characteristic of VET that TPACK and similar models do not address is the so-called *dual subject matter* (KMK, 2019, p. 6). This means that the curricula of VET are not primarily structured according to academic disciplines but rather with a focus on the practical work and business processes relevant to specific occupations. Therefore, the learning objectives of VET derive from disciplinary subjects (e.g. methodology, epistemology and theories) as well as from the professional practice (e.g. how certain tasks and problems are handled within the working practice) (Kremer & Sloane, 2014, p. 8). An examination of Shulman's works (1986; 1987), which forms the foundation of the TPACK model, reveals a conceptualization of content rooted in academic disciplines; learning objects that relate to the professional fields of action are not represented. TPACK therefore reflects on how technology influences scientifically structured knowledge, but it does not address the impact of digital transformation on the operational and business processes within these professional domains.

This contribution addresses this research gap by developing and testing an instrument for self-assessment of digital competencies among prospective teachers in vocational education. The instrument is conceptually based on the TPACK model and aims to represent the dual subject matter of vocational education through adaptations of the model or adjustments of existing scales/items. The article begins with a brief introduction to the modeling of digital competencies based on the TPACK model (Chapter 2). Chapter 3 then presents the development and testing of the instrument as part of an initial pretest (n=78) and focuses on how the evaluation of teachers' digital competencies can be mapped using a self-assessment instrument. The objective here is to transfer a conceptual extension of the TPACK model into an instrument and to conduct an initial exploration. Subsequently, Chapter 4 provides insights into the content analysis of the results from the pretest, centering on how vocational teacher trainees assess their digital competencies. Finally, the findings from the pretest are discussed concerning the evaluation of teachers' digital competencies in the context of VET (Chapter 5).

2 Modeling Digital Competencies of Teachers in VET

The requirements discussed for teachers in the context of digital transformation are often summarized under the term *digital competencies*. In discussions about these competencies, various gaps or ambiguities can be identified (for an overview, see e.g. Rubach, 2024). On one hand, the areas of requirements occasionally merge into a conglomerate which is difficult to grasp (e.g. due to different understandings or a lack of disclosure of the specific perspective under consideration). On the other hand, discussions about digital competencies are at times strongly dominated by individual facets, commonly focus-

ing on the application of technology for instructional design (Sloane et al., 2018, p. 12). Additionally, the context of vocational education introduces specific characteristics that significantly differ from general education. Therefore, this chapter focuses on how digitization changes content-related knowledge in the context of VET. Firstly, I introduce the TPACK model and provide an overview of empirical findings. Secondly, I emphasize why a content-related reflection on digital competencies is crucial for teacher training in vocational education.

2.1 The TPACK Model and Empirical Findings

The TPACK model according to Koehler et al. (2013) is frequently used and adapted in teacher training to conceptualize digital competencies. It is a structural model that depicts the relationships between content (*Content Knowledge*, CK), pedagogy (*Pedagogical Knowledge*, PK) and technology[1] (*Technological Knowledge*, TK) in the form of a Venn diagram. The intersections between PK and CK, TK and PK and TK and CK represent the links between the adjacent dimensions: *Pedagogical Content Knowledge* (PCK), *Technological Pedagogical Knowledge* (TPK) and *Technological Content Knowledge* (TCK). *Technological Pedagogical Content Knowledge* (TPACK) is at the center of the model, combining all three base dimensions. A possible interpretation[2] of TPACK encompasses the knowledge, skills, and abilities of a teacher to instruct content by (a) considering the specifics of the subject, (b) guided by basic pedagogical principles, and (c) through the appropriate use of technology (Koehler et al., 2013, p. 16). The model therefore comprises a total of seven dimensions. TPACK is based on previous works by Shulman (1986; 1987), who emphasizes the relevance of subject-specific didactic knowledge, which in his model results from the meaningful combination of content-related knowledge and pedagogical knowledge. The TPACK model incorporates the conceptualization of subject-didactic knowledge from Shulman's original model and introduces the technological dimension, opening avenues for integrating technology into subject-didactic considerations. This model extension serves as a theoretical framework for delineating various perspectives on the digital transformation within teacher training programs, such as examining how digitization influences pedagogical approaches to teaching specific subject content.

The TPACK model is often referred to in both national discourse (in Germany) (e.g. Beißwenger et al., 2021; Brandhofer, 2020; Eickelmann & Drossel, 2020; Knackstedt, Sander & Kolomitchouk, 2022) and in international discourse on digital competencies in teacher education (an international overview is shown by Voogt et al., 2013). Numerous evaluation instruments are conceptually based on the model. Overviews of empirical studies and validated instruments based on the TPACK model can be found in Kadıoğlu-Akbulut, Çetin-Dindar, Küçük and Acar-Şeşen (2020) or Valtonen et al. (2017). The findings demonstrate, among others, that not all seven theoretical TPACK dimensions can be confirmed empirically (Archambault & Barnett, 2010). Voogt et al. (2013) conclude that, from a conceptual perspective, different interpretations arise, especially for the TPACK

1 In this article, digitization is conceptually subsumed under the term *technology*.

2 For a discussion regarding the interpretation of the TPACK dimension, refer to Voogt, Fisser, Pareja Roblin, Tondeur & Braak (2013, p. 119).

dimension (separate knowledge domain versus integration of CK, PK, TK and their intersections). The authors also emphasize that TPACK must be differentiated for specific subject areas (Voogt et al., 2013). Individual studies transfer the TPACK model to specific disciplines, for example for mathematics (Handal et al., 2013). For the VET context in general, only a few studies have transferred the model (e.g. Arifin et al., 2020; Torggler et al., 2023). Additionally, there are even less studies that transfer the TPACK model to the commercial domain and differentiate the individual dimensions (Schlottmann & Gerholz, 2022; Seufert et al., 2019).

2.2 The Dual Subject Matter in VET

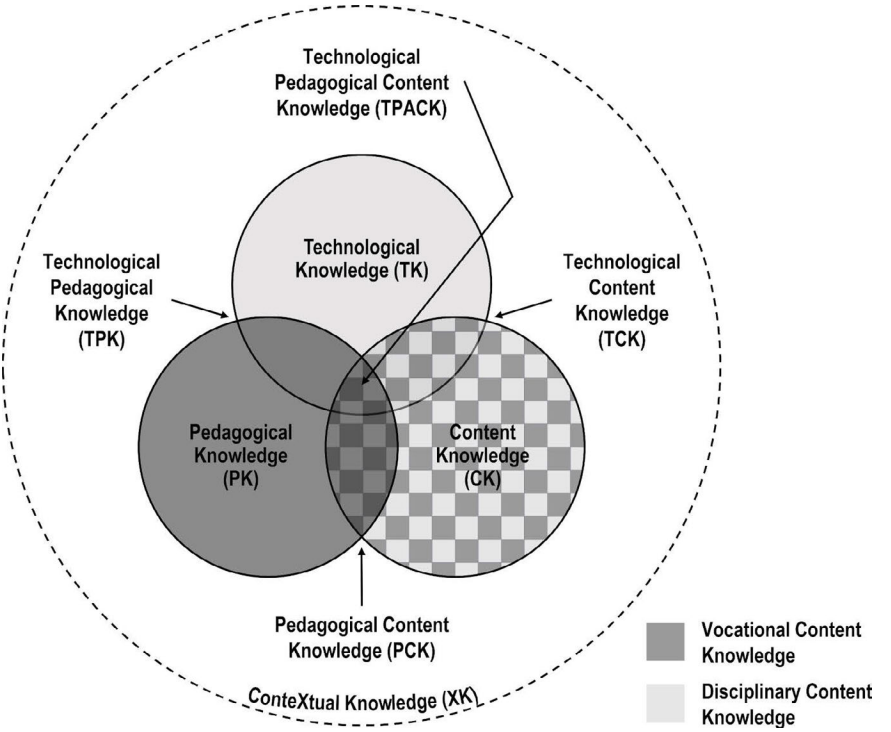
Unlike general education, vocational education curricula are not exclusively based on disciplinary subjects but are structured according to professional fields of action. In the curricula of VET the professional fields of actions of the occupations are converted into so-called *learning fields*; these learning fields represent "didactically elaborated professional fields of action" (Sloane, 2003, p. 4). Accordingly, VET is characterized by a dual subject matter, i.e. the learning objects are determined on the one hand by the subject system of the respective reference discipline(s) and on the other hand by the professional fields of action of the respective occupations (KMK, 2019, p. 6). Following Kremer and Sloane (2014, p. 8), I divide the knowledge from these two content-related reference systems into *disciplinary knowledge* and *vocational knowledge*. From a sociological perspective, the knowledge derived from these two reference systems differs fundamentally. Disciplinary knowledge represents knowledge which is logically structured by a discipline, and which is developed, expanded, and reviewed within a scientific community. Vocational knowledge represents job specific knowledge like workflows or methods which derive from work practices within an occupation (more detailed in Sänger & Jenert, 2023). Teaching according to the idea of learning fields requires the design of authentic work situations (so-called *learning situations*); these learning situations should present the vocational learners with tasks that are typical of a certain field of action in the respective occupation (Sloane, 2003, p. 8). Disciplinary knowledge is therefore not represented in the structure of the reference discipline(s), as is usual for general education. It is used, for example, to assess or solve a problem in an authentic work situation and is thus integrated into the learning situation, i.e. disciplinary knowledge is typically derived inductively in the respective learning situation (Tramm, 2002). Therefore, in instructional practice, disciplinary knowledge is *applied* or *put into practice* in real work situations instead of being strictly confined to its disciplinary framework (Gerholz & Goller, 2021, p. 413). A closer analysis of Shulman's conceptualization reveals that for him, content knowledge is derived exclusively from the structure and knowledge bases of scientific disciplines (Shulman, 1986; 1987). Since the TPACK model is also based on Shulman's conceptualization of content knowledge, the model only reflects disciplinary knowledge. Due to its conceptualization of content, the TPACK model does not sufficiently represent the dual subject matter and therefore falls short when it comes to modelling digital competencies of teachers in VET (Sänger & Jenert, 2023).

The dual subject matter must be considered when modeling digital competencies of teachers in VET. Originally, the TPACK model only considers how the digital trans-

formation affects disciplinary knowledge, e.g. how simulations change the understanding of certain phenomena (Koehler et al., 2013, p. 16). Content-related digital competencies (TCK dimension in the TPACK model) also need to reflect vocational knowledge, i.e. the extent to which occupations, professional fields of action, and ultimately individual occupational activities are affected by digital transformation and how teaching in VET needs to adapt to these transformational processes (Busse et al., 2022). The latter consideration implies that, in addition to general vocational knowledge, teachers must also have knowledge of how the digital transformation affects operational work and business processes (e.g. business cases which could be used as an example) (Windelband, 2021).

In the discourse on digital competencies in vocational teacher training, there are already initial approaches which attempt to take the dual subject matter into account. In the field of business education, Seufert et al. (2019) and Schlottmann and Gerholz (2022) can be mentioned, among others. The contributions locate knowledge about effects of digital transformation on work and business processes at the intersection between content knowledge and technological knowledge (TCK dimension). They consider the digital transformation of work and business processes from a discipline-oriented perspective. In contrast to existing contributions, this article focusses on an occupational perspective, i.e. vocational knowledge is considered as an independent component in the conceptualization of digital competencies. This conceptualization is implemented by including vocational knowledge as component of content knowledge (CK dimension) in the original model (see Figure 1). The conceptualization of vocational knowledge is based on the work of Rauner, who defines vocational knowledge as "knowledge incorporated in practical work" (2007, p. 62); the origin of vocational knowledge thus lies in professional practice (more detailed in Sänger & Jenert, 2023). The expansion of the content dimension also affects the TCK dimension: knowledge about how digitization influences work and business processes is also regarded as an independent component of digital competencies (vocational logic). It is complementary to knowledge about how digitization affects scientifically structured bodies of knowledge (disciplinary logic), as originally reflected by the TCK dimension in the TPACK model. Therefore, I distinguish between *Disciplinary Technological Content Knowledge* and *Vocational Technological Content Knowledge*. In the subject-specific didactic dimension (PCK), the expansion of the model addresses the challenge of combining both types of content knowledge (disciplinary and vocational) with pedagogical considerations (a more detailed explanation of the model extension can be found in Sänger & Jenert, 2023). The next chapter will outline the transfer of the conceptual extension into a first instrument and its initial exploration.

Figure 1: Extended TPACK model



Source: Sänger & Jenert, 2023, p. 446

3 Development and Testing of the Instrument

The development[3] and testing of an instrument for the self-assessment of digital competencies for prospective teachers in VET is presented below. The instrument is conceptually based on the TPACK model but makes additions at individual points to consider the dual subject matter, as outlined in Chapter 2.2. The aim here is to operationalize the model extension and conduct an initial exploration. Since the instrument was designed for testing in business education programs, the instrument is framed by this context, for example by including items relating to professional fields of actions in commercial-administrative occupations.

Firstly, items were collected that had already been used and validated in studies in the context of the TPACK model; this resulted in a total of 164 items. In the second step, the items were assigned to the TPACK dimensions if the assignment did not emerge from the studies themselves. The items were then summarized in the case of multiple responses or completely excluded due to the context-specificity of the studies. Ultimately, 38 items

3 The development of the instrument was supported by teacher training students as part of a teaching-related project in a Master's program, especially by compiling, assigning, and condensing the items. I thank the student group for their assistance.

were included which were distributed across the TPACK dimensions. Two approaches were chosen in order to include both disciplinary and vocational content knowledge: On the one hand, individual items relating to content knowledge were modified. For example, item CK1 ("I have sufficient knowledge about my teaching subject") was adapted to "I have sufficient knowledge (e.g. concepts, models, theories) about my teaching subject as well as its vocational relevance". On the other hand, the scale *Vocational Technological Content Knowledge* (TCK-V[4]) was newly developed. This scale specifically addresses the digitization-related content knowledge for professional fields of action (vocational knowledge). The TCK-V scale is conceptually based on the work of Schlottmann and Gerholz (2022) and Seufert et al. (2019). Schlottmann and Gerholz (2022) locate the knowledge about how digital technologies change business processes in the TCK dimension. Seufert et al. (2019) introduce a new dimension in their model called "Knowledge about the Digitization of the Economy" (p. 320) as part of content knowledge. Based on the model extension presented in Chapter 2.2, I combined both approaches with the extended TCK scale for vocational knowledge. The goal is to address the dual subject matter in all content-related dimensions while maintaining the integrative approach of the TPACK model. In addition, a further scale on media education was included according to the framework of Herzig and Martin (2018). It is dedicated to the responsible use of and education on digital media use (MEDE). There is no genuine connection expected between media education and vocational knowledge; but since TPACK does not address media education explicitly, I added this scale for the first exploration of the instrument. This addition is an attempt to integrate the subdivision into media didactics and media education according to Herzig and Martin (2018) into the TPACK model. In addition to an introductory section containing socio-demographic information, the instrument used in the pretest comprises a total of 46 items. Table 1 shows an overview of the instrument as well as sample items with references.

At the end of each scale, respondents are also asked about the areas or sources from which they acquired their knowledge (e.g. internship semester, university, or apprenticeship). Since the knowledge is not expected to originate from a single source, this question allows multiple answers. The TPACK scales are assessed using a six-point Likert scale (1=not at all true; 6=totally true), as is the origin of the knowledge (1=not at all; 6=everything).

4 To stay within the logic of the TPACK model, I extended the original TCK dimension. In this article, I use *Vocational Technological Content Knowledge* (TCK-V) and *Digitization-Related Vocational Content Knowledge* interchangeably (representing how work and business processes are influenced by digitization).

Table 1: Overview of the instrument

Dimension	Sample item	Reference
Content Knowledge (extended CK)	I have sufficient knowledge (e.g. concepts, models, theories) about my teaching subject as well as its vocational relevance.	Own item extension based on Chai et al. (2013)
Pedagogical Knowledge (PK)	I can adapt my teaching style to the heterogeneity of my students.	Based on Schmidt et al. (2009)
Technological Knowledge (TK)	The high technical complexity discourages me from using digital media.	Based on Vogelsang, Finger, Laumann & Thyssen (2019)
Pedagogical Content Knowledge (PCK)	I can address my students' (general) work-related learning difficulties for my subject without the use of technology.	Based on Chai et al. (2013)
(Disciplinary) Technological Content Knowledge	I can select digital media that can be used to better convey subject content in the classroom.	Based on Endberg & Lorenz (2016)
Vocational Technological Content Knowledge (TCK-V; extended TCK)	I am aware of the digital tools (e.g. enterprise resource planning systems) that play a role for my students.	Own item formulation based on Schlottmann & Gerholz (2022) and Seufert et al. (2019)
Technological Pedagogical Knowledge (TPK)	I can adapt the use of digital media to different activity-oriented teaching activities.	Based on Osterberg, Bleck, Melai, Meier & Lipowsky (2020)
Media education (MEDE; extended TPK)	I am able to sensitize my students to the handling of private data in digital environments.	Based on Rubach & Lazarides (2019)
Technological Pedagogical Content Knowledge (TPACK)	I am able to apply strategies to integrate knowledge of teaching approaches, technologies and content in my teaching.	Based on Schmidt et al. (2009)

The instrument was used in both Bachelor's (n=50) and Master's (n=28) modules in programs in the field of business education at the University of Paderborn to test the developed instrument and gain initial insights into the self-assessment of prospective teachers regarding their digital competencies. The data was analyzed using a principal component analysis (PCA) with Varimax rotation in SPSS to determine the factor structure[5]. In a first step, only the original TPACK scales were considered; in a second step, the two new scales TCK-V and MEDE were also included. The sample suitability according to the KMO criterion (.881) and Bartlett's test (<.001) is fulfilled in the first analysis; the anti-image correlations are greater than .60 (for sample suitability, see Tabachnik &

5 In this article, the term *factor* is used synonymously with *component*. Differences between factor analysis and principal component analysis are discussed, among others, by Tabachnik and Fidell (2013). They point out that despite different underlying assumptions, various extraction methods tend to produce similar results in practice under equivalent conditions (p. 647).

Fidell, 2013, p. 617). The conceptualization of the TPACK model suggests seven factors, i.e. one factor per TPACK dimension (Zelkowski, Gleason, Cox & Bismarck, 2013, p. 183). First, the components were calculated based on the Eigenvalue greater than one; SPSS determined 6 components. The three basic dimensions of the TPACK model (CK, PK and TK) each load uniquely onto one factor, as does the PCK dimension, i.e. the subject-didactic dimension. The dimensions TCK, TPK and TPACK show cross-loadings, while all TPACK items load onto the factor within a closed scale. Hence, I found the TPACK scale to be the best solution for this factor. If the items from the TCK and TPK dimensions are excluded from the PCA, five factors (factor loadings >.60) can be clearly identified, which explain approx. 73 % of the total variance. Hence, five factors appear to be the most suitable for the original TPACK dimensions (CK, PK, TK, PCK and TPACK).

In the second step, the two additional scales TCK-V and MEDE were also included in the PCA. The sample suitability according to the KMO criterion (.871) and Bartlett's test (<.001) is also fulfilled here; the anti-image correlations are greater than .60. However, the items of the MEDE scale load onto the same factor as the PK dimension, i.e. the general pedagogical dimension, in the sample surveyed. For this reason, the MEDE scale is not included in the instrument as the scale could not be identified as an independent factor. The TCK-V scale, which explicitly addresses the digitization-related vocational content knowledge for the occupational fields of action (see Table 2), forms a separate component with the items TCK-V1 to TCK-V3 (factor loadings > .60). The TCK-V scale is included in the instrument due to its statistical suitability and its theoretical relevance for modeling digital competencies in VET.

To ensure that the TCK and TCK-V dimensions differ empirically from one another, cross-factor loadings were examined in a final step. The highest cross-loading between both dimensions is .24. According to Tabachnik & Fidell (2013, p. 654), a factor loading of .32 or below can generally be considered as poor. A cross-loading is observed when an item loads at .30 or higher on two or more factors (Fabrigar, Wegener, MacCallum & Strahan, 1999, p. 287), which is not the case between the two dimensions. Consequently, the analysis indicates that the two scales are independent.

Table 2: Items of the TCK-V scale

Item	Item formulation (original in italics)
TCK-V1	I am aware of the digital tools (e.g. enterprise resource planning systems) that play a role for my students. *Mir ist klar, welche digitalen Werkzeuge (bspw. ERP-Systeme) für meine Schüler*innen eine Rolle spielen.*
TCK-V2	I am well-informed about the role that digitization plays in changing business processes in the daily work routine of students. *Ich bin gut darüber informiert, welche Rolle die Digitalisierung für Veränderungen von Geschäftsprozessen im Arbeitsalltag der Schüler:innen darstellt.*

Item	Item formulation (original in italics)
TCK-V3	I can provide assistance to my students regarding the operational complexity of digital tools (e.g. enterprise resource planning systems). *Ich kann hinsichtlich der Bedienkomplexität von digitalen Werkzeugen (bspw. ERP-Systemen) meinen Schüler:innen Hilfestellung geben.*
TCK-V4 (excluded)	I am capable of informing myself about digitization-related changes in the economy and utilizing them for my teaching. *Ich bin in der Lage, mich über digitalisierungsbezogene Veränderungen in der Wirtschaft zu informieren und diese für meinen Unterricht zu nutzen.*

The final instrument therefore comprises six factors (factor loadings >.60) with 29 items, which explain approx. 75 % of the total variance (see Table 3). The reliability analysis of the identified scales shows good to very good internal consistencies (Cronbach's alpha between .838 and .935); for the gradation of Cronbach's alpha, see Zelkowski et al. (2013, p. 185), among others.

Table 3: Principal Component Analysis

	1	2	3	4	5	6
K1	.640					
CK2	.761					
CK3	.729					
CK4	.668					
PK1		.627				
PK2		.635				
PK3		.664				
PK4		.763				
PK5		.745				
TK1			.756			
TK2			.809			
TK3			.870			
TK4			.776			
TK5			.783			
TK6			-.628			
PCK1				.813		
PCK2				.876		
PCK3				.794		

	1	2	3	4	5	6
TPACK1					.656	
TPACK2					.661	
TPACK3					.720	
TPACK4					.794	
TPACK5					.632	
TPACK6					.640	
TPACK7					.740	
TPACK8					.628	
TCK-V1						.911
TCK-V2						.737
TCK-V3						.770

Note. Extraction: Principal Component Analysis. Rotation: Varimax with Kaiser normalization.

4 Analysis of the Results

The presentation of the results can be divided into three sections: the evaluation of the socio-demographic information, the TPACK scales and the information on the sources of knowledge. In sections two and three, only the items identified in the second PCA are considered (Table 3).

Approximately two thirds of the participants in the present sample (n=78) were Bachelor's students and one third were Master's students in the field of business education at the University of Paderborn. Approx. 62 % of the students in the sample are female, approx. 38 % male. The average age in the sample is approx. 25 years (standard deviation of approx. 4 years). On average, the students are in the third semester of their Bachelor's or Master's degree. Overall, the present sample can be classified as typical of the field of business education (see e.g. survey Goller & Ziegler, 2021). At the beginning of the survey, the areas in which the students had generally already gained experience (aptitude and orientation internship, professional field internship, practical semester, side job or part-time work, apprenticeship and practical experience in the field of work) were also surveyed.

The scales were evaluated for the entire sample on the one hand and separately for Bachelor's and Master's students on the other. The comparative analysis of Bachelor's and Master's students examines the question of whether students tend to rate their competencies higher as they progress through their studies (as examined by Zinn, Brändle, Pletz & Schaal, 2022, for example). On average, Master's students rate their competencies across all dimensions approximately half a scale point higher than their Bachelor's counterparts, as shown in Table 4.

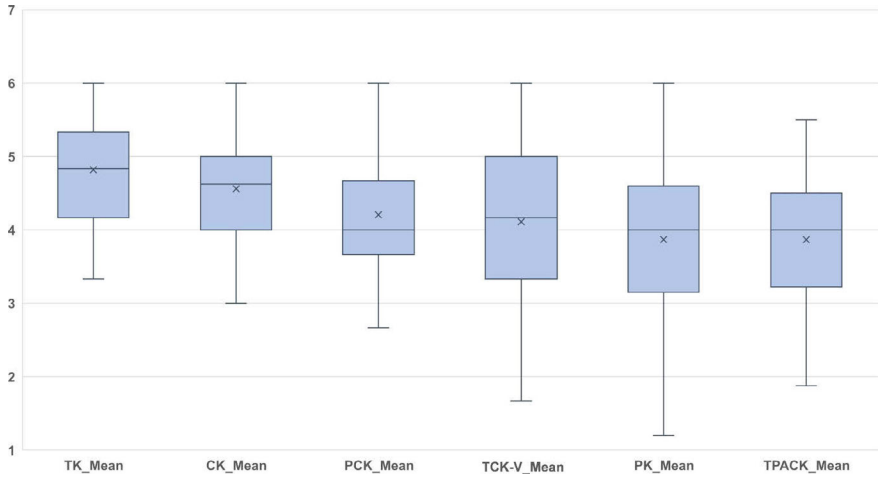
Table 4: Mean comparison of Bachelor's and Master's Students

	BA (n=50)		MA (n=28)					
Variable	M	SD	M	SD	T	df	p	d
CK	4.41	.78	4.84	.59	-2.56	76	.013	.60
PK	3.66	.98	4.25	.67	-2.85	73	.002	.67
TK	4.68	.74	5.10	.72	-2.21	76	.015	.52
PCK	4.20	.77	4.23	.86	-0.17	76	.863	
TPACK	3.66	.96	4.24	.68	-3.13	72	-.003	.67
TCK-V	3.93	1.02	4.43	1.08	-2.01	76	.048	.47

Note. Answer scale six-point Likert scale (1=not at all true; 6=totally true).

When looking at the entire sample, the basic dimensions TK and CK are on average more pronounced than the PK dimension, i.e. students rate their pedagogical competencies lowest with regard to the three basic dimensions CK, PK, and TK (with the lowest values being PK3=PK5=3.76; SD=1.02 and 1.20 respectively). PK3 asks about the ability to assess students' performance; PK5 asks about knowledge of methods and concepts that guide didactic action. The items representing the CK and TK dimensions are the most pronounced of all scales, with the TK dimension achieving the highest mean values of all scales overall. Consequently, students rate their technology-related competency highest of all competencies, led by the item TK3 („I can communicate and cooperate with the help of digital media in my future career"). The PCK dimension, i.e. subject-specific didactic knowledge, is rated slightly better than pedagogical knowledge on average across the entire sample, but worse than content-related knowledge. The TCK-V scale, which assesses digitization-related vocational content knowledge, receives lower average ratings compared to subject-specific didactic knowledge but higher ratings than pedagogical knowledge. The items that represent the TPACK dimension, i.e. teaching of a subject-related content, taking into account both pedagogical principles and the use of technology, are rated lowest on average by the students in the entire sample. The item TPACK6 („I am able to create self-directed learning activities of practical professional content knowledge with the help of ICT tools [e.g. web quests, blogs]") achieved the lowest mean value of all items with a mean value of 3.67 (SD=1.11). The scales are rated on average in descending order as follows: TK, CK, PCK, TCK-V, PK, TPACK (see Figure 2).

Figure 2: Mean comparison of the scales in the total sample



Note. Answer scale six-point Likert scale (1=not at all true; 6=totally true).

Regarding the sources of knowledge, it should first be noted that not all possible sources of knowledge were fulfilled for all students. For example, only 9 out of 78 respondents had already completed the practical semester at the time of the study and only around two thirds of all respondents had completed an apprenticeship; this limits the evaluation. On average, the highest mean values across all scales were found in the categories *apprenticeship/practical experience in the field of work* and *private environment*. For the dual subject matter of VET, the scales CK and TCK-V are particularly interesting. Table 5 shows the mean values and standard deviations of the three most frequent statements for the sources of knowledge in descending order for the CK, TCK-V and TPACK scales.

Table 5: Average responses regarding the sources of knowledge

	CK	TCK-V	TPACK
1	Apprenticeship/Practical experience in the field of work	Apprenticeship/ Practical experience in the field of work 3.74	Private environment
	4.29		3.12
	(1.12)	(1.56)	(1.49)
2	University	Private environment	Apprenticeship/ Practical experience in the field of work 2.92
	3.63	3.26	
	(1.19)	(1.32)	(1.41)
3	Private environment	Side job or part-time work	University
	3.54	2.78	2.89
	(1.03)	(1.46)	(1.37)

Note. Answer scale six-point Likert scale (1=not at all; 6=everything).

5 Discussion

The primary objective of the article was to transfer a conceptual extension of the TPACK model into an instrument and to conduct an initial exploration of its applicability. Additionally, it aimed to examine student teachers' self-assessment of their digital competencies. Therefore, the following discussion refers on the one hand to the testing of the instrument and on the other hand to the evaluation of the results from self-assessment. Furthermore, the limitations and possible practical implications of the study are discussed.

5.1 Results from the PCA

In relation to the instrument's testing, I found that the discriminative power of items with a technology reference is not sufficient. This is likely because the dimensions TCK and TPK already contain elements represented by the TPACK items; this finding aligns with the study by Zelkowski et al. (2013). A significant difference from the results of Zelkowski et al. in this study is the identification of the subject-specific didactic dimension (PCK) as an independent factor. In contrast to the technology-related items, this scale is characterized by the item formulation *without the use of technology* (item formulation based on Chai et al., 2013, p. 46). The explicit exclusion of technology reference could explain why the scale loads onto a separate factor, linguistically distinguishing itself from the other scales. From a conceptual standpoint, this study underscores the limitations of employing TPACK as a framework for empirically measuring digital competencies, as not all TPACK dimensions could be identified as measurable factors in the present study. This could be attributed to the limited ability to distinguish between specific dimensions or the idealized nature of these dimensions for modeling, posing challenges in empirical measurement (Archambault & Barnett, 2010). Consequently, it must be critically examined whether TPACK offers a suitable basis for modeling all facets of digital competencies. Brandhofer (2020) compares the TPACK model with established competence catalogs for modeling digital competences, such as the Digital Competence Framework for Educators (DigCompEdu). The recent article by Wilmers et al. (2023) provides an overview of different models of digital competencies for different areas of education. Rubach and Lazarides (2023) present a systematic review that provides a more extensive systematization concerning teachers' competence and competence-related beliefs about ICT use, which is detached from the TPACK model. One advantage of alternative models detached from TPACK is that the individual dimensions can be considered in a more differentiated way than TPACK can achieve. In my opinion, a disadvantage of alternative models is that the interactions between the dimensions are at least partially lost. These considerations of interrelationships are helpful to carry out an integrative modeling of teachers' digital competencies (Schmid & Petko, 2020, p. 136). Due to the proximity of the TPACK model to the usual curricular division of teacher training programs in Germany into subject science, subject didactics and educational science, curricular references can also be derived from the model, e.g. to identify goals for curricular development (Jenert & Kremer, 2021, p. 12).

The TCK-V scale was newly developed for the instrument to specifically capture digitization-related vocational content knowledge. Unlike in the original conceptualization in the TPACK model, this scale does not focus on the impact of technology on disciplinary knowledge but reflects the effects of digital transformation on work and business processes. The scale emerged from a theoretical standpoint and follows the assumption that vocational knowledge is not adequately represented in previous models of digital competencies (Sänger & Jenert, 2023). In the PCA, the scale was identified as an independent factor, providing empirical confirmation that vocational knowledge requires its own scale.

It should be emphasized, regarding the PCA, that the sample (n=78) is relatively small. Depending on the minimum sample size assumed as a condition, the present sample size needs to be considered as a limiting factor. According to Tabachnik and Fidell (2013), a sample size smaller than 100 is acceptable if clear factors can be identified and all factor loadings are greater than 0.6 (p. 618); these criteria are met in the present study. Furthermore, another constraint exists concerning the evaluation of the instrument with student-teachers. Future research should also include testing the instrument with experienced, in-service teachers.

5.2 Analysis of the Self-Assessment

The analysis of the results of the self-assessment suggests that students tend to perceive themselves as tech-savvy, but apparently lack general pedagogical and didactic conceptual knowledge. The rather low average self-assessments in the TPACK dimension could indicate a low development of the required digital competencies for future teaching activities; this assumption should be re-examined in a further study. The comparative examination of the self-assessment of Bachelor's and Master's students suggests that students tend to rate their competencies higher with advancing progress in their studies (see also Zinn et al., 2022). To further investigate whether students tend to assess their competencies higher with progression of their study, this assumption should be retested in a larger sample. It is important to note the limitations of self-assessments for competency measurement, as investigated in the context of TPACK by Max, Lukas and Weitzel (2022). Since a predominant part of studies use self-assessments (Voogt et al., 2013), Max et al. (2022) suggest a combination of self-assessments and performance tests.

Regarding the knowledge sources, the categories *apprenticeship/practical experience in the field of work* and *private environment* are consistently mentioned most frequently across all assessed scales, on average. While acknowledging that information about knowledge sources may be influenced by individual student circumstances, the unexpectedly high relevance of the private environment underscores the importance of this source of knowledge. Concerning the sources of content knowledge, the categories of *apprenticeship/practical experience in the field of work*, *private environment*, *university*, and *side job or part-time work* are mentioned most frequently on average for the CK and TCK-V dimensions. The high relevance of the prospective teacher's own *apprenticeship/practical experience in the field of work*, especially regarding the digitization-related vocational content knowledge (TCK-V), emphasizes the importance of these two categories beyond the university context.

5.3 Key Findings and Future Directions for Instrument Development

Overall, the results of this study empirically support the argument that vocational technological content knowledge (TCK-V) requires its own independent scale. As the TCK-V dimension forms a separate factor, I assume that the distinction between disciplinary and vocational knowledge also applies to content knowledge (CK). My assumption aligns with the theoretical perspective suggesting the consideration of both components of the dual subject matter as separate elements in modeling digital competencies. To test my assumption and to improve dimensionality, for the future development of the presented instrument, both disciplinary and vocational knowledge should be represented as independent components. Consequently, the items addressing content knowledge (CK) will be separated into *disciplinary content knowledge* and *vocational content knowledge*. Since I integrated both reference systems of content knowledge (discipline and profession) into the CK items in this study, I cannot test my assumption with the present data. The revised instrument should then be tested and validated in a larger sample using confirmatory factor analysis in order to assess the suggested adaptions. Moreover, exploring the relationships between variables can contribute to assessing the nomological validity of the instrument, for instance, by investigating whether an apprenticeship positively correlates with self-assessed vocational knowledge or if the semester in the respective program positively correlates with the overall self-assessment of digital competencies. Additionally, the newly developed scale for digitization-related vocational content knowledge (TCK-V) should be reviewed once again.

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010204

VET Teacher Education – a Co-Constructive Design Process

Robert Hantsch & Harald Hantke

Abstract *VET (vocational education and training) teacher education is intended to foster professional competence and continuous learning for teachers throughout their careers. Even though teacher education in Germany is anchored in subject-specific sciences, subject-specific didactics (vocational), educational sciences, and practical experience, fragmentation and discontinuity persist. The article addresses these challenges in a systematic manner, integrating structures, content, and stages to achieve coherence. Using a case study from the federal state of Mecklenburg-Vorpommern, we identify, understand, and propose solutions for improving coherence in VET teacher education. Through a design-based research approach, we propose prototypes for cross-stage and cross-institutional collaboration, emphasizing the need for such partnerships to address issues of coherence.*

Title *VET Teacher Education – a Co-Constructive Design Process*

Keywords *teacher education, coherence, cooperation, case study*

1 Introduction

Often, "good" teacher education has been associated with the belief that teachers' training and continuing education are fundamental to the success of schools and teaching practices (Oelkers, 2001, p. 151; Diettrich, 2009). However, VET teacher education, especially academic VET teacher education in Germany, has come under increasing criticism for issues such as fragmentation between subject-specific science, didactics, and educational sciences; the need for more practical orientation; the lack of sufficient networks;

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and the inability to cooperate among stakeholders. VET teacher shortages and lateral recruitment increase challenges that call for a reevaluation of the traditional staged model (Lange et al., 2024). Because of the complexity of multiple stakeholders and the historical evolution of state-specific systems, there are no quick fixes. Considering the complexity of VET teachers' tasks and the three stages of teacher education, reforms should not be focused solely on individual stages. Innovation development, reforms of VET teacher education, and societal trends and educational policies should be addressed across stages and institutions.

In this article, we examine how coherent and collaborative structures can be established for the professionalization of VET teachers in Germany at every level of teacher education and across them (including lateral entry and alternative routes to employment). In the following chapters, we initially systematically address the criticisms of current (VET) teacher education in Germany, including fragmentation and discontinuity, and examine them in terms of stages. Following the theoretical presentation, a detailed analysis of the federal state of Mecklenburg-Vorpommern will be provided. The analysis is part of a design-based research (DBR) project that ties theory, research, and practice together. In this analysis, we present a case study in which insights into structural and conceptual problems in VET teacher education in Mecklenburg-Vorpommern are first outlined along a generic model proposed by McKenney and Reeves (2012). Based on this, prototypes as products of the DBR process are presented for developing cross-stage and cross-institution cooperation formats to promote a coherent VET teacher education. We conclude with an overview of the key findings for developing cooperative formats as well as an outlook on further implementation, transfer, and evaluation steps.

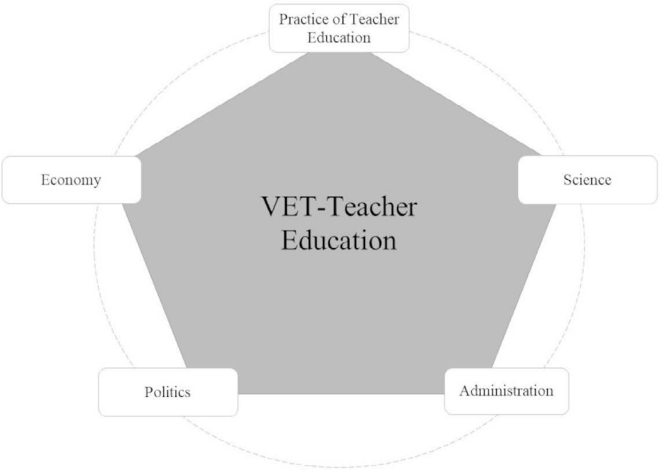
2 Criticism of Current VET Teacher Education in Germany

Teacher education in general and VET teacher education in particular faces the challenge of developing professional competence and providing learning opportunities throughout the professional biography (Kunter et al., 2011). It is expected that VET teachers are experts in their fields (i.e. engineers or business administrators) as well as educators. Moreover, they should consider their subject matter and workplace issues as non-separable domains of professional competence (Grollmann & Bauer, 2008; Kell, 2011, p. 444). As (VET) teacher education progresses through three stages (university, preparatory service, and in-service training), professional knowledge drawn from different disciplines is addressed differently. There are four distinct parts to (VET) teacher education across all stages (Nickolaus & Abele, 2008; Deissinger et al., 2018):

1. subject-specific sciences related to occupational specialization (e.g. engineering, mechanical engineering, civil engineering, computer science, business science) and subject-specific sciences related to a general subject (e.g. German, English studies, politics, sport, physics, chemistry, mathematics, religion),
2. subject-specific didactics,
3. (vocational) educational sciences, and
4. practical experience.

Interactions among these four parts are characterized by discontinuities and fragmentation (Schneider 2001; Hellman, 2019, p. 12; Schwalbe et al., 2021, p. 61). Considering this challenge, research on (VET) teacher education emphasizes coherence. Cramer (2020, p. 270) distinguished formal institutional coherence, in which institutions are in charge, and informal individual coherence, which is a subjective perception of meaning and relationship among individuals. These institutions and individual actors structurally support conceptual and temporal coherence (Cramer, 2020, p. 273; Bohl & Beck, 2020, p. 287). Therefore, it is important to understand that VET teacher education is embedded in a state-specific network of actors with overlapping and divergent interests and logics. Using Cramer's (2020) definition of coherence, five central reference systems can be derived at the macro and meso levels: practice, science, administration, politics, and business.

Figure 1: Reference system of VET teacher education in Germany



Source: adapted from Hantsch et al., 2022, p. 135.

"Practice" refers to teacher education institutions (i.e. universities, VET schools, and Studienseminar) or preparatory service at the second stage. "Science" refers primarily to the acquisition of knowledge and development of theory. As important decision makers and supervisory bodies in teacher education, school authorities, ministries, and university management are included in the administrative reference system. The fourth reference system, politics, is represented by education policy actors from trade unions, chambers, and associations as well as political parties. The former are more politically involved (e.g. in the framework of the State Committee for VET) (Landesausschuss für berufliche Bildung). The reference system "business" provides practical training for VET teachers, promotes innovations in VET teacher education, forms cooperative relationships between learning institutions (Lernortkooperation), and ultimately controls the demand for VET teachers in the respective federal state through apprenticeship programs (Hantsch et al., 2022). Among and within reference systems, expectations,

objectives, and quality standards differ. Consequently, VET teacher education is characterized by dichotomies, discrepancies, and antinomies. There is no doubt that the reference systems' structure is complex, sometimes contradictory, and not necessarily coherent (Hantsch et al., 2022).

Against this background, selected problems and challenges of the various stages of (VET) teacher education are discussed in more detail below.

2.1 First Stage of (VET) Teacher Education: Fragmentation and Lack of Practical Relevance

Often, academic teacher education is criticized for being fragmented and too far removed from practice because (VET) teacher education courses comprise several disciplines whose theories and methods are sometimes very different from one another and address different professional knowledge forms: subject knowledge, subject-didactic knowledge, and pedagogical-psychological or (vocational) educational science knowledge (Mayer et al., 2018.). The courses offered may create dissonance and redundancy among students, who perceive them as fragmented (Mayer et al., 2018). Providing a more coherent integration of the four parts, including practical experiences during internship, has long been a desideratum and desirable state of affairs for VET teacher education programs (Mayer et al., 2018, p. 10; Kremer & Weiland, 2023, p. 57).

To address concerns about fragmentation, German universities have restructured teacher education by establishing either teacher education centers or schools of education. As part of the reform, centralized, interdisciplinary institutions were created to coordinate and manage teacher education, integrating subject-specific, subject-didactic, and educational science components as well as practical experiences. The goal of this holistic approach is to enhance students' overall professionalization (Weyand & Schnabel-Schüle, 2010, p. 9; Hollenstein et al., 2020, p. 323).

As Röhner (2021) outlined, these centers or schools can be divided into two basic categories. The first type, with faculty status, enables the centralization of authority over educational research and teaching. It focuses primarily on theory and methodology of the new learning sciences as well as empirical educational research. Although this type may limit interdisciplinary orientation, it reduces fragmentation in (VET) teacher education courses (Röhner, 2021, pp. 207–209). There is a second type, which is prevalent in Germany, with a cross-sectional structure across all teacher education departments and subjects aimed at improving education quality. This type maintains the research traditions of education and related disciplines and encourages school- and teaching-related research. However, it also leads to a greater fragmentation of (VET) teacher education programs even though it promotes greater interdisciplinary orientations. This differentiation results in a dilemma: greater interdisciplinarity leads to greater fragmentation and vice versa.

Along with fragmentation, academic teacher education often receives criticism for its lack of practical relevance, which is referred to as a theory-practice gap. From a historical perspective, there has been a shift from theory-heavy teacher education courses to the opposite extreme due to increased tertiarization, academicization, and scientification (Horn, 2016, p. 158; Hollenstein et al., 2020, p. 328). This transformation is intended

to meet the demand for heightened professionalization in (VET) teacher education. Horn (2016) stressed, however, that theoretical knowledge alone is not sufficient; academic (VET) teacher education must be supplemented by experiential practice grounded in educational science (Horn, 2016, p. 161). Without explicit reference to educational science training, there is a risk that true experiential learning will be hindered during the practice phase because students may imitate mentors and overlook valuable insights from their studies (Horn, 2016, p. 161; Kremer & Weyland, 2023, p. 57; see also Chapter 2.2). To bridge the theory-practice gap, theoretical knowledge (disposition) about effective teaching and learning processes must be integrated with practical knowledge (situation-specific skills) to be applied successfully to teaching practice (performance). There is still room for improvement in the connection between academic content and practical experience in the professionalization of (VET) teachers in German-speaking countries (Hollenstein et al., 2020, p. 328).

2.2 Second Stage of (VET) Teacher Education: Lack of Theory and Dependency Relationships

The second stage of (VET) teacher education, the so-called Vorbereitungsdienst (preparatory service) – the stage of training at the Studienseminar (study seminar) – is often criticized for being disconnected from theory and characterized by dependency relationships.

Therefore, the finding outlined in the last chapter that the networking of academic content and practical experience in the context of (VET) teacher professionalization cannot be described as satisfactory also applies to the second stage of (VET) teacher education but from the theoretical remoteness viewpoint. According to Anderson-Park and Abs (2020, p. 333), the primary purpose of the Vorbereitungsdienst (preparatory service) is to reflect on practical experience at school in light of theoretical and practical opportunities for action developed in the (VET) teacher education course so that the teacher trainee's (Referendar) professional competence can be further developed. However, studies have shown that theory-based reflection is often ineffective. As Horn (2016) pointed out, schematic lesson preparations can be prepared according to the seminar lecturer's specifications, and reflections on lessons are usually made on the basis of everyday observations and language without any reference to general pedagogical knowledge. Consequently, professionalization is hindered and deprofessionalization occurs (Kunze, 2014, as cited in Horn, 2016). A similar criticism was expressed in 1998 and 1999 by a commission on behalf of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (Kultusministerkonferenz/KMK) about the current problems in teacher education. A major criticism of teacher education was the lack of coordination between the first and second stages (Schubarth et al., 2006). As described above, a tendency existed toward a lack of theoretical knowledge in the second stage of (VET) teacher education and toward a lack of practical experience in the first stage.

Besides the lack of theoretical knowledge at the Studienseminar (study seminar), there has been criticism of the strong dependency relationships between trainees and trainers. For example, the trainers are generally responsible for the organization of

the pedagogical and subject-didactic external training parts of the preparatory service, which means they also conduct classroom visits and document the trainees' training status (Anderson-Park & Abs, 2020, p. 334). Consequently, there is a risk of subjectively one-sided assessment of teacher trainees or abuse of power due to structural relationships of dependency (Heinrich, 2011, p. 89). Furthermore, structural dependency relationships may lead to affirmation of the trainers' opinions by preservice teachers in the above-mentioned commission. This problem is defined as a high level of pressure on teacher trainees, not least because of an excessive focus on grades in the recruitment of staff members (Schubarth et al., 2006, p. 20). Additionally, this prevents the development of a culture of discussion, which is important for reflective teaching development. The culture of discussion in training seminars appears to have a significant impact on the development of reflective abilities (Kunze, 2014; Decker, Kunter, & Voss, 2015, as cited in Anderson-Park & Abs, 2020, p. 336). It is considered advantageous for the development of reflection to adopt multiple perspectives and juxtapose points of view rather than just exchange experiences (Anderson-Park & Abs, 2020, p. 336). As the aforementioned commission also recommended, the predominantly school-based nature of the traineeship must be developed further into one that is predominantly adult-oriented (Schubarth et al., 2006, p. 20). A similar relationship exists between mentors and trainee teachers in training schools. For example, Braaten (2019, as cited in Bernholt et al., 2023) found that experiences in school practice were particularly productive for students who had a cooperative relationship with their mentors. In particular, lessons were planned, taught, and reflected on an equal basis rather than based on a hierarchical relationship of dependence.

2.3 Third Stage of (VET) Teacher Education: Lack of Structure and Arbitrariness

The third stage in (VET) teacher education, in-service and continuing professional development, is often criticized for its lack of structure and arbitrariness. As a result, it is considered significantly more worrying (Pasternack et al., 2017, p. 234) and is often described as underdeveloped when compared to international standards (Daschner, 2021, p. 12). Despite the legal requirement for teachers to undergo continuous professional development in all federal states, refusing to do so does not result in certain professional disadvantages, such as being placed in a lower salary grade or losing their teaching qualification in Germany. Consequently, in terms of quality, the obligation to provide further training does not lead to the exclusive use of structured learning opportunities to fulfill this obligation. Second, the obligation does not result in extensive continuing and further training. For instance, some federal states have a time requirement for continuing education, but teachers in those states do not have substantially higher participation rates (Richter & Richter, 2020, p. 346). In the IQB education trend, for example, 28 % of teachers attend no more than two in-service courses within two school years whereas 23 % attend at least five in-service courses (Hoffmann & Richter, 2016, as cited in Richter & Richter, 2020, p. 348). Training decisions are usually self-directed based on personal interests and priorities (Richter & Richter, 2020, p. 346). Therefore, further education and training for (VET) teachers do not guarantee they will work on their individual weaknesses. Additionally, there is no regular, public reporting of offers, demand, participants,

formats, costs, or effects of further training (Daschner, 2021, p. 14). Therefore, training courses cannot be organized in a systematic manner (Böttcher et al., p. 73) because no data is available on training needs.

Another systemic weakness in the German further and continuing training architecture for teachers is that there are generally no fixed times available during working hours for professional learning opportunities. As a result, the prerequisites for systematic and continuous further development of all teaching staff in Germany are only implemented to a very limited extent (Richter & Richter, 2020, p. 346).

However, this is currently more necessary than ever because to counter the shortage of teaching staff, more and more lateral entrants are entering the teaching profession who need to be qualified on the job (Puderbach & Gehrmann, 2020, p. 354). Here, we distinguish between lateral entrants who are trained in-service after being recruited and those who complete the preparatory service without having completed teacher education. The educational science and didactic content of teacher education courses, however, are dispensed with in both cases (Puderbach & Gehrmann, 2020, p. 355). Considering that (VET) teachers are not consistently developed as professionals throughout their work process, lateral entry may lead to deprofessionalization, resulting in a negative impact on teaching quality (Griese & Marburger, 2015; Puderbach & Gehrmann, 2020).

As lateral entry is increasingly implemented, the competition between stages of (VET) teacher education is escalating. In traditional (VET) teacher education, a (VET) teacher education course is completed in the first stage and a traineeship is completed in the second stage before the learner enters the third stage of (VET) teacher education. However, lateral entrants with subject-specific degrees may enter the second or third stage of (VET) teacher education directly, which raises various questions regarding the equivalence of training and professionalization standards (Puderbach & Gehrmann, 2020, p. 356).

2.4 Summary and Common Problems: Fragmentation and Discontinuity Due to a Lack of Cooperation and Networking

Based on an examination of the problems and challenges encountered during the three stages of (VET) teacher education, the following conclusions can be drawn.

The first stage of academic studies focuses mainly on theoretical knowledge and subject-specific content. Students acquire a basic understanding of pedagogical theories and in-depth knowledge of their teaching subjects. Additionally, the practice-oriented elements of (VET) teacher education remain structurally lacking, and the connection between this knowledge and its practical application remains limited.

During the second stage of study, the preparatory service, students apply the theoretical knowledge they have acquired in the classroom to practical work in schools under the guidance of experienced teachers. In reality, difficulties often occur here because there is no explicit link between the theory learned in the first stage and the practice in schools. As a result, teacher trainees face the challenge of transferring theoretical concepts to classroom practice.

In-service training serves to continually develop professional and pedagogical skills in the workplace, ensuring (VET) teachers can keep up with the teaching profession's con-

stantly changing demands. There is, however, a lack of commitment to further training at this stage as well as a high degree of arbitrariness in the services offered. Additionally, this stage is often less systematically linked to the previous stages than the first two stages of (VET) teacher education.

It appears that first, the stages of (VET) teacher education were fragmented in many ways, which mainly affected the first stage. Second, there is also fragmentation across stages in the sense of discontinuity. Due to the lack of coherent relationships among (VET) teacher education stages, students, and teacher trainees, teachers have difficulties undergoing a continuous and coherent educational process. For example, what is taught in theory may not be able to be put into practice due to the gap between what is taught and what is needed. For the purpose of ensuring more effective and simultaneously more satisfying (VET) teacher education, a greater level of cooperative integration and coordination would be desirable.

This general problem context of phased teacher education motivated a design-oriented research project on cross-stage VET teacher education in Mecklenburg-Vorpommern.

3 Design-Orientated Research Project on Cross-Stage VET Teacher Education in Mecklenburg-Vorpommern

(VET) teacher education cultures and structures vary across the federal states in Germany, so cross-state findings regarding (VET) teacher education presented in the previous chapter need to be complemented by regional, state-specific, and specific analyses. Fragmentation or discontinuity can only be understood by examining specific case studies. An analysis of this kind was conducted as part of a design-oriented research project in Mecklenburg-Vorpommern to address its specific challenges. Using design-oriented research methods, the findings on structural and conceptual challenges will be used to develop practical interventions promoting coherence in VET teacher education in Mecklenburg-Vorpommern.

3.1 Design-Based Research as Methodological Framework

Throughout this project, DBR is used as a methodological framework to integrate theory, research, and practice (Bakker, 2018, p. 7). It is not the specific method that counts, but rather how we apply it in an iterative framework to develop practical interventions and gain theoretical insight. Research and design occur continuously through design, implementation, analysis, and revision; invention, analysis, and revision occur alternately. DBR approaches all begin with a perceived discrepancy in practice. With close collaboration between educational research and practice, we can overcome this problem. The term "design" therefore refers to a creative, exploratory approach to problem solving (Johannesson & Perjons, 2021; Reinmann, 2022). In our approach, we follow the generic model McKenney and Reeves (2012, p. 77) proposed, which includes four phases: analysis/exploration, design/construction, evaluation/reflection, and implementation/dissemination. These phases are not strictly linear but include interactions (iteration) and flexible se-

quences; however, the development of an intervention is always framed by the phases of analysis/exploration and evaluation/reflection. It is generally possible to collect and analyze quantitative and qualitative data for these two phases using the entire repertoire of social science methods. Its primary objective is to gain insight into a phenomenon and, incidentally, create an intervention (Stappers et al., 2018, p. 165). In the following chapters, the analysis and data collection are limited to the first phase of the DBR process, the analysis of the problem.

It was necessary to adopt a flexible data collection process along with the iterative loops of the DBR process to contextualize and dig deeper into the coherence problem in VET teacher education in Mecklenburg-Vorpommern due to the complexity of VET teacher education and insufficient data and research opportunities. To understand how the design object needs to be shaped to contribute to problem solving, we explore formal institutional coherence and informal individual coherence in VET teacher education in Mecklenburg-Vorpommern, as Cramer (2020, p. 270) described. Exploration and analysis are guided by the following guiding questions:

> "What are the central issues surrounding formal institutional coherence and informal individual coherence within VET teacher education in Mecklenburg-Vorpommern, and how do these aspects interact to influence the effectiveness of educational practices within this context?"

The following sections are based on school statistics provided by the Ministry of Education and Child Day Care. Furthermore, the content is informed by protocols, presentations, and interviews conducted across stages and institutions during events, meetings, and workshops. During the Campus BWP MV project, which ran from 2019 to 2023, expert discussions enriched these insights. See Table 1 for a detailed understanding of data collection timeframes, settings, and methodologies.

Kuckartz (2014, p. 84) used a thematic qualitative text analysis approach to analyze and interpret the collected data. In Mecklenburg-Vorpommern, three fundamental problems in VET teacher education were identified and categorized: quantity, quality, and cooperation. The core problems were subcategorized based on inductive analysis of the data material. We present the results of the analysis and prototypes derived from them after describing the VET teacher education system in Mecklenburg-Vorpommern.

Table 1: Overview on study process

Timeframe	Setting	Data Collection Method
2019	Preparation of the project proposal "Campus BWP MV" SWOT analysis of teacher education	Expert Interviews
Oct. 2020 – June. 2021	Kick-Off meetings with 20 school principals, representatives of the ZLB; representatives of the KBS; representatives of the MBK Protocols	Protocols
April – Aug. 2022	Master thesis about Human Resource Management at Vocational Schools.	Expert Interviews
Oct. 2021	Workshop with 30 BA and MA students in Business Education	Protocols and result walls from discussions
Oct. 2021 – Jun. 2022	Topic-focused meetings with 18 school principals, representatives of the ZLB; representatives of the KBS; representatives of the MBK	Protocols
May 2022; Oct. 2022; May 2023; Nov. 2023	Cooperation workshop on teacher education for vocational schools	Protocol and presentations
April – Aug. 2023	Master thesis about Structures and Concepts of Continuing Education and Professional Development for Vocational School Teachers in Mecklenburg-Vorpommern	Expert interviews with representatives of the KBS
Sep 2023	Congress including various Workshops: "We – for strong and sustainable Vocational Schools in Mecklenburg-Vorpommern"	Result walls in task cards
Oct 2023	Public panel discussion on lateral and direct entry	Presentations
Nov 2023	Closing event of the collaborative project "Campus BWP MV"	Presentations, workshop protocols, and developed agreements

3.2 VET Teacher Education in Mecklenburg-Vorpommern

In Mecklenburg-Vorpommern, VET teacher education is mostly offered at the University of Rostock. There is a bachelor's degree program and a master's degree program in business and economic education at the Institute of Business and Economic Education, specializing in the education of VET teachers in the vocational subject of economics and business administration. Furthermore, as of 2014, students can choose from four (to be expanded to five by 2024) vocational subjects offered by the Institute of Vocational Education (Institut für Berufspädagogik): agricultural economics, electrical engineering, in-

formation technology, and metal technology. Additionally, Neubrandenburg University of Applied Sciences and the University of Rostock have partnered to provide two bachelor's degree programs at Neubrandenburg to lead to master's degrees at Rostock. It is intended to educate teachers in vocational subjects, such as nursing, social work, and health care.

In the second and third stages of (VET) teacher education, the Ministry of Education and Child Care (MBK) plays a crucial role. On behalf of the Ministry, the Competence Centre for VET Schools (KBS) coordinates, develops, and evaluates the second (traineeship service) and third stages (in-service training) of VET teacher training as well as the lateral entry paths, known as Quer- and Seiteneinstieg. An integrated traineeship service operates within a cooperative network of training schools, where teacher trainees receive practical teaching training under mentorship, and seminar schools, where theory and practice are integrated to enhance future VET educators' teaching competencies. Principals of vocational education schools appoint training supervisors (Ausbildungsbeauftragte) for pedagogical training and mentors for practical teaching training.

The third stage of VET teacher education is coordinated by a number of institutional actors. These include the MBK, with its respective departments; the Institute for Quality Development (Institut für Qualitätsentwicklung), which specializes in general education; and the KBS, which specializes in vocational education and training. Through direct engagement with schools and guidance for training planning, the KBS plays an important role. The school principal develops a training plan based on feedback from VET teachers. The plan will be evaluated to see whether it aligns with the school's specific concepts and the government's guidelines. In the KBS, a coordinator evaluates whether training sessions are feasible and then adjusts the budget based on that evaluation. In general, the IQ-MV oversees teacher education from the preparatory service, ensuring further training and in-service training are provided as well as continuous improvement in general education teaching. Additionally, the Institute is responsible for cross-cutting issues, such as inclusion, sustainability, and digitalization.

Across all stages of (VET) teacher education, the Centre for Teacher Education and Educational Research (ZLB – Zentrum für Lehrkräftebildung und Bildungsforschung) plays a critical role in Mecklenburg-Vorpommern. Its primary focus is harmonizing the various stages of (VET) teacher education, and its representatives are actively involved in the Advisory Board for Teacher Education and Educational Research at the Ministry. Its purpose is to align the content and structure of the three stages of (VET) teacher education, contributing to quality enhancement.

3.3 Core Problems of VET Teacher Education in Mecklenburg-Vorpommern

The results below capture insights pertinent to our DBR project in an exploratory manner. Therefore, they are presented in alignment with the initial DBR phases McKenney and Reeves (2012) outlined (analysis and exploration). This approach is intended to comprehend the fundamental challenges concerning coherence in VET teacher education and to contemplate them in crafting the design.

3.3.1 The Quantitative Problem: Heterogeneity of Qualification Pathways

As a result of the 2020 agreements between Mecklenburg-Vorpommern and Rostock University, the number of study places and study programs for VET teacher education has grown. Approximately 140 study places are now available for VET teacher education at the University of Rostock. Also, the study program has expanded to include information technology and metal technology. Consequently, staffing levels in the respective institutes have increased, academic staff have been given permanent positions, and two new professorships in VET teacher education have been created. Based on internal university statistics, it appears that the number of graduates from master's programs in VET teacher education fluctuated within the low double digits until 2018. Only since 2019 has the number of graduates stabilized, at around 30 per year, with half of these graduates specializing in the vocational subject of business and administration.

The Ministry of Education, Science, and Culture of Mecklenburg-Vorpommern's (2021) report on teacher demand development for the period 2021 to 2035 indicates that approximately 43 VET teachers will be needed from 2023 to 2035 to compensate for age-related departures. It is estimated that approximately 60 % of VET teachers will retire by 2035 in public and independent VET schools. These departures will peak in 2029, provided that VET teachers stay in the teaching profession until their planned retirement age. Retirements will likely peak earlier than expected (Ministerium für Bildung und Kindertagesförderung [MBK], 2021, p. 31; Prognos, 2023, p. 25). Furthermore, according to the teacher demand projections (Ministerium für Bildung, Wissenschaft und Kultur [MBWK], 2021), there will be an increasing need for VET teachers in business and administration, healthcare, and social services. There is also a similar development in specialized upper secondary schools and specialized grammar schools. The pre-vocational sector will also suffer a significant number of retirements by 2035, which will affect roughly three-quarters of teachers.

It is evident that despite these positive developments in capacity, Mecklenburg-Vorpommern still lacks a sufficient number of VET teachers. As a result of the shortage of VET teachers in Mecklenburg-Vorpommern, two new lateral-entry models have emerged, making the route to becoming a VET teacher increasingly varied. There have been two formal routes to lateral entry (MBK, 2022) since February 2023:

1. **Lateral-entry qualification (Seiteneinstiegsqualifizierung):** This lateral-entry qualification is available to individuals with non-teaching-related university degrees (bachelor's or master's) who have completed vocational training or have a master craftsman's diploma. The qualification consists of a basic pedagogical qualification and a modular qualification series. Upon successful completion and after a specified period of service, they can obtain a teaching qualification, similar to a teaching license but with lower compensation. They can also qualify for part-time preparatory service, leading to regular VET teaching positions, according to LehbildG Nr. 5 M-V.
2. **Part-time preparatory service (Berufsbegleitender Vorbereitungsdienst):** This program is open to individuals without a teaching-related university degree (master's, diploma, PhD). Generally, the university degree must fulfill the subject-specific requirements for two general-education subjects or two vocational fields. The KBS evaluates the admission requirements, distinguishing between applicants with profi-

ciency in two subjects and those with proficiency in just one. For the latter group, it is recommended that they simultaneously study a second subject. It takes 24 months to complete the part-time preparatory service.

The Ministry of Education (2023) presented at a discussion round organized by the ZLB ("Zusammenkunft Seiten- und Quereinstieg in M-V vom 27.10.2023"), stating that 60 positions will be available each year for lateral-entry qualification and 20 will be available for part-time training. Therefore, over one-third of VET teacher education is provided via non-university qualifications. In recent years, lateral entrants have accounted for a significant portion of new hires at public VET schools, according to discussions with school principals and KBS representatives. There are currently 2–3 lateral entrants for every VET teacher graduate from the university, indicating that traditional academic VET teacher education is no longer the preferred route to qualification.

University and VET school representatives report cannibalization effects in VET teacher education. VET teacher education programs at the University consistently demonstrate significant diversity among their students in terms of sociodemographic factors, educational backgrounds, and occupational backgrounds (Lange, 2024). Cohort analyses conducted by the Chair of Business and Entrepreneurship Education show that more than half of applicants have completed vocational training before entering university. This applies to all VET teacher education programs, according to university representatives. Therefore, bachelor's degree programs and lateral entry programs target similar audiences. There are two options available to potential students: unpaid full-time study or a paid lateral-entry qualification. The decision to pursue a master's degree also involves similar considerations for bachelor graduates. Once again, potential students have the choice of traditional study or lateral entry. There is a situation in which universities are expected to educate more students, but there may be a reduction in student numbers due to competing offers in the same state.

3.3.2 The Qualitative Problem: Fragmentation and Discontinuity

According to Chapter 2 in this text, VET teacher education in Mecklenburg-Vorpommern can also be fragmented and discontinuous. Mecklenburg-Vorpommern's teacher trainees (Referendare) do not perceive their training stages as coherent but rather as fragmented and loosely related. During discussions on developing a coherent curriculum at the KBS involving various experts, meetings with school principals, representatives of the KBS, and workshops on cross-stage teacher education at the "We – for strong and sustainable VET Schools in Mecklenburg-Vorpommern" congress (see Table 1), it was stressed that the lack of a coherent link between stages of teacher education poses a risk for competence acquisition. Often, stakeholders perceive the insufficient integration of knowledge across stages as a problem of theory-practice transfer. Therefore, opportunities for linking these stages effectively are often overlooked. In the data analysis, it becomes apparent that mutual accusations regarding respective shortcomings prevail, as also evident in the presentation of the cooperation problem (Section 3.1.3). In addition, fragmentation and discontinuity pose a variety of challenges for study programs and professions as well as individuals. Based on the analytical development of subcat-

egories from the given data, the following sections provide a detailed analysis of these challenges at each level.

Study-Program-Specific Challenges

The design of VET teacher education at the university level is handled by more than 16 academic chairs. Educating VET teachers in a forward-looking and demand-driven manner requires curricular cooperation among these academic chairs. However, university representatives point out that communication and cooperation structures are not systematically established and are instead confined to lose relationships between academic chairs. Based on a review of the study programs' curricula, it becomes clear that most teaching activities are handled by subject-specific scientists, who usually do not focus on VET teacher education. From discussions with students, it seems that they perceive little connection between the subject-specific science and the vocational subject (which also includes the compulsory subject).

All VET teacher education programs face these challenges, but their dimensions differ. The Institute for Business and Economic Education (Institut für Wirtschaftspädagogik) is solely responsible for vocational didactics, practical teaching exercises, and a significant portion of educational sciences (including general didactics) in the BA/MA programs for business and economic education. In the BA/MA programs for VET teachers offered by the Institute for Vocational Education (Institut für Berufspädagogik), these parts are supervised by various academic chairs, so the Institute of Vocational Education (Institut für Berufspädagogik) has less influence on curricular and didactic design than the Institute of Business and Economic Education. The ZLB in 2017 established a working group on VET Education (Arbeitskreis Berufliche Bildung) to promote interdisciplinary dialogue among VET teacher education academic chairs.

A major challenge is also presented by the structure of the cooperation model between Rostock University and the University of Applied Science in Neubrandenburg (HNB). At NHB, competences and resources have to be established, which has been partially successful (e.g. the position for health professions didactics, which has been vacant since 2021). This is perhaps one reason for the difficulty in coordinating curricular, temporal, and organizational agreements between the two institutions. The university representatives criticized the lack of subject-specific scientific experience (Fachwissenschaftler) in VET teacher education formats as well as the insufficient coordination among subject-specific science, practical teaching phases (Schulpraktische Übungs), and subject-specific didactics. Furthermore, the cooperative model poses many challenges to students, such as organizing their studies and balancing their studies with family and part-time work.

Profession-specific challenges

Aside from focusing on various university programs, quality can be viewed in the context of challenges unique to the profession. Teachers in VET have a diverse and dynamic work profile (Diettrich, 2009; Kalisch & Kaiser, 2019). It is essential to adapt training regulations and curricula regularly to technological and organizational changes. Various teaching formats in various types of schools and the student body's heterogeneity pose

demanding challenges. As versatile networkers, VET teachers collaborate with students, social workers, companies, chambers of commerce, and further VET institutions. This role contributes significantly to regional development and shapes Mecklenburg-Vorpommern's VET landscape. In spite of this, current regulations, such as the Teacher Training Act and the educational administration, may not fully meet the demands of this comprehensive profile regarding VET teacher education, lateral and alternative career paths, and staff deployment planning and performance assessment.

Having spoken to healthcare school management, for example, it is clear that in the field of teacher training for healthcare professions, the question arises of whether, given the variety of professional structures, specializations, and training paths, training for speech therapy teachers or emergency services teachers is more effective than the current education model of a "universal teacher" (Arens, 2018). Moreover, practical experience in VET schools indicates that a VET teacher for healthcare professions with a related field, such as nutrition, may be able to work more effectively in nursing and health schools than the existing qualification in general education, which is still not stipulated in nursing schools and healthcare professions schools (but will change soon). It is important to place these descriptions in the context of the current dynamic developments regarding nursing profession reform and the minimum requirements for nursing schools and teachers. A project being funded by the Federal Institute for Vocational Education and Training (BIBB) examines nursing teacher education in federal states. This will result in recommendations for improving teacher education (Bundesinstitut für Berufsbildung [BIBB], 2023).

Another example is that the KBS does not recognize Study Track I of the master's program in business and economic education as a teaching qualification. In this program, students cannot prove that they have taken another general education subject or another vocational subject. As a result of the strict interpretation of the two-subject rule, they cannot currently teach in public VET schools. There is no consideration of the fact that these students would be able to specialize in more areas by taking additional optional modules, for example in IT, project management, human resources, and service management. VET schools could benefit from such specializations, but they are ignored or not considered from the beginning. VET school and university representatives emphasize that teacher education and training cannot yet be discussed in light of this versatile work profile's meaning, purpose, and quality.

Individual-/actor-specific challenges

Data analysis revealed that fragmentation and discontinuity in VET teacher education are also discussed at a personal level, partly due to the small number of actors. At all stages, teachers, lecturers, department heads, and school administrations can be identified as direct actors in teacher education.

In teacher education at universities, academic staff play a multifaceted role. Aside from precarious employment conditions and fluctuation in university systems, they must deal with an unclear job profile combining teacher educators, VET education researchers, networkers, recruiters, and administrators. Although the measures the state of Mecklenburg-Vorpommern has taken for permanent employment at the University

of Rostock have provided a certain degree of security and continuity for the staff there, staff turnover, for example, due to the lack of formalized cooperation structures (see cooperation problem), can still result in significant expertise losses.

As individual actors, school principals hold an exceptionally challenging position, marked by a variety of tasks, frequent staff turnover, and a high vacancy rate. Dialogue with school principals highlights the challenges they face, such as a lack of time and little influence over their employees' professional development. Even though the Ministry of Education emphasizes school autonomy, VET school principals still lack autonomy in decision-making. As a result of the problematic development of teaching provision, principals recognize the importance of teacher education but often do not give it the highest priority.

During discussions with teachers, it became clear that there are no comprehensive approaches or resources for the qualitative design of mentoring during traineeships (Referendariat) or study-integrated internships (Schulpraktische Übungen). Specifically, mentors of trainee teachers criticize the oppressive regulatory framework, the lack of professionalization opportunities, and the lack of stage-specific cooperation and support networks. Due to a shortage of teachers, tasks in teacher education are increasingly shared among a few individuals.[1] Consequently, being a mentor is often viewed as a burden. In relation to important issues such as sustainability, digitalization and inclusion, which could affect staff and school development, teachers involved in these tasks note that reduction in hours (Abminderungsstunden) is available for these issues. However, the conceptual integration of these positions, such as regional sustainability advisors, into school development, quality management, or curriculum development is seen as only partially successful. In addition, the time available is perceived as insufficient, which may explain why it is currently difficult to fill these positions in VET schools.

As we examine the various actors and their framework conditions in teacher training, it becomes clear that this is a critical point for the development of quality VET teacher education and an important reason for the lack of coherence in it.

3.3.3 The Cooperation Problem: Insufficient Cross-Institutional and Cross-Stage Cooperation

VET teacher education involves a variety of stakeholders, as explained in chapter 2. Additionally, from the perspective of organizational theory, those who shape the structures in which VET teacher education occurs, such as administrators in schools, universities, and ministries, also play a role. Consequently, there are particular challenges in cooperation and communication among all these actors for VET teacher education to be successful. In the data analysis, three subcategories were identified: organizational form and autonomy, information deficits and knowledge gaps, and reproduction of biases.

1 In some VET schools, the provision of a traineeship (Referendariat) cannot be guaranteed due to a lack of originally trained teachers.

Organizational form and autonomy

According to the Teacher Training Act, the stages of teacher education are interconnected and form one whole. This formulation, however, raises the question of how the various actors in this cross-stage unit work together. The ZLB could serve as an intermediary between stages of (VET) teacher education, facilitating a coherent VET teacher education system by integrating the education stages and connecting the actors in the university. It is, however, only partially manageable given the existing resources, competencies, and multitude of challenges (e.g. qualitative problems).

According to the analysis of the data, the direct actors in VET teacher education (teachers, lecturers, professors, school management) perceive the organizational structure as bureaucratic-administrative. In this perspective, all subsequent participants are primarily considered recipients of macro-level programs. Administrations, teachers, and university members have all expressed negative experiences with the personnel development plan (Personalentwicklungskonzept 2004), the introduction of the quality development management system Q2E, the inclusion process (since 2006), and the current digitization process. Critics describe these reform processes as "raids" and "top-down processes" because they are contradictory, insufficiently participatory, lacking support, and limited in maneuverability. The staff development plan led to VET teachers being reassigned to part-time posts or teaching subjects outside their expertise. Meanwhile, Q2E was introduced as a quality management system, which was perceived as a contradiction. As a result, these processes, some of which are considered unsuccessful, continue to affect staffing structures and the general attitude of those involved in the reform processes. Although VET schools are regarded as "independent schools," they are integrated into a strict bureaucratic structure as subordinate authorities. The concept of "school autonomy" is therefore limited to pedagogical autonomy. In the case of personnel development, for example, the ministry views it as an administrative process and not under the remit of VET schools. In many ways, these experiences are similar to those of higher-education stakeholders. Frequently, they are only involved as assistants to the Ministry or excluded from various innovation processes, including curriculum committees and evaluations. Besides the lack of involvement in VET teacher education development in Mecklenburg-Vorpommern, there is a perceived lack of appreciation for academic institutions' research strengths. For example, the recent evaluation of the second stage of teacher training was not conducted in cooperation with a university or similar research institution. Instead, it was conducted by the Ministry of Education and Childcare. Furthermore, recent years have seen severe restrictions on school research, and university findings and contributions have been largely ignored.

Mecklenburg-Vorpommern does not have formal cooperation structures to review VET teacher education, identify shared action areas, or promote innovation in VET teacher education. Stages and actors in VET teacher education are currently isolated in terms of objectives, content, and responsibilities. As a result, the overall governance structure is unclear. We examine it further in the following category.

Information deficits and knowledge gap

The data analysis revealed that the reference system actors lack a clear understanding of their specific tasks and options. The objectives of VET teacher education at its various stages as well as the responsibilities of actors involved are systematically misunderstood and undervalued. For example, actors in VET schools often do not realize that a single academic chair is not responsible for all BA and MA programs. Consequently, curricular changes are not understood as well as the duration of institutional change processes. Furthermore, there is often uncertainty about who is the contact person, and there is a perception that there is uncertainty about the turnover of research staff. Therefore, school representatives perceive universities as unreliable and lacking continuity. There is also a lack of knowledge about key decision makers and committees in the VET system's governance structure. There is a lack of awareness among school leaders about the functions of the Landesausschuss für Berufliche Bildung/LAB and the Ministry of Education's Advisory Board for Teacher Education and Educational Research, resulting in a lack of recognition of the need for active participation on committees and collaboration with key actors. On the other hand, university representatives have only a very abstract understanding of the current challenges facing VET schools. The joint workshops often helped them realize the extent of the current problems in the institution of VET schools and the pressures for action in the VET teacher education field. The challenges associated with a shortage of VET teachers, such as securing certain functional positions, participating in examination committees, providing educational programs, and mentoring trainees, are often underestimated. Various actors also report that VET research in Mecklenburg-Vorpommern is marginally supported at present. As a result, there is a lack of information, for instance, about the implementation of the learning field concept, the integration of cross-cutting issues in VET schools, and the design of the second and third stages of VET teacher education. A mutual exchange only revealed that VET schools feel left alone in most innovation and transformation processes and would have appreciated university support. This is also reflected in the next category.

Reproduction of Biases

By using the two preceding content-analytical categories, researchers can form a third category in the data, which may also be interpreted as a consequence of the previous categories. In Mecklenburg-Vorpommern, teacher education is organized bureaucratically-administratively, which isolates the actors from each other. There is a lack of awareness of the overall structure of teacher education and actors' system logic, constraints, and leeway because of this structure. This then leads to the third category, "reproduction of biases"

According to the data collected, the involved actors maintain a distant relationship, attributing to each actor a kind of outsider status in the sense that "they don't understand teacher education" (own translation). Discussions, workshops, and individual conversations revealed that biases are reproduced in the reference system. Some of these biases stem from past experiences and can be attributed partly to knowledge and information gaps for which there is relatively little current evidence. However, most appear biased due to a lack of knowledge about each other. Across all actors, outside of universities,

a perception is reproduced that researchers live in an ivory tower, lack practical experience, and are unwilling to engage in it. They are not seen as experts who accompany practice, for instance, in current digitalization processes. Academia actors, on the other hand, consider VET schools theory averse and reflection weak. Rather than the educational mission, the focus is on quantitative lesson coverage, grading, and exam orientation. Several university actors critique the teacher education and teaching profession, which largely follow a conservative reproduction logic. As a result, prospective teachers have very little room for personal growth and development. The ministry is perceived as a practical and theory-averse authority that does not provide innovative impulses outside of four-year legislative cycles. Claims have even been made of a lack of interest in teacher education.

3.4 Design & Construction: Prototypes of a Coherent VET Teacher Education System in Mecklenburg-Vorpommern

The DBR project developed a variety of cooperation formats based on the refinements and differences in quantity, quality, and cooperation identified in the state-specific case study. Further, it developed existing formats in collaboration with stakeholders in the Mecklenburg-Vorpommern VET teacher education system. A cross-stage and cross-institutional dimension was added to improve VET teacher education's overall structure. To illustrate their importance in developing VET teacher education in Mecklenburg-Vorpommern, these formats will be explained in more depth below.

3.4.1 Cooperation Workshop on VET Teacher Education

The Cooperation Workshop on VET Teacher Education is a cross-stage, cross-institutional workshop held every two years starting in 2022. Concerning the cooperation problem (3.3.3) in VET teacher education in Mecklenburg-Vorpommern, this workshop will coordinate, implement, and evaluate operational measures in areas of joint focus. The strategic focus areas are quality and innovation in teacher education, recruitment and retention of students and teachers, and cross-stage and cross-institutional information flow. Among its members are six professors from the University of Rostock and Neubrandenburg University of Applied Sciences, 19 principals from VET schools, five representatives from the Ministry of Education, one representative from the Ministry of Science, two representatives from the KBS, and one representative from the ZLB. A total of 35 people participated in the cooperation workshop. Using the strategic fields of action, operational measures are defined and implemented at the subordinate level by working groups (see Work Group on Student and Teacher Recruitment; Work Group on Coherent Curriculum). Several initiatives have been implemented, such as two-day excursions to different schools each year (LehrerbildungsLANDPARTIE), peer-to-peer advertising in VET schools, meet-and-greets between students and teachers, school fairs, and a joint newsletter. The next milestone in the strategic focus, quality and innovation in VET teacher education, is the development of a vision for VET schools in 2024. This jointly developed vision will serve as the basis for defining the precise operational goals and responsibilities for VET teacher education.

This format is integral to addressing various challenges in VET teacher education through cooperative efforts. The effort can also be viewed as a collaborative lobbying effort to improve teacher training.

3.4.2 Working Group on Student and Teacher Recruitment

The Working Group on Student and Teacher Recruitment includes academic staff, study counselors, those who handle the recruitment campaign for teachers from the Ministry of Education (Ministerium für Bildung und Kindertagesförderung), and the Ministry of Science's public relations officer. Concerning the quantitative problem (3.3.1) and cooperative problem (3.3.3), this working group meets regularly to coordinate public relations to recruit students and teachers. Several measures have been jointly implemented in the working group, briefly outlined below. A format for exchange has been developed in the context of the study-integrated internship. By doing so, students and schools can get to know each other and share their ideas and expectations about the upcoming placement, teaching practice, or future profession. Additionally, BA and MA students have developed the teacher education field trips format (LehrerbildungsLANDPARTIE). Many students have participated in this excursion more than once, and it is now an integral part of the annual program. University staff also use the excursion to meet stakeholders in VET schools.

The working group represents an important format for addressing the specific characteristics of VET teacher education in relation to the heterogeneous target audience and dynamic, heterogeneous working environment in strategies for recruiting teachers. Furthermore, the working group can quickly develop and implement operational measures through short communication channels, thus promoting contact among students, academic staff, and stakeholders.

3.4.3 Working Group on Coherent Curriculum

Initially conceived to exchange ideas on introducing an e-portfolio among VET program coordinators at the university, this format evolved into a coherent-curriculum working group. Teachers and mentors involved in VET teacher education have been added to the working group and KBS staff. Regarding the problem of quality (3.3.2) and cooperation (3.3.3) in VET teacher education in terms of fragmentation and discontinuity between stages of VET teacher education, this working group aims to comprehensively understand the objectives and content of various stages of VET teacher training. Prioritizing common objectives and content is vital to proactively addressing possible structural issues, especially during subject-specific exchanges. Additionally, specific topics were discussed to improve cooperation. Among them are the analysis of interfaces and transitions in teacher education and the recognition, guidance, and co-creation of educational formats. Following the formation of the working group, a common lesson plan structure will be developed for the first and second phases. Throughout this development process, it is intended to stimulate the exchange of ideas on lesson design and education.

The working group has the potential to contribute significantly to the quality improvement of VET teacher education in the sense that it promotes coherency across different stages. Despite initial positive impressions, continuity could not be ensured due to limited time and unclear decision-making authority.

3.4.4 Working Group VET Teacher Education

Regarding the qualitative problem (3.3.2), the ZLB's interdisciplinary working group, VET Teacher Education, focuses on study programs for VET teachers. To expand the content of the working group, a closer connection will be made with the Cooperation Workshop on VET Teacher Education. A strategy circle and an extended expert group make up the working group. This strategy circle is made up of professors who are responsible for BA and MA programs. In this way, they can discuss and agree on key strategic issues related to VET research, teacher education, and student education. Among the members of the expert group are members of the strategy circle and academic staff from the Institute for Business and Economic Education (Institut für Wirtschaftspädagogik) and the Institute of Vocational Education (Institut für Berufspädagogik), as well as other stakeholders from the Neubrandenburg University of Applied Sciences and the University of Rostock.

Because the working group and the Cooperation Workshop are closely aligned, cross-study program issues, such as student recruitment, retention, transition management, university teaching quality, and networking, can be addressed and improved.

4 Conclusion and Outlook

Currently, there are no suitable verification methods or success indicators to evaluate comprehensively the success of cooperation structures and formats. Despite these challenges, we will outline critical insights for improving coherency in VET teacher education in Germany in the concluding chapter.

Through the DBR project, various actors from various structures collaborated on ideas for developing teacher education in VET. Participants' high willingness to participate in the Cooperation Workshop VET Teacher Education indicates the necessity and importance of this format. The feedback from participants confirms this impression and includes constructive suggestions for further development. Through the cooperation workshop, we developed concrete, verifiable measures that proved the work was effective and that cross-stage and cross-institutional cooperation is possible. Based on the recommendations by Künkel et al. (2019, p. 10), four core processes were identified for successful implementation and sustainability. Only one cooperation workshop has undergone all four processes:

1. Exploration and resonance or identification with the common mission of VET teacher education
3. Establishment and formalization of cooperative structures
4. Joint design, implementation, and evaluation of design and change activities
5. Further development, institutionalization, and sustainability of the collaborative relationship

Moreover, relationship promoters (Gemünden & Walter, 1995) played a prominent role in the context of these processes in promoting cross-stage and cross-institutional collabo-

ration.[2] They promoted perspective taking and facilitated the flow of information in the reference system by actively networking and bridging institutional boundaries. To build trust, relationship promoters must be willing to work for others beyond their interests – an understanding of collaboration is essential. This role contributed to the development of the above formats and the active participation of the actors.

At a higher level, it has been shown that measures to promote coherence, particularly in the federal system, must consider regional, level-specific, institutional and personnel aspects. Only with this comprehensive approach can the problems' multidimensionality be understood. Nevertheless, the development, testing, and implementation of the specific formats in the context of the four core processes listed above can be seen as a product of the DBR project, which also has a high transfer potential for realizing coherence or reducing a lack of coherence (not only) in the area of VET teacher education.

First, it is crucial to develop a fundamental understanding of the professionalization process of (prospective) teachers and to create a sensitivity to their challenges and a shared willingness to understand teacher education as a co-constructive design process. The practical findings outlined in this article on the design of formats to promote cooperation in teacher education and the case study itself can then be transferred to other federal states and regions based on this fundamental understanding to further develop VET teacher education toward coherence there, too.

The next steps would therefore be to take a closer look at this fundamentally existing supra-regional transfer potential as part of a transfer research project. Secondly, it is important to examine whether the implemented formats for cross-stage and cross-institutional cooperation and the associated short-term successes (see above) are regionally sustainable and help improve vocational education and training in the medium and long term. It is therefore important to identify success indicators regionally for the sustainability and supra-regionally for the transferability of a more coherent VET teacher education.

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2 The term "collaboration," in line with Castañer and Oliveira (2020, p. 994), goes beyond the concepts of cooperation and coordination. We understand collaboration not merely as a simple sum of cooperation and coordination (Gulati et al., 2012) but as voluntary, mutual support to achieve common and individual goals within and between the stages of VET teacher education.

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010205

Vocational Education and Training for Sustainable Development

Train the Trainers in Germany

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Abstract *The topic of sustainability and the concept of Vocational Education for Sustainable Development (VESD) play a major role in dual vocational education and training in Germany, especially due to the modernised occupational profile items on environmental protection and sustainability introduced in 2020. This article presents didactic approaches to the design and organizational embedding of measures aimed at developing and expanding the skills of VET personnel related to sustainability. Furthermore, an outlook is provided on an implementation project in the training occupation of gardener, demonstrating how the content of sustainable management can be integrated with qualification programs for in-company and inter-company trainers.*

Title *Vocational Education and Training for Sustainable Development. Train the Trainers in Gardening and Landscaping in Germany*

Keywords *vocational education for sustainable development, train the trainer, gardening and landscaping*

1 Introduction

In view of the changing social, educational policy, and economic framework conditions, as well as climate change and energy crises, further education and training for professionals are essential instruments for meeting the increasing knowledge intensity of gainful employment. Not least due to the adoption of the Sustainable Development Goals (SDGs) by the United Nations, Germany's participation in the European Green Deal, and

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the expansion of the standard occupational profile item of environmental protection to include sustainability in dual vocational education and training (German Federal Government, 2021; Bundesinstitut für Berufsbildung [BIBB], 2021), it is clear that the topic of sustainability is also becoming increasingly important.

The companies providing training play an important role in preparing their trainees and apprentices for the current and future requirements and challenges of a holistic approach to Vocational Education for Sustainable Development (VESD). The basic didactic concept of VESD encompasses all processes of the value chain in the company and incorporates ecological, social, and ethical principles into economic decision-making processes (Mayer, 2020, p. 25).

However, translating the demand for more sustainability into binding vocational actions is challenging, as the ambiguity of the term *sustainability* and the high level of abstraction of the sustainable development concept complicate the implementation of sustainability-oriented vocational education processes (Kastrup et al., 2012, p. 119). For example, there are still hardly any formal training and further education programs for trainers on the topic of vocational education and training for sustainable development. Even when obtaining the *trainer aptitude certificate* in accordance with the German Ordinance of Trainer Aptitude (Ausbilder-Eignungsverordnung [AEVO]), future trainers hardly come into contact with sustainability. Additionally, there is no obligation to provide further pedagogical and didactic training following the formal acquisition of the trainer aptitude, which is why this often does not take place. As Schlömer et al. (2019, p. 488) argue, there is a lack of professionalization among training staff.

Nevertheless, skilled professionals are needed who can respond to current challenges in the labor market, recognize innovations, and contribute to transformation in companies (Hemkes et al., 2013). Sustainably oriented companies are becoming increasingly attractive for apprenticeships, especially for young people (Bellmann & Koch, 2019; Deutscher Gewerkschaftsbund Jugend [DGB-Jugend], 2021).

This article explores considerations for the didactic design and organizational integration of measures to develop and expand the knowledge and competencies of vocational education and training personnel in the field of VESD. Firstly, findings from pilot project research on the design of teaching-learning arrangements to promote sustainability-oriented educational processes are presented with a focus on the company as a learning location. Building on this, these principles are then concretized using the example of skilled work in the occupation of gardener, with a focus on the specialization of gardening and landscaping.

2 Connecting Work-Based Learning with Sustainable Practices

Dual vocational education and training in Germany is intended to impart the typical competences in an occupational profile in breadth and depth, and thus has more than just a qualification function. It should also enable trainees to actively participate in and help shape the world of work and society. Vocational education and training therefore includes the promotion and reflection of attitudes, inner values, or principles to which professional behavior is aligned (Beer & Frommberger, 2022, p. 77).

For vocational education and training, company requirements are thus linked to societal educational demands. This is where concepts of Vocational Education and Training for Sustainable Development (VETSD) come in. The core processes and value chains typical of the sector, along with their key problems, are identified and turned into starting points for sustainable and action-oriented teaching and learning processes. This takes place at the level of occupational and sector-specific skilled work and with regard to the development potential of education for sustainable development in occupational activities. Well-trained personnel in companies are indispensable for supporting and driving these developments forward.

When looking at vocational education and training staff in companies, it must be noted that they generally fulfil a dual function: More than 90 % of the trainers involved in vocational training within the dual apprenticeship system in Germany take on tasks both as skilled workers and as trainers. This means they are in a constant field of tension between company interests, their own employee interests, and the qualification requirements and expectations of the trainees (Grollmann & Ulmer, 2020, p. 536). Particularly in the in-company part of dual vocational education and training, it is usually a matter of creating the greatest possible overlap between the pedagogical demand for vocational socialization, employability, and personality development on one hand, and the business demand for economically useful and applicable skills for operational tasks on the other (Schlömer et al., 2019, p. 487).

It should also be considered that in-company continuing education can take on a socialization function and serve to control value orientation—also "in order to increase acceptance of operational requirements and new technologies and at the same time align subjective learning interests and motivations with the achievement of entrepreneurial target categories" (Dobischat & Schäfer, 2022, p. 869). Trainers in vocational education and training, therefore, play a key role due to the dual function described above, as they "can contribute to a change in cultures as well as work and business processes through teaching-learning processes" (Schlömer et al., 2019, p. 492).

In line with findings from vocational education research, companies tend to prefer vocational and workplace-related training offerings that focus on learning objects originating directly from work processes and that offer usable opportunities for later use within the company (Dobischat & Schäfer, 2022, p. 863). Based on Lipowsky (2009), who examined the effectiveness of further training measures for teachers, and taking into account findings from pilot research in the field of VETSD (Beer & Steinkamp, 2023; Kuhlmeier & Kastrup, 2023), overarching conditions for the success of qualification programs for in-company training personnel can be described. Effective further training measures for trainers focus on technical content and have close links to the curricula (Lipowsky, 2009, p. 352), offering a high degree of connectivity to in-company training practice. This means that the topics, materials, and methods used should be categorized in the training context and interlinked with the training content—Lipowsky speaks of a "content focus" in this context.

When developing tailored training formats, it is essential to initially review and analyze the foundational elements and curricula underlying the respective vocational training (Kuhlmeier & Kastrup, 2023, p. 13). In a subsequent step, industry-specific job requirements and competency expectations for apprentices and other professionals must

be identified; this can only be achieved through close collaboration with trainers and other representatives from the business sector. Additionally, further training measures should address the domain-specific acquisition and understanding processes of learners in the context of training (Lipowsky, 2009, p. 353). This is not simply a matter of teaching didactic and methodological concepts, but of enabling training staff to develop their own teaching and learning concepts and adapt existing ones (Kuhlmeier & Kastrup, 2023, p. 15).

In order to establish VESD content in vocational education and training structures, the responsible stakeholders should have or generate a fundamental willingness to change. This willingness can be positively influenced if the measures and materials offered meet an actual need and have a high potential for benefit, if the company stakeholders believe that the changes initiated represent an appropriate cost-benefit ratio, and if the innovations can ideally be integrated into the current or future organizational development processes of an institution.

The project *Qualification for Sustainable Training and Management in Gardening, Landscaping and Sports Ground Construction (NAWiGaLa)*[1] is looking at how this can be realized.

3 VESD in Practice: The Implementation Project NAWiGaLa

The aim of the project is to strengthen sustainability-related vocational skills through the development and implementation of VETSD qualifications for vocational education and training staff in companies and inter-company training centres, as well as for future trainers and vocational teachers, with a focus on training as a gardener specializing in gardening and landscaping.

The profession of gardener can currently be learned in seven different specializations. The vast majority of all training contracts are concluded in the gardening and landscaping specialization—in 2021, this accounted for almost 75 % of all new contracts nationwide. In the 2022 ranking of chosen dual apprenticeships according to new contracts in Germany, the gardener is among the top 25 and has the highest number of trainees. The NAWiGaLa project, therefore, addresses an industry heavily involved in the vocational education and training of young people. Moreover, the skilled work typical of the sector offers many points of contact and interfaces with the topics of sustainability and VETSD in the context of the environment, climate, landscape, and natural balance in interaction with a liveable environment.

There is a significant need for adaptation and further training on the part of the companies, for example, regarding the materials and components selected for the construction of outdoor facilities, the machines used in gardening and landscaping, the conversion of petrol or diesel-powered machines to electric appliances, and recycling and waste management. There is also a need for information and further training in sustainable purchasing for gardening and landscaping. The economic requirements and specifications must not be disregarded.

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1 German: Qualifizierung für Nachhaltiges Ausbilden und Wirtschaften im Garten-, Landschafts- und Sportplatzbau (NAWiGaLa), translated by the authors

Occupation-specific fields of action with a high degree of overlap with aspects of sustainable management include the use of materials, components, and plants of regional origin, the avoidance of tropical timber, and insect-friendly and diversity-conscious design. Additionally, VETSD based on skilled work can contribute to increasing the attractiveness of vocational education and training and thus to securing skilled labor—an urgent and highly relevant topic given the relatively high contract cancellation rates of more than 25 % (BIBB 2023, p. 1) in the gardener training occupation.

The aim of the project is to develop, expand, and establish programs for training personnel in training and further education institutions. On this basis, the training and placement processes will be modernized to motivate employees in the companies and *take them along* on the transformation process towards sustainability.

In this way, the project is making a significant contribution to the development of a VESD-promoting framework in the gardening, landscaping, and sports ground construction sector. Additionally, the project aims to perpetuate the content and measures from the outset by involving relevant stakeholders and disseminating the various results at different levels, incorporating them into intermediate and final examinations. In this sense, sustainability is understood as a cross-cutting issue and viewed holistically: the goal is to make the training companies and other institutions in the sector competent in sustainability issues in all areas of their activities (*whole-institution approach*).

The materials to be developed are derived from and determined by the professional fields of action in horticulture and landscaping, as well as professional and scientific findings. Care is taken to ensure that the content is developed and communicated practically, oriented towards the needs of companies and vocational training staff.

To reach as many skilled workers as possible from the companies and inter-company training centres, qualification concepts are being developed that can be flexibly selected by the companies and employees. At the same time, care is being taken to ensure the greatest possible compatibility with existing qualification and further training seminars from the industry. Modular and compact qualification programs in face-to-face and online formats are planned to meet the different needs of the companies and their employees. In terms of content, the qualification program focuses not only on technical and specialist qualifications but also on the didactic teaching of industry-specific skilled work with a focus on vocational training for sustainable development.

NAWiGaLa is intended to reach companies and inter-company training centres as well as further education institutions and technical schools for master craftsman examination preparation courses in gardening and landscaping throughout Germany. As the training occupation of gardener is currently being reorganized, the project's chances of success are considered very good. Sustainability is a highly relevant topic, and it can be assumed that the reorganization will allow the potential for innovation to be used to add aspects of sustainable management and work to the occupational profile, thereby also contributing to the attractiveness of the profession.

4 Conclusion

VESD is a critical component of preparing the workforce for the challenges of the 21st century, including those related to sustainability, climate change, and environmental conservation. Integrating sustainability principles into vocational education and training is essential for equipping apprentices with the knowledge and skills needed for sustainable and environmentally responsible careers.

To achieve this goal, it is crucial to provide further education and professional development opportunities for trainers and educators in vocational education and training. Training measures should be tailored to the specific needs and characteristics of different professions and industries, as exemplified by the gardening and landscaping field.

The planned project aims to enable evaluations of the effectiveness of VESD qualification measures for in-company VET personnel and identify typical barriers to implementation. The project will also test how VESD aspects can be incorporated into regulatory work. The procedure will be documented and analysed regarding the gatekeepers, promoters, and possible *stumbling blocks* involved. Ideally, this will allow for generalizable conclusions about possible success factors and obstacles in implementing such processes in other occupations and reorganization procedures.

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010206

Between Heterogeneity and Professionalization of TVET Teacher Education in Costa Rica

Pathways and Challenges

Irinal Rommel, Monserrat Vargas Méndez & Daniel Láscarez Smith

Abstract *This article deals with the different forms of qualification and access routes to the teaching profession in TVET in Costa Rica and discusses the different requirements as well as the level of professionalization. This is done under the approach of describing the qualification of TVET teachers at the academic and non-academic level, the various access routes to the teaching profession in the TVET system and the discussion on the professionalization of teacher qualification in Costa Rica. The article concludes with a systematization of the characteristics of the forms of qualification and entry requirements in Costa Rica. This systematization allows us to derive the status of and the need for professionalization of TVET teachers in Costa Rica.*

Title *Between Heterogeneity and Professionalization of TVET Teacher Education in Costa Rica. Pathways and Challenges*

Keywords *TVET, Teacher, Qualification, Professionalization, Costa Rica*

1 Introduction

The role of teachers in Technical and Vocational Education and Training (TVET) and their qualifications are often not sufficiently appreciated. According to Grollmann (2008), there are two fundamental problems in the discourse on TVET teachers and their qualification. One is the low status of TVET itself and the other is the problem of

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raising the professionalization of TVET teachers (p. 535). In many late industrialized countries, TVET was even called a "semi-profession" (Etzioni, 1969) and always struggled with the problem of recognition. Nowadays, it is increasingly recognized at national and international level, that TVET teachers play an important role in enhancing the quality of TVET itself (Grollmann, 2008, p. 535). It can therefore be concluded that although TVET teachers play an essential role in promoting the upskilling of the workforce, they are not highly valued (European Commission, 2004). This is supported by the fact that TVET teachers cannot teach in general education schools, teachers from the general education system, however, can teach in TVET schools (Thomas, 2001, p. 9), which points to the value of the work of TVET teachers. For example, in many countries, teachers who teach TVET are not even required to have a specific TVET qualification, but only a general education pedagogical qualification. Furthermore, Misra (2011) describes that in almost all EU countries, for example, the TVET profession is not properly recognized, partly due to low pay. In his view, this has led to the TVET teaching profession becoming an alternative to unemployment rather than the first choice (p. 36; Faudel, 2002). Nevertheless, lower social status, lower salaries and less job security affect the prestige and quality of TVET teaching (Euler, 2015, p. 151). These aspects lead to the conclusion that TVET teaching is often an unattractive career prospect when compared to alternatives in industry and teaching in general education, as an example (International Labour Organization [ILO] and United Nations Educational, Scientific and Cultural Organization [UNESCO], 2018, p. 151). Furthermore, there is an enormous heterogeneity in terms of the tasks and roles that TVET teachers take on in individual national TVET systems or even the characterization of TVET teachers.

In Costa Rica, however, there seem to be some elements that have made the profession of TVET teacher quite attractive in the past in terms of salary. For example, before fiscal austerity and the 2022 labour reforms, TVET teachers were paid 40 % more compared to general education teachers.

Therefore, the question of this article is as follows: What are the academic and non-academic entry routes to the vocational teaching profession in Costa Rica, and what conclusions can be drawn about the degree of heterogeneity and professionalization in this country? This is accompanied by the following question: What qualification standards and requirements exist in Costa Rica for the integration of TVET teachers into the teaching profession? In order to answer these questions, the following chapters are dedicated to an introduction to the tasks and roles of TVET teachers. This is followed by a description of the various possible entry and qualification paths to working as a teacher at a TVET school and the corresponding teacher qualification programs in Costa Rica. Finally, a typology is presented that systematizes the characteristics of Costa Rican TVET teachers' qualifications and concludes with a discussion of the status and challenges of professionalization of TVET teacher qualification in Costa Rica. The entire work is based on a detailed document analysis and the systematization of the content obtained. The documents used include curricula and study program regulations, internal documents of the institutions on the recruitment requirements for TVET teachers, legal regulations

and requirements for study programs in Costa Rica, as well as the systematization of information from the ongoing study called "Teacher profile of TVET in Costa Rica".[1]

2 TVET Teachers within the TVET System and their Professionalization

When we speak of professionalization, various characteristics and emphases can be derived from professional knowledge. In more general terms, Hesse (1979) defines professionalization in occupational sociology as a systematically constructed pattern for the qualification and exchange of labour, which combines specific, mostly monopolized labour services with specific, mostly intensified qualification expectations as well as relatively high opportunities for earning and providing for oneself and for reputation and influence, and whose construction is primarily intended to serve the interest in the utilization of labour (p. 20, cited in Meyer, 2018, p. 3).

Meyer (2018) explains that professional knowledge as a form of expert knowledge is made up of several components. It consists of academic knowledge, which is usually acquired at universities, and traditional knowledge about professional activities in the sense of traditional experience and everyday knowledge. In addition, there is a third form of knowledge that can be described as problem-solving and interpretative knowledge (p. 4). These individual levels of knowledge are seen as characteristic for professionalization or professional knowledge.

The professionalization of teacher qualification is a crucial factor in shaping the identity of TVET teachers. Falcón-Linares (2021), cited in Matarranz (2023), points out that the professionalization of teachers is located at the theoretical level in order to define the teaching profession, its primary functions in professional performance and the roles they assume in the exercise of these functions. This is embedded in different scenarios in which they will develop and evolve (Martín-Romera & García-Martinez, 2018).

In this way, the discourse has been geared towards defining the teaching profile in static positions and under a technical view of the teaching activity determined by knowledge and expertise. This, according to Tardif (2016), presents an image of teaching as a "moral office" that serves as a lens for public opinion, rather than relating it to the work situations experienced by teachers and giving a more contextual sense to pedagogy, teaching and learning. This opens the way to a crossroads between the normative and the need to contextualize the professionalization of teachers, which becomes much more complex in TVET, as they are in a given context with specific technical training and

1 This article is based on a research that currently is ongoing at the Universidad Técnica Nacional (UTN), the Universidad de Costa Rica (UCR), the Tecnológico de Costa Rica (TEC), and Osnabrück University (UOS). Specifically, thanks to Osvaldo Murillo, Silvia Camacho and Jacqueline Garcia from UCR, Hugo Navarro and Jeison Alfaro from TEC and Laura Madrigal, Adriana Rodríguez and Lourdes Castro from UTN for their valuable contributions. Because of the need to standardize the professionalization of TVET teachers. In addition, the Costa Rican Ministry of Public Education (MEP) together with the College of Licentiates and Professors in Literature, Philosophy, Science and Arts (COLYPRO), and the National System of Technical and Vocational Education and Training (SINEFOTEP) are conducting a research process that will strengthen the information and results on the standardization of Costa Rican TVET.

diverse social environments (Montero and Gewerc, 2018). Nevertheless, one of the main challenges in Costa Rica is that not all TVET teachers have sufficient technical and professional pedagogical skills (Àlvarez-Galván, 2015, p. 66). Therefore, improving the professional development of TVET teachers is recognized as an important field of action to strengthen the national TVET system (Àlvarez-Galván, 2015, p. 68). However, efforts in this regard have not been utilized to date. But how can TVET teachers actually be characterized and what are their areas of expertise and places of work?

The definition of TVET teachers differs widely from country to country (Spöttl, 2022, p. 378). According to Grollmann (2008), TVET teachers generally are intended to work in secondary level schools and TVET colleges (p. 536). TVET teachers, furthermore, work in secondary or upper secondary institutions where they teach either theoretical subjects or practical skills in programs that are vocational or technical. In addition, they also teach general subjects (mathematics, language, history, etc.) to students in technical or vocational schools (UNESCO, 2014; Spöttl, 2022, p 378).

This article refers to the definition of teachers and lecturers in the formal TVET system. Applied to Costa Rican teachers, this means that we focus on the qualification of teachers who are qualified for the formal system of TVET schools of the National Ministry of Public Education (MEP). At the same time, however, an abbreviated view should also be taken of the qualification of teachers for the so-called non-formal system of the National Institute of Education (INA).

INA was founded in 1965 and modified as an educational institution independent of the formal system, structured with an autonomy and flexibility unusual in Costa Rica and characterized by strong communication with the labour market (Article 2 of INA's Organic Law, 1983; INA, 2018, p. 8). The TVET programs provided by the INA aim to qualify people who do not have formal educational qualifications (Láscarez Smith, 2024), for example, because they have never completed a general education pathway, and are therefore aimed at a vulnerable group. According to the reform of the INA Law of 2021 (Article 3), the INA should design TVET and further education programs aimed at increasing the family income of low-income groups, as well as designing and implementing its programs to meet the needs of the economy (Reforma parcial y adiciones a la Ley Orgánica del INA, 2021).

Although this is counted as part of the non-formal TVET system in Costa Rica, the qualifications offered and access to teaching are comparable to the formal system. Therefore, the academic and non-academic qualification pathways for TVET teachers for the main TVET providers MEP and INA are described below.

3 TVET Teacher Qualifications and Alternative Routes for TVET Teachers in Costa Rica

3.1 Academic TVET Teacher Qualifications

In many Latin American countries, there are no teacher training programs specifically geared towards TVET (World Bank, ILO, UNESCO 2023, 150). In the case of Costa Rica, the qualification of TVET teachers is generally based on an academic approach (Guzmán,

2011, p. 262). The two main institutions for the qualification of TVET teachers with a specific degree for teaching in TVET are the National Technical University (UTN) and the Costa Rica Institute of Technology (TEC). UTN offers the qualification with the academic degrees profesorado and bachillerato. The TEC, on the other hand, offers study programmes at the academic level of licenciatura (similar to a Bachelor's degree level) and maestría (similar to a Master's degree level). In terms of academic TVET related teacher qualification in Costa Rica, these are the single degree programs offered by state universities. In total, there are five academic degrees to be obtained in the Costa Rican higher education system. The following table illustrates all five academic degrees and the corresponding duration of study.

Figure 1: Academic degrees in Costa Rica

Time of Study	Degree	Graduation Level
2 Years	Maestría	Post-graduate
1 Year	Licenciatura	Graduate
1 Year	Bachillerato	Graduate
1 Year	Profesorado	Pre-graduate
2 Years	Diplomado	

As figure 1 illustrates, UTN's programs to become a TVET teacher are at the pre-graduate and graduate levels and TEC's at the graduate and post-graduate level. The degree courses offered for professional teacher training differ in the level of the academic degree to be achieved, the possibilities of future career pathways, the professional profile to be achieved and the fields of work. In addition, many private universities in Costa Rica offer teacher training. In total, there are 52 private universities in the country (Barquero Mejías et al., 2022, p. 12) that offer pedagogical qualifications but do not specialize in TVET. A precise description and classification of these private universities' offers cannot be realized at this point due to the great heterogeneity and lack of access to valid data. Therefore, this article focuses on teacher training for TVET in the two programs of the state universities and the recruitment requirements for TVET teachers at TVET schools through INA and MEP in Costa Rica.

TEC Study Program in Technical Education

TEC offers a Bachelor's degree (Licenciatura) and a Master's degree (Maestría) in the field of technical education with a very wide range of future job possibilities for graduates. Both, the Bachelor's and Master's degrees are aimed at professionals from different technical fields – engineering, architecture, accounting, administration, design, and others – who require training that provides them with the necessary skills to work as teachers with technical specializations in their profession (TEC, 2022). With its nine modules, the TEC study program focuses on the following four main areas: Pedagogy, Psycho-Ped-

agogy, Research and Interdisciplinarity. The modules are organized as followed (see table 1).

Table 1: Modules study program in Technical Education of TEC

Licenciatura	
trimester	Introduction to the TVET curriculum Educational theory and socio-historical analysis Didactical foundations in TVET
trimester	Psychological education in TVET Didactical and curriculum planning in TVET Research methodology
trimester	Learning assessment Elective module Final graduation work
Maestría	
trimester	Technical education, vocational training, culture and society Technical education, environment and sustainable development Technical vocational education and vocational training for adults
trimester	Strategic planning, policies and trends in TVET Management administration of TVET Methodology for research in TVET
trimester	Planning and trends in curriculum design in technical education and vocational training Human talent management and organizational climate in technical education and vocational training Research seminar I
trimester	Institutional evaluation and programs in technical education and vocational training Formulation and evaluation of projects in technical education Research seminar II
trimester	Ethics, equity, administration and legislation in technical education and vocational training Research seminar III
trimester	Thesis Seminar

As shown in Table 1, the Bachelor's degree (Licenciatura) takes less than one year (3 trimesters) plus the time the student needs to complete the final graduation work (thesis). The professional graduate of the Bachelor's degree (Licenciatura) in technical education program obtains the highest level of hiring of the Ministry of Public Education (MEP) for teachers of TVET. This degree offers the opportunity to work in the TVET system (mainly INA and the MEP) and in companies in further education. In this way, graduates can enter the national TVET system, such as technical colleges in the formal sector

or vocational schools in the non-formal sector. At the same time, they can work in the private business sector, e.g. to design training courses or further training programs (TEC, 2022).

With a Master's degree in technical education (Maestría), graduates have a wide range of possible jobs in the national TVET system, such as director of TVET schools, deputy for education, etc. The private sector is also suitable for these graduates in terms of being in charge of training and human resource development programs, or as consultants and having research responsibilities, among other roles (TEC, 2022).

Although access to the course information is limited, the individual modules taught in trimesters show that the TEC teaches pedagogical-psychological, didactic and research-related modules on TVET in its courses. The modules "didactic and curriculum planning in TVET", "didactical foundations in TVET" etc., for example, indicate that the two-degree programs are specifically geared towards TVET and suggest a higher degree of specialization in TVET.

The TEC programme at Master's level indicates a high degree of professionalization. Apart from being the only public institution in Costa Rica to offer teacher training for TVET at the highest academic level (Maestría), it can be considered unique in the Central America and Caribbean region.

The UTN Study Program

The UTN curriculum for TVET teachers includes the two lower academic levels of pregraduate (Profesorado) and graduate (Bachillerato) in the career called "Technical Specialization Education". The UTN program for TVET teachers is aimed at the pedagogical qualification of students who have obtained a diploma (Diplomado) in a technical field, but also for students from other fields such as languages and so on.. So, a degree in a technical field is not necessarily required, but an academic degree of diplomado (lowest academic degree in Costa Rica) is required to accesses the program. Graduates of the UTN program are mainly employed in technical colleges in the formal sector and in vocational schools in the non-formal TVET sector or are able to work in various private TVET institutions (Consejo Nacional de Rectores [CONARE], 2016).

In the following, the most important aspects of the Bachelor's degree in the so-called "Technical Specialization Education" are described. The description in the "Request for modification of the Bachelor's Degree in Technical Specialization Education (EET) with lateral exit for teaching in Technical Education at the National Technical University (UTN)" submitted to the Office of Higher Education Planning (OPES; CONARE, 2016).

The target group of the study program of the UTN, more precisely the Centre for Pedagogical Training and Educational Technology (CFPTE) of the UTN, are students with technical university degrees at diploma, profesorado and Bachelor's level who wish to prepare themselves as teachers, advisors, instructors, trainers in their areas of specialization, among others. The minimum entry requirement for this course is the academic degree of diploma in a technical or technological, or other discipline obtained in a university or para-university higher education institution equivalent to one of the degrees taught at UTN. In the case of a degree obtained in an external institution, it must be submitted for comparison with one of UTN's degree courses.

The degrees they can achieve are:

- Profesorado in Teaching (20 Credits): The certificate is obtained with the name of the technical discipline with which each student enters the Teaching Career of the Technical Specialty. For example: Professor in the Teaching of Accounting Specialty.
- Bachelor's degree in Teaching (31 Credits): In this case, it happens in the same way. The discipline indicated by the technical diploma with which each student enters the bachelor's Degree. For example: Bachelor's degree in the Teaching of Accounting Specialty.

The study program in total is developed in six trimesters, and integrates 17 courses in its curriculum.

Table 2: Study program Technical Specialty Education for the profesorado and bachillerato of the CFPTE-UTN

Profesorado	
Trimester	Foundations of education General Didactics Educational planning
Trimester	Learning Resources I Evaluation in education
Trimester	Teaching practice
Bachillerato	
Trimester	Sport activity Humanities Education I Research Methods and Technique Specific Didactics
Trimester	Humanities Education Educational Psychology I Learning Resources II Introduction to the curriculum
Trimester	Cultural activity Humanities Education I & II Educational Psychology II

It should be noted that, according to institutional regulations, students must fulfil a series of requirements to obtain their degree, such as meeting a minimum number of credits, which in this case is 98 at the level of profesorado and 120 for Bachelor's degree:

- Successful completion of all courses and activities of the curriculum of the respective section.

- At the profesorado level, the student must have competed at least 98 credits: This includes the 20 credits of the profesorado section and the credits of the degree program he/she started with (the credits taken in technical career).

At bachillerato level, the student must have completed a minimum of 120 credits, including the 20 credits of the Teacher Training section, the 31 of the bachillerato, plus the credits of the degree course with which he/she entered.

If the student does not reach this minimum, the student must pass the subjects assigned by the National Technical University until the minimum is reached.

In order to graduate from the bachillerato, students must also complete 120 hours of University Community Work (CONARE, 2016, p.9). Graduates develop a series of competences that enable them to work effectively as teachers in technical-professional education in their specialty and/or as advisors in public or private secondary institutions, para-university, university colleges, and other organizations (CONARE 2016).

The profesorado aims to train teachers who combine technical knowledge with pedagogy to improve teaching and learning processes. The Bachelor's degree aims to train future teachers for vocational schools, focusing on humanism, social responsibility and ethics. The program includes specific didactics, research and curriculum design. It emphasizes psychological processes of teaching and learning, drawing on constructivism, behaviorism, and biopedagogy. (CONARE, 2016). Although this program is unique because of its focus on vocational education, the UTN program for training vocational teachers at the academic level is still under development. A study conducted by the UTN shortly after the launch of the program identified various challenges and shortcomings of the program, including deficiencies in vocational didactics and repetitive content in the individual modules (Castro Campos et al., 2016).

Since 2016, no studies have been conducted that could reflect improvements in the curriculum, until Rommel and Vargas revealed in 2021 that there is still a very general pedagogical approach and the subject on Costa-Rican TVET is only informally included in the curriculum.

3.2 Alternative Pathways into Teaching in TVET

In addition to the TVET degree programs for teachers from the state universities UTN and TEC, there are also alternative entry options for teaching in the TVET system in Costa Rica. The requirements that must be met in order to be hired by the educational institutions as a TVET teacher vary depending on the institution. Possible access routes to teaching in TVET are described below, using the INA and MEP entry requirements as examples. No claim is made to completeness, as the examples do not represent the entirety of entry routes in Costa Rica. The INA and the MEP determine different and individual personnel categories, depending on a person's previous education and professional experience. This is also linked to specific work tasks that apply to each category of teacher in the two institutions.

Entry Pathways and Requirements of MEP

Looking at the individual categories of MEP and the associated assignments of entry requirements for teachers in TVET, two main categories can be identified, which are specified by further subcategories. Therefore, the profiles of teachers for TVET from the MEP and the combination of qualifications that enable them to teach in technical colleges of MEP differ greatly. Thus, both people with and without university degree can hold the position of a TVET teacher. Teachers for TVET in colleges of MEP without a university degree must have a degree in relevant vocational training or fulfil other requirements. The two options are:

- graduates of vocational schools, arts and crafts, whose curricula are not less than five years.
- postgraduates of the Instituto de Formación Profesional del Magisterio (IFPM) – a teacher training institution – who have graduated from other state-approved educational institutions whose curricula are no shorter than two years. Persons who have not graduated from a professional or trade school, as well as all persons mentioned in this subsection who do not have a baccalaureate and high school graduates; also, teachers who obtained a special qualification certificate before 1955, who are appointed and teach special subjects.[2]
- Although this form of qualification for teachers in TVET no longer exists, there are still teachers in TVET schools who have completed this qualification pathway.

The second category refers to people with an academic degree in a technical field without a pedagogical qualification up to a technical degree with a pedagogical qualification in general education and vocational education.

The different sub-categories of the second route of entry via academic qualifications include vocational teachers with pedagogical qualifications independent of the pedagogical field, people with a technical university degree and a pedagogical qualification at university level (Álvarez-Galván, 2015, p. 74).

In general, Álvarez-Galván (2015) points out that the pedagogical requirements for vocational teachers in MEP TVET institutions are clearly formulated, they do not appear to be fully enforced due to the shortage of teachers in specific fields (Álvarez-Galván, 2015, pp. 66–67).

The following figure illustrates the individual categories non-academic and academic with the respective subcategories and visualizes the different qualification requirements and access routes to the teaching profession for TVET teachers of the MEP.

2 This was amended by Article 1 of Law No. 5783 of 19 August 1975.

Figure 2: Qualification requirements for TVET teachers MEP

Non-academic	Academic
Without a university degree but with vocational training and supplementary pedagogical qualification	a) Degree for primary school teaching or from a university of applied sciences at Diplomado level b) University degree in a specific field (e.g. engineering) without pedagogical qualification c) University teaching qualification at Profesorado or Bachillerato level and a qualification in a subject area (regardless of level) d) Doctorate, Master´s or Licenciatura´s degree with pedagogical qualification in secondary or primary education

As can be seen in figure 2, non-academic access to the MEP is via vocational training degrees and corresponding pedagogical qualifications. Academic qualification requirements, on the other hand, are divided into four sub-categories. These sub-categories describe the different access options according to academic qualification, with different pedagogical qualifications being required or not. Thus, there can be different academic levels and specialization, ranging from a degree at the lowest academic level (Diplomado) in primary education or applied science without a pedagogical qualification to a PhD, Master's or Bachelor's degree with a pedagogical qualification, but not necessarily in TVET.

The figure illustrates that the access routes to the teaching profession at technical colleges in the MEP are very heterogeneous. The question remains open as to how exactly the tasks and fields of activity of the individual profiles differ in practice and whether there is any differentiation at all between tasks and responsibilities depending on the qualification.

In relation to the four academic qualification programs offered by UTN and TEC, graduates of the UTN program can be classified in the third category with a university degree and the TEC in the fourth category. The two universities thus serve the highest qualification categories of the MEP for TVET teachers.

Entry Pathways and Requirements of INA

In comparison to MEP, the INA takes a different approach in hiring TVET teachers for vocational schools. In general, they are called trainers at INA and are divided into four categories. Here, candidates with a TVET education or a university degree in a technical field can enter the teaching profession. Furthermore, the INA categories include professional experience in the relevant specialty and differ from vocational education and work experience but no academic degree to university degree in a technical field with corresponding practical experience, depending on the level of the university degree. The higher the academic degree (e.g., in engineering), the less practical experience is required, which is categorized as follows according to the INA's Class and Position's Manual:

- Technical Trainer 1 A: Graduate from either INA or vocational/technical secondary school in a given field of study, two to three years of work experience.
- 1B: Diploma in higher education career with 18–24 months of experience in the specialty.
- 1C: Bachelor´s university degree with 12–18 months of experience in the specialty.
- 1D: Master´s degree with up to 12 months of experience in the specialty.

Furthermore, the INA set as a prerequisite for its teachers that they complete a specific pedagogical and didactical training course offered by the INA itself. This training refers to the INA's didactic and pedagogical guidelines for teaching in TVET programs they offer (INA, 2019; Álvarez-Galván, 2015, p. 67).

So, while the MEP focuses on the academic preparation of their teachers, the INA places more emphasis on their teachers' work experience and provides specific pedagogical training that they organize (Álvarez-Galván, 2015).

In general, it can be stated that the different requirements and prerequisites of the individual TVET institutions illustrate that the required knowledge, skills and qualifications of TVET teachers are heterogeneous in Costa Rica. Currently, there are no significant scientific endeavours to homogenize entry-level TVET teaching requirements across institutions (Rommel et al., 2024, p. 231), which would promote homogenization of the teaching profession in TVET.

4 Systematization of Entry Requirements and Qualification Pathways of TVET Teachers in Costa Rica

The skills and competencies of teachers are critical to the success of teaching processes and their implementation (King Rice, 2003; Rivkin et al., 2005). One way to improve the quality of TVET is to raise the level of qualifications and skills required of TVET teachers.

Two different models can be distinguished for the recruitment of teachers for TVET based on qualifications. One is the academic teacher qualification and the other is what is often referred to as "alternative recruitment". In alternative recruitment of TVET teachers, the qualifications obtained through this route are often lower than those obtained through academic recruitment (Lynch, 1998). Nevertheless, this "alternative recruitment" is still a relevant strategy for acquiring teachers for TVET. This can also be illustrated by the example of Costa Rica.

A systematization (Table 3) of the individual possibilities was created in order to systematically present the possible qualification pathways and access routes with academic and non-academic pathways and to point out the high heterogeneity (MEP 2014; INA 2014; TEC 2022; CONARE 2016). This systematization shows which paths are possible, whether practical experience, studies with and without TVET are necessary, at which level qualifications belong and in which TVET schools the respective teachers work.

Table 3: Qualification and recruiting pathways for TVET teachers in Costa Rica

Pathways and entry requirements		**Fields of work and positions**
Non-academic without practical experience	Refers to staff with no post-secondary/tertiary education who have graduated from a technical college and have complementary pedagogical training.	Technical collages of the formal TVET system of MEP
Non-academic with practical experience	Graduate from either the INA or a vocational/technical secondary school in a given field of study. Have two to three years of work experience in their own specialty.	Vocational schools of INA counted as non-formal TVET system
Academic degree in technical subjects and practical experience	Diploma university degree with 18 or 20 months of experience in their specialty. Bachelor´s university degree with 12 to 18 months of work experience in their specialty.	Vocational schools of INA counted as non-formal TVET system
Academic degree in technical subjects and/or general pedagogy, without practical experience	Degree for primary school teaching or a pedagogical degree from a university of applied sciences at diplomado level	Technical collages of formal TVET system MEP
	University degree from at least profesorado in a subject area without pedagogical qualification	Technical collages of formal TVET system MEP
	University degree at profesorado or bachillerato level and qualification in a subject area	Technical collages of formal TVET system MEP
	Doctorate, Master's degree or Licenciatura with secondary or primary education required pedagogical qualification	Technical collages of formal TVET system MEP

Pathways and entry requirements		Fields of work and positions
Academic degree in technical subject and pedagogy with reference to TVET, without practical experience	Profesorado in Technical Education Teaching of the National Technical University (Universidad Técnica National, in Spanish (UTN)	Technical collages of the formal TVET system of MEP and vocational schools from the non-formal system of INA
	Bachillerato in Technical Education Teaching of the UTN	Technical collages of the formal TVET system of MEP and vocational schools from the non-formal system of INA, trainers in company for further education
	Licenciatura in Technical Education of the Technological University of Costa Rica (Tecnológico de Costa Rica, in Spanish (TEC)	Technical colleges of the formal system, university collages, university education and the non-formal TVET system, also planning and providing further training and education in companies
	Maestría in Technical Education of TEC	Positions designated by the Civil Service (MEP), such as: Education Advisor, Assistant to the Directorate of Educational Control, Director of TVET schools, Deputy director of education, Deputy director of higher education. In the INA Director of Training and Development, Director of Technological Centers and Vocational Trainer.

In order to discuss this heterogeneity and better classify its significance, an analysis by Grollmann and Rauner (2007) can be used to draw conclusions about the qualification and recruitment models in Costa Rica. Their analysis of TVET teacher preparation pathways and formal qualifications in 11 countries, Grollman and Rauner (2007) identified four dominant models. The first model focuses on the recruitment of professionals from specific fields who receive training in teaching methods leading to a teaching certificate. The second model involves studying the subject at Bachelor level and acquiring general teaching skills in a designated program. The third model combines the study of subject and educational science and leads to a Bachelor's or Master's degree, which sometimes also includes vocational. The fourth model is based on an integrated approach to vocational disciplines and emphasizes competence development in a profession-specific context. These diverse pathways illustrate the complexity of TVET teacher preparation and the need for tailor-made approaches that respond to the specific needs of each context. On the other hand, it seems necessary to bring order to the matter and develop typical routes with the same standard.

Applying this definition of requirement and qualification models by Rauner and Grollmann (2009), in the case of Costa Rica it can be said that it is a model based on a combination of three models: recruitment of practitioners, additive model and vocational didactics model. Therefore, the entry requirements here are extremely heterogeneous. It is possible to enter the teaching profession with or without an academic

degree. An academic degree does not necessarily have to be TVET-oriented; a pedagogical university degree also appears to be sufficient for secondary education I or II. However, the various institutions have different recruitment requirements. While the MEP relies on a pedagogical academic degree without compulsory practical experience, the INA concentrates on practical experience and then qualifies its teachers accordingly in pedagogical terms.

5 Discussion and Conclusions

Recent discussions on the qualification of TVET teachers in Costa Rica illustrate that there is a lack of standardization in teacher training with regard to the recruitment requirements of TVET providers (Rommel et. al., 2024). It is indicated that the qualification of teachers for TVET takes place at the academic level in Costa Rica, based on previously obtained academic degrees in a technical field and complemented by a pedagogical qualification.

Although the qualification for TVET teachers in Costa Rica is also at an academic level, the lack of standardization and homogenization of the entry requirements to work as a teacher in TVET hinders both the degree of standardization of the teacher's qualification as well as the degree of professionalization. Ultimately, it can be deduced from the above that to date there are no concrete standards – such as competencies to be achieved – for the qualification of teachers for TVET that would determine the qualifications required for the professionalization of the profession itself.

The two state universities UTN and TEC have been offering academic degrees for a number of years, which are declared as specific training for teaching in TVET, both for the formal and non-formal system. However, a concrete description of the standards for the degree courses can only be provided via the entry requirements for the individual academic levels to be aspired to. Furthermore, these have no specific reference to future work as a TVET teacher. However, the entry requirements for working as a teacher can also be described outside of the academic qualification. The two main actors of TVET in Costa Rica – here the MEP and the INA – therefore follow different guidelines. These different guidelines also allow people without an academic degree or pedagogical qualification to work as a teacher for TVET.

Costa Rica faces challenges in terms of the provision and qualification of teachers for TVET. According to the Organization for Economic Co-operation and Development (OECD, cited in Álvarez-Galván, 2015), one problem is that MEP teachers do not have adequate pedagogical training, while the preparation of teachers at the MEP seems to be too academically oriented. At the same time, the demand for TVET teachers in Costa Rica has increased, which is confirmed by the fact that the INA in particular is hiring more teachers than in previous years.

The requirements for INA and MEP teachers as the two main TVET actors in Costa Rica are not equivalent and homogenized, which makes the exchange of teachers more difficult. The OECD recommends a clear homogenization of qualification requirements for INA and MEP teachers (Álvarez-Galván, 2015; Láscarez-Smith & Baumann, 2017, p. 103). This would allow for a better understanding and recognition of teacher profession-

alization in Costa Rican TVET. In addition to allowing other aspects such as the permeability of teachers in the system.

As can be seen from the descriptions, the access routes for teachers in TVET in Costa Rica can be presented at different levels of professionalization of teachers in TVET. On the one hand, there is academic qualification that enables access to the teaching profession with a corresponding academic degree. On the other hand, Costa Rica has a total of four degree courses offered at state universities for TVET teacher training, which are neither coordinated or harmonized with each other and also do not have the same understanding of the skills to be acquired as a minimum requirement for academic education. At the same time, however, other entry routes are also possible which do not necessarily require an academic qualification. These access routes were described using the INA examples and are systematized and presented in tabular form in Chapter 4. It became clear that there is also access via practical experience without an academic qualification. In conclusion, it can be said that the access routes and qualification paths for teachers in Costa Rica ultimately also depend on the individual TVET institutions and their own requirements. However, the explanations clearly show that there is a very high degree of heterogeneity with regard to the possible routes into teaching in TVET. During the process, it was established that no concrete standards can be used for teacher training in TVET. But, in the context of the discussion on the professionalization of teachers in TVET in Costa Rica, a decisive impetus could be provided here. The formulation of minimum standards, such as competencies to be acquired, could be considered possible.

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010207

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

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

Tina Gryson, Katrien Strubbe, Tony Valcke & Ruben Vanderlinde

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

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

Keywords *Vocational secondary education, In-service teachers, Teacher Design Teams, Professional development, Qualitative research*

1 Introduction

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

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

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

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

2 Research context: Project Integrated General Subjects in Flanders

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

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

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

3 Theoretical framework

3.1 Teacher Design Teams

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

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

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

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

3.2 Teachers' professional development

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

3.2.1 Professional development of attitudes and beliefs

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

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

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

3.2.2 Consistency of curriculum materials

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

4 Method

4.1 Research aim and questions

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

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

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

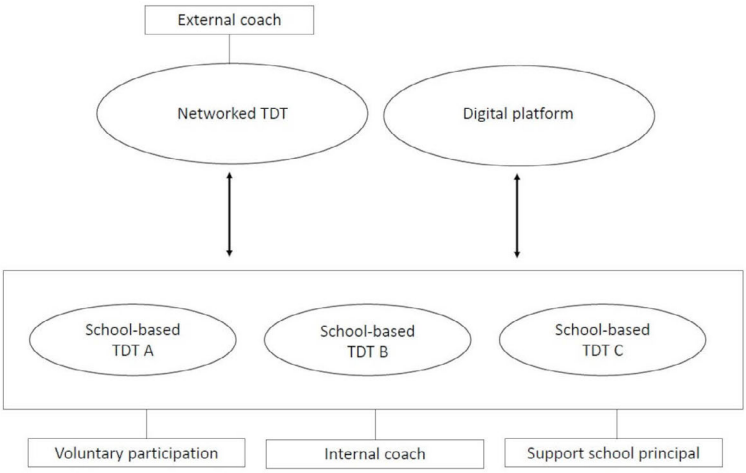
Research Question 2 (RQ2): How do TDTs affect vocational teachers' instructional practices?

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

4.2 Implementing Teacher Design Teams

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

Figure 1: Main conditions TDT programme



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

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

4.3 Participants and Teacher Design Teams

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

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

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

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

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

Table 2: Description of the school-based TDTs

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

4.4 Data collection

During two school years (2020–2021 and 2021–2022), the TDT programme was implemented in three Flemish secondary schools. Each school year, an interview was conducted with each participating teacher. One teacher (Kevin) did not want to participate in all interview moments and is therefore excluded in this study. This implies that data were collected and analysed from nine teachers. Based on the yearly interviews, a picture of the initial and post-intervention perceptions was obtained. The first interviews occurred during the second trimester of the 2020–2021 school year[1], while the second interviews were conducted towards the end of the 2021–2022 school year. The interviews in the school year 2020–2021 were conducted and recorded online with Microsoft Teams because of the Covid-19 restrictions. In the school year 2021–2022, teachers could choose for an online or face-to-face interview as both show similar results (Abrams et al., 2014).

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

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

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

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

4.5 Data analysis

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

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

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

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

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

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

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

5 Results

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

5.1 Attitudes and beliefs

5.1.1 Attitudes and beliefs towards PGS

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

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

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

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

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

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

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

5.1.2 Beliefs about the teachability of vocational students

In the PD regarding the beliefs about the teachability of vocational students, a rather negative development is emerging. Looking at the initial beliefs about the teachability of vocational students, four of the nine teachers have positive teachability beliefs, but negative beliefs at the second interview. More specific, Vanessa, Vic, Sarah and Peggy were first convinced that all attainment targets are feasible for all students. The second interviews show that an ongoing reform[2] and the additional demands of PGS weaken the belief that vocational students can master the subject matter.

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

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

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

5.1.3 Self-efficacy beliefs

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

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

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

5.2 Instructional practices

5.2.1 Classroom practices

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

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

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

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

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

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

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

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

5.2.2 Designing curriculum materials

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

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

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

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

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

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

6 Conclusion and Discussion

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

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

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

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

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

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

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

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

Notes

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

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General Section

International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010208

A Language-Sensitive Textbook Analysis

Tasks and Texts Used to Teach Business at German Vocational Schools

Junmin Li & Firat Deniz

Abstract *Germany has a significant number of people who did not learn German as their first language. For this learning group, German can represent a challenge to achieving a successful vocational education, but even native German speakers can experience language difficulties; one approach to overcoming language barriers is language-sensitive teaching. Textbooks serve as a didactic medium for planning, initiating and supporting school learning processes, and this paper investigates the extent to which textbooks for business education at vocational schools are designed to be language sensitive. An analysis of a textbook from a language-sensitive perspective reveals that the majority of the text and tasks in the textbook have language-sensitive elements but that there remains potential for improvement at the word, sentence, text and visual levels of analysis.*

Title *A Language-Sensitive Textbook Analysis. Tasks and Texts Used to Teach Business at German Vocational Schools*

Keywords *language-sensitivity; textbook analysis, learning task, Germany, vocational school*

1 Introduction

Germany has a significant number of people who do not speak or have not learnt German as their mother tongue. This first language barrier became apparent with labour migrants who came to Germany in the 1950s and 1960s through bilateral agreements between the Federal Republic of Germany and several other countries to fill labour shortages. The recruitment stopped in 1973, but many of the 14 million migrant workers remained in Germany. They also brought their families with them, meaning that the num-

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ber of people who did not speak German as their first language grew steadily over the years (Herbert & Huhn, 2001). More recent phenomena have ensured that the issue of German as a second language remains topical. The Syrian conflict in the 2010s led to several waves of refugees reaching Germany, among other countries: there were around 33,000 people from Syria living in Germany in 2011, but this had risen to around 870,000 by the end of 2021 (Statistisches Bundesamt, 2023). The conflict in Ukraine has also produced large waves of refugees; the number of Ukrainian citizens in Germany rose to more than a million in 2022 alone (Statistisches Bundesamt, 2023). All school and vocational education and training programmes now include children, young people and adults from these refugee communities, and German language competence is a challenge for a successful education.

However, German as a second language is not the only cause of language barriers; even native German speakers can experience language difficulties. There are many reasons for this, from a lack of education in the family to cognitive issues (Scharff Rethfeldt, 2013). It should be noted that these students, just like migrant students, need language support to first develop their educational language skills and then to achieve subject-related learning objectives.

Various approaches and measures have been proposed to overcome language barriers. One suggestion that is often made is language-sensitive teaching, which, broadly speaking, encompasses measures and actions to help learners with language difficulties to overcome language barriers in the classroom. Language is a competence that should not be assumed; instead, the individual language competences of the learners should be sensitively considered. Appropriate measures may relate to different elements of the lesson, such as planning, the teacher's mode of expression and language aids (Rossner & Bolitho, 2022). Textbooks are such an element; they convey information mainly through language (Macgilchrist, 2018), play an important role in school learning and serve as a didactic medium for planning, initiating and supporting school learning processes (Vera, 2018).

This paper investigates the following research question: to what extent are textbooks for business education at vocational schools designed to be language sensitive? To do this, one textbook from a full-time vocational school will be analysed from a language-sensitive perspective.

2 Theoretical Context: Language-Sensitive Teaching and Language-Sensitive Research

Becker-Mrotzek and Roth (2017) emphasise that language skills are a key prerequisite for educational success and for professional and social participation. They also argue that too many students in Germany leave school without sufficient language skills. Educational language, which is fundamental to the acquisition of academic knowledge, is rarely taught explicitly in the classroom (Becker-Mrotzek & Roth, 2017), and students who do not have extended educational language skills from home may therefore encounter language barriers and develop content deficits. It has been recognised in educational policy that language teaching and promotion must take place at all levels

of education and in all subjects. As early as 1999, the Ministry for Schools, Youth and Children (MSJK, 1999) declared the promotion of the German language to be a teaching task in all subjects, and towards the end of the 2000s, subject didactics also began to focus more on the topic (Boubakri et al., 2017). One result of these educational policy discussions is the idea of language-sensitive teaching; even if this alone does not lead to internal differentiation, it can allow for students with different language learning needs and enable them to improve their language skills.

The term 'language-sensitive teaching' encompasses various teaching concepts that consciously use language as a means of thinking and communicating in order to link subject learning with language learning. These concepts, which are also termed 'language aware' or 'language responsive', ultimately aim to make it easier for students to achieve their subject-related learning goals and to develop cross-curricular language skills in the long term (Shanahan & Shanahan, 2008; Schleppegrell, 2004). Even if, at first glance, learners with a migration background appear to be the primary recipients of language-sensitive teaching, the concept actually seeks to include all 'language-weak' learners, including native German speakers.

The guiding principle of language-sensitive subject teaching is that students should be treated individually by teachers who are sensitive to their individual language competences and to the language used in teaching and learning (Shanahan & Shanahan, 2008; Schleppegrell, 2004). Language is understood as a medium for subject-related learning that should not create avoidable linguistic barriers in that role; conversely, language learning is subject-related, i.e., language is learnt through the subject content (Leisen, 2013).

Leisen (2013) identifies three basic principles for individual support:

- Language situations should be technically authentic but manageable.
- Language requirements should be just above the learner's language ability.
- Learners should be given as few language aids as possible but as many as necessary.

2.1 Textbooks for Vocational Learning

One of the most commonly used teaching materials in schools is textbooks, which are core instruments in almost all subjects. In textbooks, knowledge is primarily conveyed through language, and acquiring knowledge through textbooks therefore requires language competence. The way language is used in textbooks is therefore relevant not only to subject learning but also to language learning (Macgilchrist, 2018). For learners with language difficulties to be able to use their textbooks for subject and language learning, the language in them must be used purposefully so that it is not a barrier and so language skills can be developed.

However, the definition of a textbook is not always consistent. As a didactic medium, textbooks should serve to plan, initiate, support and evaluate school learning processes. In short, textbooks should serve as pedagogical aids and a source of information, both in terms of content and in terms of structuring that content and providing a consistent theme for the teacher and learners. Textbooks are also political because they are 'embedded in a political, pedagogical-didactic and socio-economic context' (Wiater, 2003, p. 12),

and they are politically significant because the state indirectly controls teaching–learning processes in schools and the development of the skills, attitudes and behaviours of young people by allowing textbooks only under certain conditions (Höhner, 2005).

In Germany, the approval of textbooks is regulated differently in each of the federal states. In most cases, approval is granted by the competent state Ministry of Education and Cultural Affairs (*Kultusministerkonferenz*) or a subordinate authority (Kultusministerkonferenz [KMK], 2023). In North Rhine-Westphalia, only approved learning materials may be used in schools, and all such materials must meet certain criteria to be approved, including federal state guidelines, mandated curricula, teaching standards and legal requirements. They must also provide learning opportunities and reflect the latest scientific knowledge. The approval of a learning aid or textbook can be granted through an expert procedure, a simplified procedure or a general approval, and the state's Ministry of Schools and Education (*Ministerium für Schule und Bildung*) determines the approval procedure for subjects in the different types of schools (Schulministerium NRW, 2023).

This significant interaction between textbooks, curricula and their functions means that traditional textbooks still play an important role in teaching in the German education system and are still seen as supportive and motivating by both teachers and learners in many subjects and regions of Germany (Fuchs, Niehaus & Stoletzki, 2014). Nevertheless, it has been claimed that textbooks rarely meet the expectations of teachers in Germany in view of the increasing heterogeneity of society (Fuchs et al., 2014), while some teaching and learning studies argue that understanding technical writing is essential for textbook work and learning (Oleschko & Moraitis, 2012). Wiater (2013) also emphasises that it is not only students whose first language is not German who have problems with the language in German textbooks: 'It is also [a problem] for native German-speaking students who have a restricted language code or dialectal language peculiarities' (p. 17). Various requirements are therefore imposed on textbooks to improve students' understanding. As the subject matter and thus the linguistic demands become more complex over the course of students' school years, so the language problems of students with language difficulties grow. These demands also affect textbooks and are reflected, for example, in the terms and structures used becoming more complex and the information being condensed and presented in a more abstract way (Schmölzer-Eibinger & Egger, 2012; Macgilchrist, 2018).

2.2 Learning Tasks for Vocational Learning

Teachers encourage students' learning through tasks appropriate to the teaching and learning objectives set, which can be taken from a textbook or from other sources. Tasks play a role at both the end and beginning of the teaching–learning process; tasks that occur at the end include learning assessments, examinations and exercises to prepare for examinations, but learning tasks can be used in all phases of the learning process that enable learning itself and contribute to the social function of schools (Richter, 2012; Nikolaus, 2016). Although other functions are possible, the following are the main functions of tasks (Thonhauser, 2008):

- Operationalising learning objectives
- Stimulating learning as learning tasks
- Determining learning outcomes as assessment tasks

The task culture aims to achieve standardised skills among students and to bring the German language back into focus (Oleschko & Moraitis, 2012; Crookes & Gass, 1993). In their interdisciplinary model of task quality, Blömeke, Risse, Müller, Eichler and Schulz (2006) emphasise the need for linguistic references:

> At the same time, however, there must be an opportunity to master the task. If a task seems so difficult to the students that they see no chance of mastering it, they are likely to turn away from it. … In this context, however, it is also important that the task is understandable, i.e., that the students can grasp it in terms of content and language. (p. 336)

The ideas set out in this section illustrate the importance of textbooks and textbook tasks for school and classroom practice. It is clear that the linguistic aspect must be considered in both the development and evaluation of these central elements of teaching.

3 Methodology

Content analysis was used in this study to analyse the selected textbook (Mayring, 2021). Categories of analysis were defined that focused on the linguistic design of the textbook in the context of the subject matter of the book and the research question of this study, and the category system and coding guide are described below.

3.1 Selected Vocational School Programme

Vocational school courses are divided into different fields, such as business, handcrafts, hospitality and health care (see Ministerium für Schule und Bildung, 2023). The *Berufsfachschule* vocational programme is examined here, which enables the acquisition of the extended first school leaving certificate (*Hauptschulabschluss* after 10th grade) and requires a first school leaving certificate (*Hauptschulabschluss* after 9th grade). This programme can bring together students with a wide range of learning needs and sociocultural backgrounds, including those from international support classes, those with a migrant background and those from educationally disadvantaged families, for all of whom language-sensitive textbook design is of great importance.

3.2 Object and Units of Analysis

In this study, a textbook used in schools for teaching economics was analysed to determine whether and to what extent it was designed to be language sensitive. A textbook from a vocational school was chosen because such programmes tend to be attended by

linguistically weaker students (Beicht & Eberhard 2013), who would benefit greatly from language sensitivity.

At the beginning of 2023, 22 municipal vocational schools in Aachen and Cologne, in the state of North Rhine-Westphalia, were contacted and asked which textbooks were used for teaching business subjects. After a reasonable waiting period, ten responses were received – a response rate of 45 %. Some teachers stated that they did not use textbooks at all or used them only occasionally to extract texts, graphics or exercises for certain areas. A number of different textbooks were mentioned.

In the end, a textbook mentioned three times was chosen: *Geschäftsprozesse im Unternehmen – Lernsituationen für die BFS 1* (Business Processes in the Company – Learning Situations for the vocational programme '*Berufsfachschule*' published by Europa-Lehrmittel. The book has been available digitally since 2022, was written by Dr Karin Huse and has 210 pages. It covers four learning areas of the training programme: 1) Starting and managing a business, 3) Planning and procuring goods and 4) Planning and developing a service programme. According to the foreword, the book is suitable for students who are aiming for the first or extended first school leaving certificates (*Hauptschulabschluss*) after grades nine or ten, for classes with international backgrounds (*Internationale Förderklasse*) and for other types of schools (Huse, 2022). The learning situations in the book deal with content relevant to the learning fields and are intended to teach professional, social and personal competences using text, materials and tasks. The book is about an example company and a trainee gaining their first professional experience, and students are supposed to encounter situations from the everyday life of the company. The preface does not mention linguistic design.

The textbook was not subjected to a complete analysis; after a review, it was decided that each learning area should be examined. The three learning areas mentioned earlier contain two learning situations (LSs) each, and one from each learning area was used for the analysis: LS 1.1, LS 3.1 and LS 4.2. By analysing half the available situations, a good degree of representativeness was achieved. Together, the analysed situations account for about 70 pages of the textbook.

The units of analysis were texts and tasks, and the LSs contain both situation texts and information texts. Situation texts are clearly marked on a blue background with the headings 'Situation' or 'Continuation of the situation', while information texts are on a brown background. All text in the selected LSs was analysed. Tasks in the book are on a yellow background with the headings 'This is for you to do', 'Further tasks' or 'Comprehension questions', and the number of subtasks varies. In the end, 30 texts and 25 tasks were analysed.

3.3 Categories for Analysis

To analyse the selected textbook in a language-sensitive way, a categorisation system was created. Two different but similar coding guidelines were developed for the texts and tasks. The publication Language in Textbooks (*Sprache in Schulbüchern*) by the Austrian Federal Ministry for Education, Arts and Culture (2012) was used as a basis for creating the category system and is itself based on research on German as a second language (Schmölzer-Eibinger & Egger, 2012, p. 39). Its recommendations are presented in

the form of a checklist, and it distinguishes between recommendations for the design of texts and those for the design of tasks, with most recommendations applying to both. It also distinguishes between the word level, sentence level, text level and visual level.

After review, 27 recommendations were selected from the checklist as templates for the categories to be used in this study: 12 for assessing text and 15 for assessing tasks (see Table 1). After making minor changes, each category was phrased as a statement that could be scored on a scale from 0 (not applicable) to 3 (highly applicable). Ideally, a text or task should be awarded 3 points in all categories; if not, revisions in the respective categories would be needed. The original recommendations did not specify how a text or task might be scored; to ensure objective evaluations, criteria were established for awarding points in each category after several test runs. Not all numbers of points could be awarded in all categories; for example, TA1 ('providing all necessary information to solve the task') was scored as either 3 points or 0 points, with intermediate scores not being considered useful.

Table 1 presents an overview of the categories. The labels in the first column summarise the category's level and whether it applies to texts, tasks or both. The levels are represented by the letters W (word), S (sentence), T (text) and V (visual), with X representing texts and A representing tasks.

Table 1: Overview of the categories

Acronym	**Categories for analysis of texts**	**Categories for analysis of tasks**
	Word level	
WXA1	Precision and appropriateness of word usage	
WXA2	Accurate and sufficient explanation of difficult words	
WXA3	Clear differentiation of everyday vocabulary from professional vocabulary	
WXA4	References to functional words that are important for understanding	
WXA5	Appropriate number of newly introduced professional terms	
WXA6	No unnecessary nominalisations	
WA1		Explicit use of operators
	Sentence level	
SXA1	Appropriate complexity of sentence constructions	
SXA2	No unnecessary subordinate sentences	
	Text level	
TXA1	Suitable cohesive agents	
TX1	Gradual introduction of information	
TA1		Providing all necessary information to solve the task
TA2		Clear and logical sequence of work steps

Acronym	Categories for analysis of texts	Categories for analysis of tasks
	Visual level	
VXA1	Visual highlighting of important words and information	
VXA2	Clear differentiation of information and content through paragraphs and bulleted lists	

Table 2 presents, as an example, the scoring criteria for the category 'Precision and appropriateness of word usage' at the word level (WXA1). Implementation of a category of language sensitivity is considered precise and appropriate if it is suitable for the respective age group, topic, problem and context of use (Schmölzer-Eibinger/Egger, 2012, p. 16). In this case, word usage was not appropriate if unknown or little-used terms were not explained or clarified, so the analysis of 'appropriateness' focused on the use of known professional terms. Similar scoring criteria were defined for all categories.

Table 2: Precision and appropriateness of word usage at word level (WXA1)

	Score	Criterion
Precision and appropriateness of word usage at the word level	0 = not applicable	More than one inappropriate word per sentence
	1 = low applicability	More than 0.5 but less than 1.0 inappropriate words per sentence
	2 = moderate applicability	More than 0 but less than 0.5 inappropriate words per sentence
	3 = high applicability	No inappropriate words

Once all the texts and tasks were analysed, the distributions of scores were calculated for each category. The following simplified example can be used to illustrate this:

In category WXA2:

- 20 % of the texts scored 0 points
- 10 % of the texts scored 1 point
- 30 % of the texts scored 2 points
- 40 % of the texts scored 3 points

In this way, it is possible to estimate at which linguistic levels and in which areas the textbook needs to be sensitised. The total number of points in all categories can be calculated for each text or task and expressed as a percentage of the maximum possible to provide a rating of its language sensitivity.

Although four possible scores for each category might suggest four evenly divided ratings of overall language sensitivity, it was ultimately decided that this did not reflect reality and was not face valid. For example, a text or task with only 75 % of the possible total score would not, in reality, be considered to have the highest level of language sensitivity. After many trial calculations, it was decided that a score of 85 % could be considered fully language sensitive. The other ratings, which are not equally distributed, are presented in Table 3[1].

Table 3: Language sensitivity ratings

Language sensitivity rating	Language sensitivity descriptor
0 %–29.99 %	Not language sensitive at all
30 %–59.99 %	Less language sensitive
60 %–84.99 %	More language sensitive
85 %–100 %	Fully language sensitive

These ratings allow statements to be made about the language-sensitive design of the textbook, which can be found in the results section.

4 Results

The results of the textbook analysis are presented below. Each category is analysed separately, and the overall language sensitivity of the texts and tasks are then presented.

4.1 Results at the Word Level

At the word level, there were six categories in which both texts and tasks were analysed and one category for tasks only.

4.1.1 Precision and Appropriateness of Word Usage

In this category, the texts and tasks were analysed according to whether they contained clear, precise word use that was appropriate for the target group and the context. Words were considered inappropriate only in the texts or tasks in which they appeared for the first time in the book and were not explained (see Table 4).

1 It was difficult to define the boundaries for the language sensitivity ratings because there was no information in the literature searched. The limits of lowest and highest ratings were simpler because the former naturally starts at 0% and the latter ends at 100%, but the intermediate limits proved problematic.

Table 4: Frequency distribution for the category 'precision and appropriateness of word usage'

Precision and appropriateness of word usage	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	0	0.00 %	0	0.00 %
1 = low applicability	1	3.33 %	3	12.00 %
2 = moderate applicability	22	73.33 %	5	20.00 %
3 = high applicability	7	23.33 %	17	68.00 %
Total	30	100.00 %	25	100.00 %

Almost one in four of the texts analysed (23.33 %) scored 3 points – these texts contain no inappropriate words and can be described as fully language sensitive in terms of appropriate word use. Most of the texts (73.33 %) scored 2 points, with an average of no more than 0.5 inappropriate words per sentence, and can be described as more language sensitive. Only one text scored 1 point, with an average between 0.5 and 1.0 inappropriate words per sentence and can be described as less language sensitive. None of the analysed texts scored 0 points.

Similarly, none of the tasks scored 0 points, meaning that none contained more than three inappropriate words. Three items (12 %) scored 1 point and contained 2–3 inappropriate words; five (20 %) scored 2 points and contained one inappropriate word, but most – 17 (68 %) – scored 3 points, with no inappropriate words.

In this category, almost all the texts and tasks scored at least 2 points and can therefore be described as more language sensitive. Furthermore, while about 75 % of the texts scored 2 points, about 70 % of the tasks scored 3 points.

4.1.2 Accurate and Sufficient Explanation of Difficult Words

In this category, difficult words were foreign words, technical terms or complex compounds (two or more words are connected to a new word in order express a new meaning) that were newly introduced. Here, too, the target audience and context of use were considered when deciding whether a word was 'difficult'.

Table 5: Frequency distribution for the category 'accurate and sufficient explanation of difficult words'.

Accurate and sufficient explanation of difficult words	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	6	20.00 %	3	12.00 %
1 = low applicability	3	10.00 %	2	8.00 %
2 = moderate applicability	9	30.00 %	2	8.00 %
3 = high applicability	12	40.00 %	18	72.00 %
Total	30	100.00 %	25	100.00 %

The analysis showed that 20 % of the texts in this category were not language sensitive (0 points), i.e., none of the difficult words were explained; 10 % of the texts scored 1 point, with less than half of the difficult words explained; 30 % scored 2 points, with more than half of the difficult words explained but at least one not; and 40 % of the texts were fully language sensitive, with all difficult words appearing for the first time being explained.

For the tasks, most (72 %) scored 3 points, 8 % each scored 1 and 2 points, and 12 % scored 0 points, using the same criteria as for the texts. One reason for the majority of tasks scoring full marks could be that the tasks usually process information already introduced in the texts, so technical terms already clarified did not need to be explained. In this category, most of the texts (70 %) and tasks (80 %) received the two highest scores.

4.1.3 Clear Differentiation of Everyday Vocabulary from Professional Vocabulary

In this category, the texts and tasks were searched for terms that have different meanings in professional language than in everyday language, e.g., in German, the professional word for 'capital allowance' (*Abschreibung*) means 'copying out' in everyday language. The key factor was whether the meanings of terms with the potential for confusion were explicitly stated (see Table 6).

Table 6: Frequency distribution of the category 'clear differentiation of everyday vocabulary from professional vocabulary'

Clear differentiation of everyday vocabulary from professional vocabulary	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	10	33.33 %	1	4.00 %
1 = low applicability	0	0.00 %	0	0.00 %
2 = moderate applicability	1	3.33 %	0	0.00 %
3 = high applicability	19	63.33 %	24	96.00 %
Total	30	100.00 %	25	100.00 %

A third of the texts analysed (33.33 %) scored 0 points and failed to explain ambiguous terms. None of the texts scored 1 point; only one scored 2 points, with most – but not all – potentially confusing terms being explained; and the remainder (63.33 %) scored 3 points, with all necessary technical terms being differentiated. Both the infrequency of such terms and the presence of a glossary with their meanings may have accounted for the majority receiving full points.

For the tasks, only one received 0 points, none scored 1 or 2 points, and almost all (96 %) scored 3 points, with no unexplained ambiguous terms.

4.1.4 References to Functional Words That are Important for Understanding

In this category, clues that draw attention to functional words were analysed. Such words do not convey specific content but make connections between elements of a sentence to help in understanding a problem; they include conjunctions, prepositions and adverbs. Possible clues to these function words could be emphases, explanations or pictures.

Table 7: Frequency distribution in the category 'references to functional words that are important for understanding'

References to functional words that are important for understanding	**Text frequency**		**Task frequency**	
	Absolute	%	Absolute	%
0 = not applicable	30	100.00 %	25	100.00 %
1 = low applicability	0	0.00 %	0	0.00 %
2 = moderate applicability	0	0.00 %	0	0.00 %
3 = high applicability	0	0.00 %	0	0.00 %
Total	30	100.00 %	25	100.00 %

All the texts and tasks scored 0 points. There were no references to functional words in the textbook whatsoever; no bold or coloured print, underlining or other highlighting was used to indicate important functional words, and although there was a lot of highlighting in the book, it was used for substantive terms and not for conjunctions or prepositions. As there were no references to functional words in the book, it was clear that no consideration had been given to whether particular texts or tasks needed them.

4.1.5 Appropriate Number of Newly Introduced Professional Terms

Comprehension problems can be caused by introducing too many new professional terms too quickly, so these should be introduced in a targeted and measured way. In this category, the texts and tasks were analysed for newly introduced and unknown technical terms and foreign words. Previous chapters and pages were reviewed to determine whether a term had already been introduced (see Table 8).

Table 8: Frequency distribution in the category 'appropriate number of newly introduced professional terms'

Appropriate number of newly introduced professional terms	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	8	26.67 %	0	0.00 %
1 = low applicability	5	16.67 %	0	0.00 %
2 = moderate applicability	5	16.67 %	0	0.00 %
3 = high applicability	12	40.00 %	25	100.00 %
Total	30	100.00 %	25	100.00 %

The texts were relatively evenly distributed: 40 % scored 3 points, containing a maximum of two new technical/foreign words; approximately 17 % scored 2 points, with three new technical/foreign words; and the same number scored 1 point, containing four new professional terms. More than a quarter of the texts scored 0 points, with more than four new technical/foreign words.

All the tasks scored 3 points as none contained a subtask with more than one new technical term. Thus, while some of the texts needed improvements in language sensitivity, all the tasks already received the highest scores. An important reason for this is that most of the technical terms addressed in the tasks were already introduced in the texts so that the reader would be familiar with them before starting the tasks.

4.1.6 No Unnecessary Nominalisations

Nominalisations can be unnecessary or superfluous when presenting a context and can make it difficult to understand a task or text. This analysis was more difficult because there are no conventional criteria for objectively rating whether a nominalisation is unnecessary. The coding was thus not strict, and nominalisations were often judged as 'not unnecessary' provided there were not several in a row or in a sentence. Attention was paid to whether a nominalisation could cause confusion for a linguistically weak student, although this was itself somewhat subjective (see Table 9).

Table 9: Frequency distribution in the category 'no unnecessary nominalisations'

No unnecessary nominalisations	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	0	0.00 %	0	0.00 %
1 = low applicability	0	0.00 %	0	0.00 %
2 = moderate applicability	13	43.33 %	4	16.00 %
3 = high applicability	17	56.67 %	21	84.00 %
Total	30	100.00 %	25	100.00 %

The texts were almost evenly distributed between the top two scores, with slightly more than half (56.67 %) scoring 3 points, containing no nominalisations that were considered unnecessary. The remainder (43.33 %) scored 2 points, containing on average no more than one unnecessary nominalisation per sentence.

The tasks were also distributed between the two top scores: 16 % scored 2 points, with at least one subtask containing 1–2 unnecessary nominalisations, but the vast majority (84 %) scored 3 points, with no unnecessary nominalisations. The frequency distributions suggest that the criteria used for the category were inadequately rigorous, given how few nominalisations were considered unnecessary.

4.1.7 Explicit Use of Operators

In this category, only the tasks were analysed to determine whether all the operators in the action prompts were explicitly mentioned. In addition to classical operators, such as 'explain', 'present' and 'calculate', clear W-questions (e.g., 'What do you mean by …?') were also considered explicit clarification if the question clearly explained to the reader what should be done. For example, the question 'What do you mean by a range extension?' would most likely prompt the student to give a description.

Table 10: Frequency distribution in the category 'explicit use of operators'

Explicit use of operators	**Task frequency**	
	Absolute	%
0 = not applicable	1	4.00 %
1 = low applicability	0	0.00 %
2 = moderate applicability	2	8.00 %
3 = high applicability	22	88.00 %
Total	30	100.00 %

Operators such as 'read', 'describe', 'compare' and 'discuss' could be found throughout the textbook, and most of the tasks explicitly stated all required actions, with 88 % scoring 3 points. Two tasks (8 %) scored 2 points because they did not explicitly mention all calls to action. Only one task scored 0 points, but, with few exceptions, the textbook used explicit operators or calls to action.

4.2 Results at the Sentence Level

The results at sentence level all applied to both texts and tasks.

4.2.1 Appropriate Complexity of Sentence Construction

Complex sentences can be created by, for example, inserting partial sentences or by the frequent use of parenthetical expressions. This category focused on insertions, which are

parenthetical expressions or sentences between dashes that are not necessary for correct sentence structure (see Table 11).

Table 11: Frequency distribution in the category 'appropriate complexity of sentence construction'

Appropriate complexity of sentence construction	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	0	0.00 %	0	0.00 %
1 = low applicability	2	6.67 %	0	0.00 %
2 = moderate applicability	1	3.33 %	0	0.00 %
3 = high applicability	27	90.00 %	25	100.00 %
Total	30	100.00 %	25	100.00 %

Most of the texts (90 %) scored 3 points, with a complexity appropriate for the target group – that is, containing a maximum of 0.5 insertions per sentence. Only one text (3.33 %) scored 2 points, with an average of more than 0.5 but no more than 0.75 insertions per sentence, and two (6.67 %) scored 1 point, containing more than 0.75 and no more than one insertion per sentence. No texts scored 0 points, with more than one insertion per sentence on average.

The tasks all had a complexity of sentence construction entirely appropriate for the target group. No tasks were identified that had a subtask (or introductory text, if applicable) with more than two insertions. Overall, the textbook used insertions (parenthetical expressions and phrases between dashes) in a targeted and measured way.

4.2.2 No Unnecessary Subordinate Sentences

Subordinate sentences should be used sparingly, as their overuse can cause comprehension problems. Examples of commonly used subordinate sentences are relative sentences, conditional sentences and concessive sentences (see Table 12).

Table 12: Frequency distribution in the category 'no unnecessary subordinate sentences'

No unnecessary subordinate sentences	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	2	6.67 %	0	0.00 %
1 = low applicability	5	16.67 %	0	0.00 %
2 = moderate applicability	13	43.33 %	0	0.00 %
3 = high applicability	10	33.33 %	25	100.00 %
Total	30	100.00 %	25	100.00 %

The texts were distributed between the four possible scores. A third (33.33 %) scored 3 points, with no more than 0.33 subordinate sentences per sentence on average; 43.33 % scored 2 points, with more than 0.33 but no more than 0.66 subordinate sentences per sentence; five texts (16.67 %) scored 1 point, with more than 0.66 but no more than one subordinate sentence per sentence; and two texts (6.67 %) scored 0 points, with more than one subordinate sentence per sentence. Nevertheless, the majority (about 77 %) received the two highest scores and were therefore at least fairly language sensitive.

All the tasks were scored 3 points; they were all fully language sensitive and avoided the overuse of subordinate sentences, with no tasks containing a subtask (or introductory text) with more than two subordinate sentences.

4.3 Results at the Text Level

At the text level, there was one category for both texts and tasks, two for tasks only and one for texts only.

4.3.1 Suitable Cohesive Agents

Cohesive devices are linguistic tools used to link texts and establish contextual links within a text. The analysis focused on proforms, recurrences, substitutions and connectives and found that they were very common and easy to use. The evaluation itself was not strict and depended only on whether the connection between the sentences, paragraphs or subtasks was obvious. For each text or task, the total number of cohesive devices was divided by the number of sentences or subtasks. As mentioned, cohesive devices are very common, so almost all the texts and tasks scored 3 points (see Table 13).

Table 13: Frequency distribution in the category 'suitable cohesive agents'

Suitable cohesive agents	**Text frequency**		**Task frequency**	
	Absolute	%	Absolute	%
0 = not applicable	0	0.00 %	0	0.00 %
1 = low applicability	0	0.00 %	0	0.00 %
2 = moderate applicability	0	0.00 %	1	4.00 %
3 = high applicability	30	100.00 %	24	96.00 %
Total	30	100.00 %	25	100.00 %

One task scored 2 points, with an average of less than one but at least 0.5 suitable cohesive devices per subtask. All other tasks (96 %) contained, on average, at least one suitable cohesive device per subtask. Overall, in terms of suitable cohesive devices, the textbook can be described as fully language sensitive.

4.3.2 Gradual Introduction of Information

Only texts were analysed to determine whether they introduced too much new information at one time or whether it was introduced gradually. The criteria for the scores were defined in detail, and the assessment of 'new information' was comparatively strict. Where appropriate, unimportant statements were also considered new information because they can also cause confusion (see Table 14).

Table 14: Frequency distribution of the category 'gradual introduction of information'

Gradual introduction of information	**Text frequency**	
	Absolute	%
0 = not applicable	8	26.67 %
1 = low applicability	2	6.67 %
2 = moderate applicability	1	3.33 %
3 = high applicability	19	63.33 %
Total	30	100.00 %

Nearly two-thirds of the texts (63.33 %) scored 3 points, either introducing a maximum of one new piece of information in each sentence or containing a maximum of five sentences with two new pieces of information. Only one text scored 2 points, containing one sentence with three new pieces of information. Two texts (6.67 %) scored 1 point – one containing more than eight sentences with two new pieces of information and the other having one sentence with four new pieces of information. Just over a quarter of the texts (26.67 %) scored 0 points, containing either more than one sentence with at least three new pieces of information or at least one sentence with more than four new pieces of information.

Whether or when a particular piece of information should be considered new and independent is partly subjective, so it was decided that a strict approach should be taken because even statements that eventually turn out to be irrelevant can cause confusion for students with language difficulties. It should be noted that a third of the texts received the lowest two scores.

4.3.3 Providing all Necessary Information to Solve the Task

Only tasks were analysed in this category, in which it was determined whether all the important information, tools and references to materials needed to complete the task were included. It was also decided that this category would have only two possible scores. Although intermediate scores could, with some complexity, be conceptualised, they would not necessarily be useful because the category refers to 'completeness', offering two obvious options: 'complete' or 'not complete' (see Table 15).

Table 15: Frequency distribution in the category 'providing all necessary information to solve the task'

Providing all necessary information to solve the task	Task Frequency	
	absolute	%
0 = not applicable	7	28.00 %
1 = low applicability	0	0.00 %
2 = moderate applicability	0	0.00 %
3 = high applicability	18	72.00 %
Total	25	100.00 %

Most of the tasks (72 %) provided all the important information and hints for solving the task, but 28 % did not and therefore scored 0 points.

4.3.4 Clear and Logical Sequence of Work Steps

The steps of a task should be listed in a sensible and understandable order to avoid ambiguity and excessive demands when working on a task. In this category, only tasks were analysed, and again, it was considered sufficient to use only two scores.

Table 16: Frequency distribution in the category 'clear and logical sequence of work steps'

Clear and logical sequence of work steps	Task frequency	
	Absolute	%
0 = not applicable	0	0.00 %
1 = low applicability	0	0.00 %
2 = moderate applicability	0	0.00 %
3 = high applicability	25	100.00 %
Total	25	100.00 %

All the tasks specified work steps in a meaningful and comprehensible order, which was usually done by numbering the steps. There were also cases in which a single subtask was given, with its relevant information, immediately followed by a processing field. The next subtask would then be given with its associated information and processing field. Tasks with only one step also scored 3 points in this category.

4.4 Results at the Visual Level

At the visual level, there were two categories in which both texts and tasks were analysed.

4.4.1 Visual Highlighting of Important Words and Information

This category looked for visual highlights of important words and information, focusing on headings, note boxes and bold and coloured fonts (see Table 17).

Table 17: Frequency distribution of the category 'visual highlighting of important words and information'

Visual highlighting of important words and information	**Text frequency**		**Task frequency**	
	Absolute	%	Absolute	%
0 = not applicable	2	6.67 %	5	20.00 %
1 = low applicability	4	13.33 %	1	4.00 %
2 = moderate applicability	5	16.67 %	4	16.00 %
3 = high applicability	19	63.33 %	15	60.00 %
Total	30	100.00 %	25	100.00 %

Of the texts, 63.33 % contained, on average, at least one visual highlight per paragraph and scored 3 points; 16.67 % contained at least 0.5 but less than one highlight per paragraph and scored 2 points; and 13.33 % had between 0 and 0.5 highlights per paragraph and scored 1 point. Only two texts scored 0 points and contained no visual highlighting.

Of the tasks, 60 % scored 3 points and contained at least one visual highlight per subtask, and 16 % scored 2 points, with an average of at least 0.5 but less than one highlight per subtask. Only one item scored 1 point, with an average of less than 0.5 highlights per subtask, and 20 % of the tasks scored 0 points, containing no visual highlights.

The textbook was relatively good in its visual highlighting. The majority of the texts (80 %) and tasks (76 %) scored at least 2 points, with 63 % of the texts and 60 % of the tasks scoring 3, which can be considered fully language sensitive in this category.

4.4.2 Clear Differentiation of Information and Content Through Paragraphs and Bulleted Lists

To avoid confusion, excessive demands and demotivation, unrelated content in texts or tasks should be kept clearly separate and related content should be clearly labelled. This analysis looked at whether paragraphs and bulleted lists were used, with no particular attention paid to the number of paragraphs. Only three score criteria were defined because a fourth would not be meaningful, as is explained below (see Table 18).

Table 18: Frequency distribution in the category 'clear differentiation of information and content through paragraphs and bulleted lists'

Clear differentiation of information and content through paragraphs and bulleted lists	Text frequency		Task frequency	
	Absolute	%	Absolute	%
0 = not applicable	1	3.33 %	0	0.00 %
1 = low applicability	0	0.00 %	0	0.00 %
2 = moderate applicability	2	6.67 %	0	0.00 %
3 = high applicability	27	90.00 %	25	100.00 %
Total	30	100.00 %	25	100.00 %

One text was identified that used neither paragraphs nor bulleted lists, although at least one opportunity to do so was identified, and this text scored 0 points. Two texts (6.67 %) scored 2 points and used paragraphs only, although a list of some of the information would have been possible and appropriate. Most of the texts (90 %) scored 3 points; these offered all possible and appropriate methods of visual delimitation, whether that be both, one or neither in each case.

All the tasks analysed scored 3 points using the same criteria as for the texts. Thus, with few exceptions, all texts and tasks used paragraphs and bullets to clearly differentiate content.

4.5 Language Sensitivity of the Texts and Tasks

The extent to which language-sensitive design was achieved in each text or task is shown in Table 19. First, the total number of points a task or text scored in all categories was calculated and then divided by the total number of points possible – 36 for texts (12 categories × 3 points) and 45 for tasks (15 categories × 3 points). This score was then used to determine the language sensitivity rating of the task or text using the scoring key.

None of the analysed texts were at the lowest rating (see Table 19), with a language sensitivity of less than 30 % or 'not at all language sensitive'. Two texts (6.67 %) can be described as 'less language sensitive', with language sensitivity ratings of 50 % and 58 %. Most of the texts (25; 83.33 %) achieved the third rating – 'more language sensitive' – with scores ranging between 60 % and 84.99 %, and only three (10 %) were rated 'fully language sensitive', with scores of 86 %, 89 % and 92 %.

None of the tasks received the lowest two ratings, meaning that everyone had a language sensitivity score of at least 60 %. Of these, 40 % reached the third language sensitivity rating, with scores between 60 % and 84.99 %, and can be described as 'more language sensitive'. The majority of tasks can be described as 'fully language sensitive', with 15 (60 %) having a score of at least 85 %, including four that exceeded 90 %.

Table 19: Distribution of the texts and tasks across the language sensitivity ratings

Language sensitivity rating	Text frequency		Task frequency	
	Absolute	%	Absolute	%
Not at all language sensitive	0	0.00 %	0	0.00 %
Less language sensitive	2	6.67 %	0	0.00 %
More language sensitive	25	83.33 %	10	40.00 %
Fully language sensitive	3	10.00 %	15	60.00 %
Total	30	100.00 %	25	100.00 %

5 Discussion and Conclusion

The majority of the texts and tasks in most of the categories were distributed between the top two scores and tended to have at least some language-sensitive characteristics. However, by looking at the individual categories, one can determine the language levels and categories for which the textbook still needs to be sensitised.

At the word level, two categories stand out with significant deficiencies. For 'accurate and sufficient explanation of difficult words' and 'references to important function words', revisions are needed to both texts and tasks; a significant number of texts were also found to need improvement in the categories 'clear distinction between everyday and technical vocabulary' and 'appropriate number of newly introduced technical terms'.

At the sentence level, the textbook shows linguistic weaknesses in only one category: about a quarter of the texts used subordinate sentences too often. At the text level, a third of the texts should be revised because they introduce too much new information too quickly, and a third of the tasks also deserve revision because they do not provide all the information needed to solve the task. Finally, at the visual level, in some texts and tasks, important words and information are given little or no visual emphasis, such as bold print or reminder boxes.

Overall, none of the tasks and only two of the texts were 'less language-sensitive', with none of the texts or tasks considered 'not at all language-sensitive'. The vast majority of the texts were 'more language sensitive' (83 %), and all the tasks were either 'more' (40 %) or 'fully' language sensitive (60 %). Based on the analysis of the sample, the textbook as a whole can therefore be considered 'more language sensitive'.

Of course, a single textbook analysis does not cover the language sensitivity of the entire vocational school programme nor that of the vocational school format and certainly not the school system as a whole. Furthermore, there are methodological limitations to the analysis. For example, the categories selected do not cover all dimensions and definitions of language sensitivity. Because the textbook is in German, it does not make sense to show text excerpts in this paper to explain the analysis, which represents a weakness in replicability. Nevertheless, this work contributes to language-sensitive textbook analyses and can offer a first point of reference for future analyses and comparisons between textbooks.

The language-sensitivity analysis of one textbook also cannot fully address criticisms of the comprehensibility of German textbooks made by textbook researchers (Schmölzer-Eibinger & Egger, 2012). Textbooks are always written for specific target groups at a specific stage of their education, so differentiation of language sensitivity is also necessary.

Textbooks are a didactic medium and fulfil pedagogical-didactic, social and political functions (Wiater, 2003), which language-sensitive design can support. Pedagogical-didactic functions are those that help and facilitate school learning processes; textbooks can thus represent, structure and control school knowledge in the form of a systematic overview (Wiater, 2003), and by consciously designing textbooks in a language-sensitive way, the internal differentiation of school learning processes can be supported, relieving the burden on teachers. Language is then no longer an obstacle to the transfer of information but rather an aid to learning, and the textbook, as an interpretation of the curriculum and an instrument of curricular control, can take on the task of language promotion and the implicit and explicit language requirements of the curriculum (Vera, 2018).

Social functions, meanwhile, include ensuring equal opportunities in the education system and ensuring basic knowledge and skills in society (Wiater, 2003). Language-sensitive design also considers the linguistic diversity of learners and reduces the information barrier to learning, further supporting equal opportunities in education and sending a political signal that the state values an inclusive society.

The practical implication of this study is that the quality assurance of textbooks should include greater consideration of the heterogeneous backgrounds of the student body (Oleschko & Moraitis, 2012), and, if necessary, language-sensitive quality indicators should be included in the approval process. As textbooks are written for specific groups at a specific stage of education and for a specific subject, the language levels of the target group and its diversity should be taken into account.

Finally, it should be remembered that language sensitivity is not the only quality feature of a 'good' textbook. During the search for a suitable book for the analysis, some teachers stated that they used textbooks only partially, extracting certain texts, graphics or illustrations. Thus, if a textbook is not effective in its didactics and methodology, it will be little used, and no amount of language-sensitive design would benefit students with weak language skills. Linguistic and didactic factors also go hand in hand: a language-sensitive textbook alone is not enough for teaching to be sensitive to language; the instructional design of a lesson also depends on the language sensitivity of the teacher.

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International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010209

VET, Patience and the Wealth of Nations

Susanne Peters & Christine Siemer

Abstract *Behavioral economics describe how preferences, experience, and individual characteristics relate to learning and choices, and therefore determine economic behavior. According to (economic) choice theories, patience is a key driving factor behind economic development as it affects economic behavior, as visible in health, crime, etc. Recent research sets up the relationship between patience and economic developments. It becomes clear that patience is strongly correlated to parameters like years of schooling, innovation, risk preferences and GDP per capita. We are interested in the connection between patience and the investment in initial and continuing vocational education and training (VET) in different European countries. This article examines whether there is a correlation between patience and the investments of the state and companies in vocational education and training (VET) in different European countries. We used a sample of European countries and correlated their values of patience (from the Global Preference Survey) with public investment in vocational training, with firm participation in vocational education and training and with enterprise expenditures on CVET. Our results indicate that there is a relationship between patience and the companies' participation in training.*

Title *VET, Patience and the Wealth of Nations*

Keywords *Patience, Vocational Education and Training, VET, Company Engagement in VET, Europe*

1 Context and Research Approach

The *homo oeconomicus* is the central assumption of political economics: The human being of classical economics is a perfect calculator without emotions because, with constant irrationality, economic theory and policy modelling becomes impossible (Beck, 2014). Therefore, three characteristics determine this conception of mankind: unlimited ratio-

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nality, unlimited willpower and maximizing self-interest. *Behavioral economics* is the attempt to reconcile the human image of economics with the human image of psychology. It analyses psychological motives in people's behavior and tries to show where these are relevant in an economic context. For example, in contrast to traditional economy (where humans act consistent and are oriented towards their personal benefit), in behavioral economics, humans pay attention to the well-being of other people and the suggested future benefits depend on the time of decision. Behavioral economics describe how preferences, experience, and individual characteristics relate to learning and choices – and therefore determine economic behavior. This influence of individual conditions on visible effects can be related to learning theories in educational science: In contrast to behaviorism, where learning is a matter of stimulus-response within a black box, and constructivism, which does not define any truth and relates to the own personal experience (see e.g., Neubert et al. 2001), in social-cognitive learning theory by Bandura (1977) decisions and their emergence are central. Social-cognitive theory can be used when explaining, predicting, and influencing behavior.

Within the discipline of behavioral economics, we find a construct named *patience*, referring to intertemporal choices (effects of a decision will take place in a different time than the decision itself). We use this construct to examine a possible interrelation between patience and education with a special regard to vocational education and training.

According to (economic) choice theories, patience is a key driving factor behind economic development as it affects economic behavior, as visible in health, crime, etc. (e.g., Chabris et al., 2008; Sutter et al., 2013; Courtemanche et al., 2014). For example, Chabris et al. (2008) show that patience is one of the most important variables to explain individual differences in terms of behavior. The authors focus on behaviors that involve an intertemporal tradeoff and therefore should be associated with intertemporal preferences (e.g., smoking, drinking, nutrition, gambling). Patience is a construct of time preference and the research debate calls patience to be the ultimate reason for variations in living standards around the globe and emphasize the crucial role of the so-called "proximate determinants" of development, i.e., the accumulation of physical capital, human capital, and productivity (Dohmen et al., 2016). In other words, the more patient a society is, the higher accumulation of human capital and knowledge is probable. The stocks of these resources differ vastly across countries, as empirical evidence suggests. This observation leads to the research scope of explaining how differences in these stocks arise and how developments of corresponding determinants can be conceptualized (Dohmen et al., 2016). Concepts of path dependency show how characteristics like culture, history, or geography determine economic development.

Dohmen et al. (2016) proved in a first systematic investigation the relationship between patience and economic development. They titled their research "Patience and the wealth of nations" referring to Adam Smith's *Wealth of Nations* (1776/2008) and signaling the importance of patience regarding consumption and savings[1]. They correlate patience with parameters like the countries' years of schooling, with R&D expenditures, innovation indices, risk preferences, and Gross Domestic Product (GDP) per capita. It becomes

1 "Savings" here relate to household savings as well as to gross (public) savings.

clear that patience is strongly correlated to all these mentioned parameters (Dohmen, 2019).

There are studies that indicate that the commitment of companies to continuing education is related to the commitment of companies to initial vocational training (Destatis, 2022). Additionally, Sunde et al. (2021) identify the links between patience and education as a research desiderate. Therefore, we ask: Is there a connection between patience and the investment in initial and continuing vocational education and training (VET) by the state and by companies in different European countries? Referring to the above-mentioned research results of patience, our hypothesis is that the more patient a society (on the country level) is, the more exists a willingness of firms and of the state to invest in apprenticeships. There is research on the costs of initial and continuing VET and their distribution among companies, private individuals and the public sector (e.g., OECD, 2022; Dohmen & Cordes, 2019), but no relation to the construct of patience is existing so far.

2 Methods

This chapter introduces the sample and the methodological approach of this study and provides a secondary analysis of the data sets used. The methodological approach of this article is quantitative. Based on three data sets and with a focus on the guiding research question, the aim is to answer whether there is a possible correlation between the independent variable "patience" and various dependent variables depending on VET-commitment. Therefore, the aim of the methodological approach is to use statistical parameters to show whether there is a demonstrable link between investment in education and patience from the perspective of behavioral economics.

2.1 Data Sets and Sample

The first data set was collected as part of the Global Preference Survey, which aims to determine economic preferences (Falk et al., 2015; 2018; Briq Institute, 2018). The data collection was funded and supported by the European Research Council with ERC Starting Grant No. 209214. For the measurement of the patience index, the sample consists of 76 countries covering all continents, every region within continents and different levels of development (Dohmen et al. 2016; also the following description of the patience data). The median sample size was 1,000 participants per country; in total, preference measures were collected for more than 80,000 participants worldwide. Respondents were selected by probability sampling and interviewed in person or by telephone by professional interviewers. In most countries, the samples are nationally representative of the resident population aged 15 years and older. From this data set, we use the variable *patience*[2] as the independent variable.

2 Example item for the variable patience *„Would you rather receive 160 U.S. dollars today or 201 U.S. dollars in 12 months?" (Falk et al., 2016, p. 14),* see also https://gps.briq-institute.org.

Also, we use a sample of European countries for our research because the European Union (EU) is an economic world region with close economic and political interrelations. Especially regarding education, the vision of the European Education Area (to be achieved by 2025) is supposed to enrich the quality, inclusiveness and digital and green dimension of Member State education systems (European Commission, 2020). We use N=17 representing Austria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Turkey, United Kingdom (due to different availability of data, some countries are not included in all correlations).

The dependent variables result from the data sets of the UOE (UNESCO OECD Eurostat) data collection (Eurostat, 2024a) and from the micro data of the Continuing Vocational Training Survey (CVTS) (Eurostat, 2024b; for a detailed description of the variables, see below). The objective of the UOE data collection on education statistics is to provide internationally comparable data on key aspects of formal education systems, also regarding the cost and type of resources dedicated to education. The CVTS is surveyed in all member states of the European Union with the help of the federal and state statistical offices; in Germany, for example, 14.000 companies took part in the 2020 survey.

2.2 Hypothesis and Analysis

We choose the following dependent variables referring to Busemeyer and Iversen (2011) who use them to analyze youth unemployment, wage bargaining and labor market stratification:

1. PublicExpend: public investment in vocational education and training (public expenditure on initial vocational education and training as a percentage of GDP; Eurostat, 2022a). The data on public investment in vocational education and training comes from the annual UOE (UNESCO OECD Eurostat) data collection (Eurostat, 2024a).
2. TrainSupport: the commitment of companies to vocational training (proportion of companies that offer their employees some form of continuing vocational training; Eurostat, 2022b). The data on companies' involvement in vocational training comes from the micro data of the Continuing Vocational Training Survey (CVTS) (Eurostat, 2024b).
3. ExpenCVT: the commitment of enterprises to continuing vocational training (expenditure by enterprises on continuing training courses; Eurostat, 2022c). The data on companies' involvement in continuing vocational training also comes from the micro data of the Continuing Vocational Training Survey (CVTS) (Eurostat, 2024b).

Thus, our three hypotheses (H1a, H1b, and H1c) are:

H1a-c: There is a statistical correlation between *patience* and (1) *PublicExpend*, (2) *TrainSupport*, and (3) *ExpenCVT*.

To test the above hypotheses, we rely on bivariate and partial correlations when analyzing the data. Our research aims to examine the relationship between patience and PublicExpend, TrainSupport and ExpenCVT.

The data analysis was carried out using the statistical software SPSS version 28. First, the data were checked for normal distribution. Except for TrainSupport, the data follow a normal distribution. Then, we correlated patience with *TrainSupport*, *ExpenCVT* and *PublicExpend*. We used Pearson's parametric method for the normally distributed variables, and Spearman's Rho for the relations that involve TrainSupport (which was not normally distributed). In a further step we used partial correlations under controlling for the effect of the variables that were significant in the bivariate analysis. Again, we chose to conduct a non-parametric analysis when the non-normally distributed variable TrainSupport was involved.

3 Results

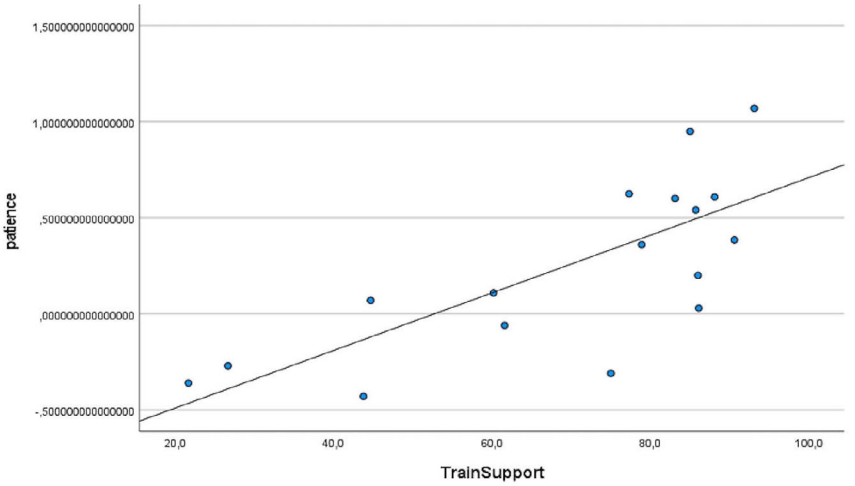
The results of the parametric correlation analysis show that for (1) *PublicExpend*, the relationship is rather moderate (r = .503, p = .005). The result of the non-parametric bivariate correlation analysis shows that there is a strong significant correlation between patience and (2) *TrainSupport*, i.e. the commitment of companies to vocational training that offer their employees some kind of continuing vocational training (rho = .713, p = .001). For (3) *ExpenCVT,* no significant correlation was found (r = .219, p = .399).

Based on the identified correlations between patience and *TrainSupport* as well as patience and *PublicExpend*, the next step was to perform partial correlations between patience and *TrainSupport* as well as patience and *PublicExpend* to rule out possible spurious conclusions by controlling for the effect of a third variable. In contrast to the bivariate analysis, we found that the partial correlation of Patience and *PublicExpend* fails statistical significance when controlling for the influence of TrainSupport on the relation (rho = .301, *p* = .296). Figure 1 displays the relation between patience and TrainSupport.

However, the correlation of patience and *TrainSupport* remains significant, even after accounting for the effect of PublicExpend (rho = .639, *p* = .014). Adding ExpendCVT as a second control variable in the partial correlation analyses does not change the mentioned results.

The key result of the present study, taking into account the three hypotheses, is that a significant strong correlation between patience from the perspective of behavioral economics and the companies' commitment to training (TrainSupport) can be confirmed. While the construct of patience has no effect on public investment in vocational training (PublicExpend) and on the willingness of companies to invest in training courses (ExpenCVT).

Figure 1: Scatterplot of the correlation between patience and TrainSupport



4 Discussion

In social-cognitive learning theory, we construct when problem-solving and choose in the way that we have been shaped and socialized. This leads to individual preferences, and a set of preferences (like within a geographic region) leads to economic developments. Economic developments are responsible for people's income, their employability, and therefore for their well-being. In this context, VET is also important and can contribute to a society's well-being. When merging VET and the idea of patience, we can see a positive correlation for patience and the companies' participation in vocational education and training.

The present quantitative results contribute to closing the research gap identified by Sunde et al. (2021) regarding a possible connection between patience and education. It was found that there is a strong, significant positive correlation between patience and the commitment of companies to offer a form of further vocational training (TrainSupport). Our hypothesis H1b can therefore be confirmed. While hypotheses H1a and H1c were rejected. It can therefore be assumed that public investment in vocational training and the commitment of companies to invest in vocational training by spending on training courses are independent of the patience of the countries studied. In order to be able to make statements about this, more predictors for the patience construct would have to be taken into account in the future in order to be able to interpret this from a behavioral economics perspective for vocational education and training.

Taking hypothesis H1b into account, the results lead to the assumption that the more patient the European countries studied (and thus the societies at country level) are, the greater the commitment of companies to invest in vocational training. This finding leads to the assumption that the companies belonging to the countries studied accumulate the effects of economic developments on their own operational processes and structures and

that, accordingly, the time preference of the decision to invest and spend can be justified by empirical knowledge.

The sample examined shows a certain heterogeneity due to the different countries. As the European countries were analysed as cases, it cannot be assumed that the results of the analysis of the sample examined can be generalized to the population as a whole.

The fact that the patience scale only includes time preference in connection with future-oriented behaviors is critical – particularly with regard to the analysis carried out. In order to determine comprehensively the construct of patience from a behavioral economics perspective for the context of vocational training research, further characteristics would be useful.

The quantitative results presented here help to close the gap in the identification of links between patience and education by demonstrating an empirical link between patience and the willingness to invest in vocational training by the state and companies in various European countries. By this, we only indicate that patience is a determinant to explain investments in VET and CVET. The extent to which an investment in vocational education and training has an effect and also leads to long-term changes in behavior could be the subject of further research.

In summary, what do we can learn from the patience-excursus in VET? Patience-oriented societies foster investment in education. We find proof for companies' commitment offering their employees some form of continuing vocational training and therefore, we could doubt that there is a connection to initial vocational education. Still, there is evidence that firm engagement in CVET is related to engagement in IVET: In Germany, 86.2 % of companies providing IVET also offered CVET in 2020; in companies without initial vocational training, only 64.5 % offered further training (Destatis, 2022). We assume that companies that offer CVET tend to be more committed to education and to the development of human capital due to the determinant of patience.

In conclusion, patience-oriented societies prioritize education, with companies emphasizing continuing vocational training. Companies offering CVET presumably tend to be more education-focused and human capital development-oriented. A lack of resources and insufficient information about training opportunities can be reasons for not investing in education. From an education theory perspective, we can reinforce this result: There are several reasons why patience-oriented societies – and the companies within them – tend to place a strong emphasis on education. First, education is seen as a means to promote social mobility and reduce inequality, as it provides individuals with the opportunity to improve their economic prospects and social status. Second, education is viewed as a means to promote innovation and economic growth, as it helps to develop the human capital needed to drive economic progress, e.g. technological developments, and improve productivity.

5 Limitations and further research

For a critical evaluation of the results, we first want to focus on the construct of patience. The idea of patience is to indicate in how far time preference relates to future-oriented behaviors, resulting for example in economic variables like income. Therefore, we take

a closer look at how the data has been collected. For the determination of the patience value, respondents were asked whether they would prefer to receive 100 euros today or 154 euros in 12 months from now. Following this logic, respondents decided to receive payments now or later within four more questions according to these choice questions. We can see that the patience value is collected via a monetary assessment of the participants. This is a comprehensible approach but does not take into account the monetary stability (or individual's perception of the stability), so to gain precise (inflation-adjusted) patience values, we would have expected to have this factor included in the survey in a direct way.[3] To address this challenge, we could add control variables for inflation and interest rates, but we assume it makes a difference within the questioning already.

There are limitations in the research design such as we use the *individual-level* patience measures and *collective-level* financial (investment; expenditure) measures. Furthermore, a small sample (N=17) leads to the question in how far our results are representative. Though, the data comes from valid and representative statistics/surveys and in this case, a small sample with a significant model is an indicator for an actual relationship between patience and the companies' engagement in training in the population as well. Nevertheless, our approach could be extended and used for a regression with more countries around the world as the Global Preference Survey is available for 76 countries. Following on from the present study, a comparison between the chosen countries can be pursued. In a next step, the nominal-scaled variables could be analyzed to determine the extent to which there are differences between the countries in relation to the existing patience of the sample. Such an approach would allow, on the one hand, to show in which countries the willingness of the state and companies to invest in vocational education and training can be expected to be accompanied by greater patience. Also, private educational expenditures by educational level could be included in a model.

Beyond a continuation of this research approach, we consider further research to be useful, e.g., regarding the question whether educational institutions can change patience. Dohmen (2019) argues that programs that are helping and supporting developing countries would work if they would foster patient behavior, e.g., if institutions create a certain and stable environment. Furthermore, it would be interesting from a vocational and economic pedagogical perspective to analyze the relation of the patience value of European countries and the skills development of employees and the economic returns of companies and countries, taking into account the changed skills requirements to be expected as a result of innovations. Based on a mixed-methods design, the methodological approach chosen here could be expanded in a follow-up study to include qualitative approaches in order to include different macro- or meso-perspectives, such as these of government stakeholders or employers/companies. Recommendations for education policy can then be derived from this further research.

3 In the questionnaire, it reads: "Please assume there is no inflation"; still, this does not include explicitly the expected monetary stability.

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Book Review

International Journal of Vocational Education Studies 2024 Vol. 1/No. 2
https://doi.org/10.14361/ijves-2024-010210

Láscarez Smith, Daniel (2023): Political Participation of Business Organizations in the Construction of the Technical Vocational Education and Training System in Costa Rica between 1980 and 2021

Osnabrueck University: Osnabrueck. https://doi.org/10.48693/410

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In September 2015, the Presidential Council for Innovation and Talent, chaired by the Vice President of the Republic of Costa Rica, decided to develop a National Qualifications Framework for Vocational Education and Training. Since then, the Ministry of Labor and Social Security, the Ministry of Public Education, the National Training Institute (INA), the National Council of Rectors (CONARE), the Union of Costa Rican Chambers and Associations of the Private Business Sector (UCCAEP) and the Union of Rectors of Private Universities (UNIRE) have been working on the development of a dual TVET system. Therefore, Costa Rica receives a great deal of attention, also in terms of scientific debates. Láscarez Smith's study aims to provide an understanding of the organization and development of TVET research in Costa Rica and how the perspective of enterprises and entrepreneurs has been addressed in developing the TVET system. So, it analyzes the specific role of business organizations within the framework of their own subjective configurations and in the context of the historical conditions in which they have developed TVET actions. Therefore, the text rather tries to understand the logic that underlies the participation of certain business groups in the constitution of the TVET system than to scrutinize the participation of companies in training.

The study pursues the research question: How has the organized political action of business groups been configured around the TVET system within the framework of the social, economic, and political transformations in Costa Rica from 1980 to 2021?

The text is organized into 9 chapters, with the first chapter introducing the general framework of the research topic, including its relevance and problematization.

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Chapter 2 is about the literature review conducted for the research topic describing methods and briefly results. Central results of research reports are, for example, that TVET programs in Costa Rica often lack the active involvement of the business sector in training and lack the kind of dedicated vocational upper secondary colleges which can become a focus for technical specialism and excellence.

The third chapter provides a historical background of TVET in Costa Rica, discussing the social, economic, political, and educational structures that have influenced the development from 1821 to 1980. The colonial inheritance leaving a weak technological structure of the labor force at the beginning of the postcolonial period; the export of agricultural products, such as coffee and bananas, the reconfiguration of political forces after the civil war in 1948, and the "entrepreneurs-politicians" who noticed the need of a well-qualified labour force are spotlights of this development.

Chapter 4 focuses on the organization of the education system in Costa Rica; chapter 5 analyses on the structure of Costa Rica's business park, composed of a majority of SMEs. The theoretical framework of the work is presented in chapter 6.

The 7th chapter provides the methodological approach: the text uses a configurationist method, which is a multilevel articulation between structure, subjectivity, and action to analyze the political participation of business associations in the construction of the TVET system in Costa Rica. It examines business political participation within a structural context, the actions taken by business organizations to transform or influence TVET policy, and how these business organizations give meaning to these actions.

The research approach is qualitative. Chambers and business organisations (n=8), TVET institutions (n=3) and experts in TVET of Costa Rica (n=3) were interviewed using semi-structured interviews. Additionally, observations in tripartite sessions of the dialogue table that the Government of Costa Rica implemented to develop the dual apprenticeships were conducted to get to know the arguments, positions, and discussions of both business representatives and the state and unions. The interviews and observations were recorded and transcribed.

Chapter 8 provides the results, clustered in three main parts:

1. the historical-structural configuration including a synthesis of the socio-historical and cultural configuration of entrepreneurial participation in the TVET system;
2. the configuration of the organized political action of the business sector presenting frameworks and institutions that fostered to attract new foreign capital and promote exports and to strengthen the TVET system, such as the Costa Rican Coalition of Development Initiatives (CINDE) and the dual apprenticeship implementation motives and process;
3. and the configuration of the business subjectivity, including the implementation of neoliberal reforms, the role of the private sector in the system, and the impact of these changes on job creation and economic growth. It also highlights the paradox of jobless growth, where economic growth did not result in significant job creation.

The last chapter concludes the work, summarises the main findings and gives an outlook on further research desiderata.

As a main result, readers can comprehend main developments in the TVET system in the era of economic liberalization in Costa Rica during the last decades. The study concludes on critical notes: The political decision-making processes of businessmen around TVET since 1980 should be understood in terms of the economic interests of the transnational sector of the economy, and not in terms of the interests of the domestic economy. This includes that the dual apprenticeships law can be understood more as a subsidy to transnational capital than as a true TVET policy that considers pedagogical and productive aspects. Therefore, Láscarez Smith wraps up that the political participation of businesses around TVET has been subordinated to the economic project as a strategy to supply a certain labor force to transnational companies. This means that TVET has been subordinated to the political project, as it was an opportunity for entrepreneurs to participate in areas in which the state and teachers' unions have historically dominated. The struggle for the approval of the dual apprenticeships law in 2019 and the reform of the INA in 2020 are considered political or economic – not educational – victories for employers.

Another key message is that although theoretically TVET can integrate young people (regarding labor markets, economic and social participation), it has in Costa Rica not been possible to assign a structure and a solid base through the actions and through the transnational subjectivities of entrepreneurs. Establishing a strong line of TVET research in Costa Rica would help to analyze the problems of youth unemployment and its relation to TVET.

Researching the state-of-the-art literature can be particularly helpful in evaluating the relevance of the study's approach: this is the first work (in English) to systematically address the current topic of the introduction of the dual TVET system in Costa Rica, considering historical path dependency and an institutionalist view. Therefore, I regard the work as directive and fundamental research. The strength of the study are its details and synopsis (often summarized in tables) that help readers to capture the key take-aways easily.

While one learns on political participation of TVET institutions, businessmen, public (state) organizations and entrepreneurs regarding the path-dependent processes of reforming and modernizing TVET programs, it would certainly be of interest for vocational pedagogy to explore didactic-pedagogical practices and approaches in greater depth. This includes pedagogical participation of constructing and reproducing entrepreneurial subjectivities in the learning process, as well as in work processes and its analysis. For example, a need for qualified teachers who know the characteristics and specificities of TVET to respond with pedagogical and didactic competencies is in demand (Rommel & Vargas Mendéz, 2023). Also, in current debates it is further argued that jobs remain vacant on the Costa Rican labour market (Maravaille & Gonzalez Pandiella, 2023), that the dual model of training needs to be contextualized and situated (Camacho Calvo, 2023) and that links between the different educational pathways as well as the Costa Rican teacher education require changes (Rommel & Vargas Mendéz, 2023).

Beyond that, however, this scrutiny lacks recommendations in the sense of "what can others learn from the case Costa Rica?" in international comparative VET, also with regard to policy learning. This is also relevant in light of the fact that Costa Rica's vocational

training research is still in its infancy and greater institutionalization is desirable (Rommel et al., 2024).

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