The Digital Competence of Vocational Education Teachers and of Learners With and Without Cognitive Disabilities

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Abstract. Nowadays, digital competence is required for participation in working life, education, and social activities. Vocational education is the key to teaching and development of digital skills. Technology enhanced learning offers enormous potential for improving equal participation and reducing access barriers. In order to meet the demands for equal access to digital technologies, to a digitized labor market and to an inclusive education system, teachers and learners need to have the necessary expertise. A survey was conducted using the Digital Competency Profiler (DCP) to explore the digital competence of teachers and learners in vocational education. The items were adapted linguistically according to requirements for people with cognitive disabilities. The aim is to identify possible gaps in the development of digital competencies in three survey groups: teachers in vocational training, trainees in food occupations, and employees with disabilities of sheltered workshops. The digital technology usage habits of the test groups are analyzed and possible differences are determined. Based on an expert assessment of the DCP items, 13 relevant competencies for vocational education are defined. Overall, the participants consider their digital competence to be good. The competencies sending text messages, making phone calls and watching videos show the highest frequency and confidence in the total sample and the competencies creating documents, writing e-mails and managing online accounts the lowest. The index value social competency is particularly high in comparison to the epistemological competency. Needs for intervention are identified, such as the systematic qualification of teachers and learners as condition for digital learning in vocational education.

Keywords: Digital Competence, Digital Learning, Digital Readiness, Vocational Education, Education for People with Disabilities.

1 Introduction

Technologies are developing rapidly and have become an integral part of our everyday lives. They are leading to a change in activities and competence requirements in professional practice [1]. For example, processes and responsibilities in food professions are becoming increasingly digitalized (e.g. ordering goods, logistics, and service). In 2016, the German Standing Conference of the Ministers of Education and Cultural Affairs presented a strategy entitled "Education in the Digital World" for the education and vocational training sectors [2]. Pedagogical concepts, the adaptation of curricula, and the reorganization of teacher training are now to be implemented independently by schools and vocational schools. Based on this strategy, the German government adopted the DigitalPakt Schule (literally: Digital Pact School) in 2019 with the aims of improving digital equipment in schools and teaching digital skills in educational institutions [3]. Reasons for the limited use of digital media in vocational training are: outdated devices or a lack of equipment, technical problems, data privacy, and labor law [4]. Education staff need to have adequate skills for dealing with digital technologies, as well as further training [4]. The increased time needed to become qualified, the transition to digital teaching methods, and the use of appropriate media represent further challenges [5]. Data from Eurostat, the European Union's statistical office, show a lack of digital literacy in terms of computer and internet skills among older people, the unemployed, and the low educated [6]. Even the test results of so-called digital natives [7] are not particularly high in an international comparison of digital competence [8].

Digital competence is an important prerequisite for the shift from analog to digital teaching and learning methods. The European Digital Competence Framework for Citizens (DigComp) was developed as a response to questions about the meaning of digital competence and what kind of skills and acquirements are involved [8]. Ferrari et al. [8] identifies digital competence as a "set of knowledge, skills, attitudes [...] that are required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment." Digital technologies offer different modes of presentation for faster and vivid understanding; enable the active, location-, and time-independent processing of learning content; and promote collaboration and communication in teams [9]. This gives them enormous potential for improving inclusion, equal opportunities, and participation. Barriers can be reduced and opportunities for participation in work life can be increased, especially for disadvantaged groups [10]. Despite the call in Article 9 of the UN Convention on the Rights of Persons with Disabilities (CRPD) for equal access to information and communication technologies and systems, media used by people with disabilities are rarely considered in research [15]. The competent use of digital media, however, is an essential requirement for participation in social and professional life [3]. Digital inequality between social groups regarding the use of technologies contributes to significant advantages and disadvantages in private and professional contexts [11]. Learners with and without cognitive disabilities can benefit from the use of digital teaching methods and assistant technologies. In order to meet the demands for adapting

the education system to the digitized labor market and for creating an inclusive education system, teachers and learners need to have the necessary expertise.

The aim of the present study is to investigate which digital competence skills are required and how these differ in the three groups of respondents: teachers, trainees, and employees of sheltered workshops. The study is based on a sample of teachers and learners in vocational education and training settings. For this purpose, digital competence is assessed using the Digital Competency Profiler (DCP). The online questionnaire is linguistically adapted to the needs of people with cognitive disabilities for a better understanding in that specific target group. In an additional survey, 12 experts evaluate the DCP items in terms of their relevance for the digital competence of teachers and learners in the vocational education field.

2 Literature review

2.1 Test procedures

In order to exploit the potential of digital tools in vocational education and to promote inclusion in the sense of the CRPD, it is necessary to take stock of the learners' existing digital competencies. Only by taking the status quo into account suitable learning tools can be developed. For this reason, an evaluation method was investigated to use in the present study by consulting reviews that refer to existing test procedures [8]; [12]; [13]. After considering their currentness, relevance and scientific characteristics, 20 test procedures were selected for the analysis. To reduce the number, all test procedures were excluded that (1) only address children under 14 years (e.g. Medien-Profis-Test) [13]; (2) address a specific target group (e.g. DigCompEdu for teachers) [14]; (3) are associated with high costs or a high preparation effort, which applies especially to certificates (e.g. ICDL Foundation). Out of the 20 test procedures, 16 were excluded: Medien-Profis-Test, DigCompEdu, IKANOS BAIT, ICDL, IC3, ACTIC, IKANOS Self-Assessment Test, CRISS System, Guagalfino self-assessment tool, Skillage, Digital Competence in the Europass CV, Pathway for employ, NAEP, MediaLitKit, iDCA, Iskills. The following procedures were selected: TILT (technological and informational literacy test) [25], DCP (Digital Competency Profiler) [17], MyDigiSkills [26], DCC (DigCompCheck) [27].

A second analysis was carried out to make a well-founded decision in favor of one of the four test procedures. For this purpose, criteria were established that were composed of the researchers' and target groups' needs, focusing on finding a test procedure with scientific standards for valid statements. Therefore, the test procedures were evaluated on the basis of the criteria *test quality (reliability, validity, objectivity)* according to Moosbrugger and Kelava [16] and *multidimensional acquisition* of digital competence. According to Ferrari [8], digital competence is composed of seven dimensions: information management; collaboration; communication; creation of content; ethics and responsibilities; evaluation and problem solving; technical operation. In addition, a *multilevel assessment* of digital competence is advantageous for the evaluation in order to enable coverage from multiple perspectives. For a valid result, the *orientation towards a framework* as well as the *empirical verification* of the test procedure are

important. Another focus is the economy of the test procedure, i.e. the conservation material resources. For this purpose, the criteria of *digital availability* and the existence of an automatically *generated evaluation profile* were included. Further criteria were created considering the needs of the target group. Accordingly, the criterion consideration of the *vocational training context* was developed. With regard to people with cognitive disabilities *reasonable processing time* (about 20 minutes, based on experience of testing mentally disabled people) and *low barrier*s (e.g. simple wording, graphical presentation) are important. In order to adapt the test procedure precisely to the needs of the target group, the criterion *possibility of customization* of items was included.

In Table 1 the criteria mentioned serve to compare the selected test procedures in the form of a three-stage assessment. The graphical representation shows whether a test procedure fulfills, partially fulfills, or does not fulfill the respective criterion. Thus justifies the choice of the DCP for the present study. The DCP is characterized by digital availability as well as automatic generation of an individual competency profile [17]. Moreover, the DCP captures digital competence at two levels: via confidence of use and frequency of use in terms of the criterion of multilevel measurement of digital competence. The DCP has been empirically tested: Blayone et al. [1] were able to confirm the differentiation ability of the procedure. In contrast, the test quality has not yet been fully verified. Like the other test procedures, the DCP does not cover all of Ferrari's [8] seven dimensions. However, five of the criteria are considered (technical operation, communication, collaboration, informational management, evaluation and problem solving), which is rated as sufficient. In the area of participant needs, the DCP is convincing. The formulation of the items and the processing time can be classified as acceptable. The DCP enables further revision due to increasing international dissemination of the DCP, which led to the customization and translation of the online questionnaire for additional application contexts. This revision is particularly necessary because neither the DCP nor any of the other test procedures is barrier-free (independently applicable for people with disabilities).

Table 1. Secondary analysis for the test procedures TILT, DCP, MyDigiSkills and DCC.

		TILT	DCP	MyDigi Skills	DCC
Researcher need	Test quality (reliability, validity, objectivity)	●	◐	○	●
	Digital availability	○	●	●	●
	Multidimensional acquisition*	◐	◐	◐	◐
	Multilevel assessment **	○	●	○	●
	Generated evaluation profile	○	●	●	●
	Orientation towards a framework	●	●	●	●
	Empirical verification	●	●	○	●
Participant need	Reasonable processing time	●	◐	◐	◐
	Possibility of customization	○	●	○	○
	Low barriers	○	○	○	○
	Vocational training context	○	○	○	○
Assessment:	**criterion fulfilled ●**	**criterion partially fulfilled ◐**		**criterion not fulfilled ○**	

*Notes: *according to Ferrari's seven dimensions [8]; **refers to the methodology of the item formation*

Likewise, the context of vocational training is not considered in any of the test procedures. In summary, the DCP is an economical test procedure that conserves time, financial and material resources. The presentation of the results in a personal profile allows quick evaluation and interpretation. The division into four dimensions (technical, social, informational and epistemological competency) and the comparison with relevant groups demonstrably enables a differentiated assessment of digital competence.

2.2 Digital Competence Profiler

The Digital Competency Profiler (DCP) is an online tool for the self-assessment of digital competence. It was developed at the Educational Informatics Lab (EILab) of the University of Ontario for the purpose of assessing the digital competencies of students and teachers to evaluate their readiness for fully online learning [1]. The assessment can be used to identify possible gaps in the development of digital skills to derive necessary steps for digital education and to determine whether groups of people are underrepresented in the area of digital competence [17]. The DCP is based on the General Technology Competency and Use (GTCU) Framework [18]; [19]. As shown in Figure 1, this framework draws on the IEEE definition of computer hardware "physical equipment used to process, store, or transmit computer programs or data" to define three orders of digital competency [20]. Briefly summarized, the epistemological order ("process") describes the application of computers and programs for efficient problem solving; the informational order ("store") summarizes the search for, interaction with and application of information; and the social order ("transmit") covers technology-based communication and collaboration [18]. Finally, a fourth dimension was added in the form of the technical order of competency, a prerequisite for successfully operating computer hardware and software [18].

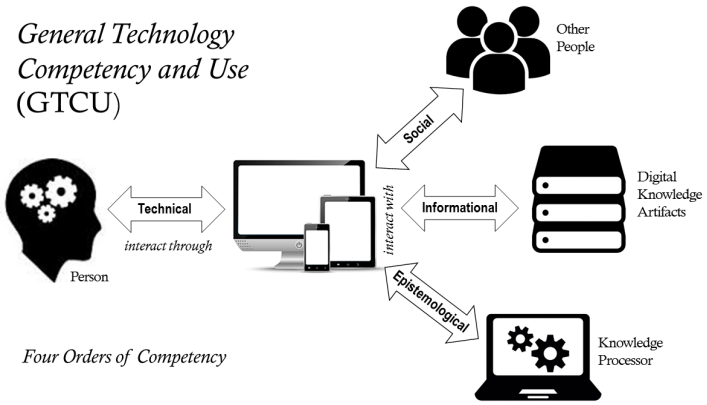

Fig. 1. "Four Orders of Competency" based on IEEE Definition of Computer Hardware [22].

In the DCP, each order of competency is surveyed with activity items (technical: 5 items, all other areas of competency: 7 items). Each item describes an activity (e.g. "To communicate with others using audio") and gives well-known application examples

(e.g. Skype) to support understanding. Participants then specify how often they perform this activity (5-point Likert scale from “never” to “daily”), how confident they feel while performing it (5-point Likert scale from “do not know how to use” to “very confident, can teach others how to use”), and which device they most often use (computer, mobile device, or another device). At the end of the survey, an individual competence profile is displayed as an aster plot for the user.

3 Method

3.1 Revision

The assessment by the multi-professional expert team (psychologist, designer, pedagogue, trainer) revealed that many DCP items are not understandable for the specific target group. The aim was to adapt the questionnaire to make it understandable for people with cognitive impairments and with different levels of knowledge of the technical terms. Therefore, each of the 26 items was reviewed by the team and adapted to ensure understandable language without changing the content of the item (see Table 2).

Table 2. Overview of the 26 DCP items in the adapted version in understandable language.

Label	Adapted item
Q1: Creating documents	I create or edit electronic documents. I write texts on the computer, e.g. letters, stories, tables or slides.
Q2: Creating audio recordings	I create or edit audio recordings. I record or modify voice messages e.g..
Q3: Creating photos and videos	I take photos or videos. E.g. with my smartphone or my digital camera. Partly I also edit media.
Q4: Managing online accounts	I manage my accounts online. I have created an account on the internet on my own, e.g. for e-mail, Amazon, Netflix or Spotify, and I can change my settings there.
Q5: Operating devices	I can operate other devices with my smartphone or computer. I can use my smartphone e.g. to turn the lights or TV on and off, raise and lower the blinds, operate the music system or adjust the heating.
Q6: Sending text messages	I write text messages with my smartphone or computer. E.g. via Whatsapp, Telegram or SMS.
Q7: Making phone calls	I talk on the phone with others. For this I use e.g. my mobile phone, Whatsapp or Telegram.
Q8: Making video calls	I use videophony. E.g. via Skype, Zoom, Facetime or Whatsapp.
Q9: Writing e-mails	I write e-mails.
Q10: Using social media	I use social networks (social media). I am on Facebook, Instagram, Snapchat, TikTok or Twitter e.g..
Q11: Sharing documents	I share documents or work with others on shared documents. I upload texts for friends or colleagues, e.g. via Google Drive, Nextcloud or Dropbox.
Q12: Publishing content	I share my pictures, videos or texts on the internet. I upload my photos to Facebook e.g..
Q13: Using digital maps	I use digital maps or GPS. I search for my way with my mobile phone or my navigation system e.g..
Q14: Reading articles	I search and read news or articles on the internet. E.g. about sports, movies, fashion or science.
Q15: Watching videos	I search and watch videos on the internet. E.g. via YouTube, Vimeo or TikTok.
Q16: Streaming movies	I search, download or stream movies on the internet. I watch movies on Netflix, Amazon, or Sky e.g..
Q17: Streaming music	I search, download or stream music on the internet. I listen to music via Spotify, iTunes or Youtube e.g..
Q18: Streaming (audio) books	I search, download, or stream books or audiobooks on the internet. I read books or listen to stories via Audible or Spotify e.g..
Q19: Managing aggregator	I use an aggregator to collect and organize digital media content (e.g. movies, music, news). An aggregator can be Twitter or an RSS feed.
Q20: Managing calendar	I enter my appointments in a calendar or share them with others. I use the calendar on my phone (Google Calendar, Microsoft Outlook or iCal).
Q21: Creating graphics	I create graphical representations of relationships, processes and structures. I make an overview of my thoughts on the computer with a mind map e.g..
Q22: Creating plans	I create and use plans. E.g. on the computer with planning software for course preparation or for room and architectural planning.
Q23: Sorting data sets	I create and fill tables for sorting large amounts of data. Data sets are many numbers and names that can be sorted by categories e.g..
Q24: Creating diagrams	I create diagrams. Diagrams are charts of numbers, e.g. pie charts or bar charts.
Q25: Performing calculations	I make difficult calculations. I use formulas in Excel or Numbers e.g..
Q26: Programming	I program by myself. I can program devices or develop my own programs, apps or games with programming languages e.g..

Notes: The English translation of the adapted items in German has not been verified.

In the new version, an item consists of a short and concise main statement and an additional description with a common example of use. In addition to the version in understandable language, that can be completed by everyone, a test administrator offered additional help if necessary. Understandable language includes simple terms and short sentences and provides a better understanding for all without the need to follow specific rules. In contrast, "Leichte Sprache" (literally: easy language) is optimally suited for the target group of people with cognitive impairments in Germany, but also requires language rules, spelling rules, and recommendations on typography. The revision of the items was done by the multi-professional team. The first version was tested in a pretest by two subjects with intellectual disabilities and little reading competence. Based on the analysis of the feedback, the questionnaire was adapted again and finalized by the team in close consultation with the EILab.

3.2 Data collection

The study consists of two independent testings (see Fig. 2). The first testing took place with trainees, employees and teachers. Two separate online questionnaires were to be completed by the subjects via laptop, tablet, or mobile phone. They received a link and had to answer the demographic data questionnaire first and then the adapted DCP questionnaire. The demographic questionnaire contained questions on: survey group, gender, age, highest level of education, work experience, digital technologies in the environment (information on ownership and intended use of equipment), daily use of digital technologies, use of internet at home, and use of mobile data. The duration of the test was approximately 30 to 60 minutes. A test administrator was available at the testing session in the sheltered workshop and in the vocational school to explain the procedure, help with questions and problems, and read out the items and answer options when necessary. A total of 30 demographic data questionnaires were completed and only 26 DCP questionnaires. Datasets were excluded if only one of both questionnaires was completed and if there were empty datasets or test runs. After matching both questionnaires to one participant each, 25 datasets were included in the following analysis.

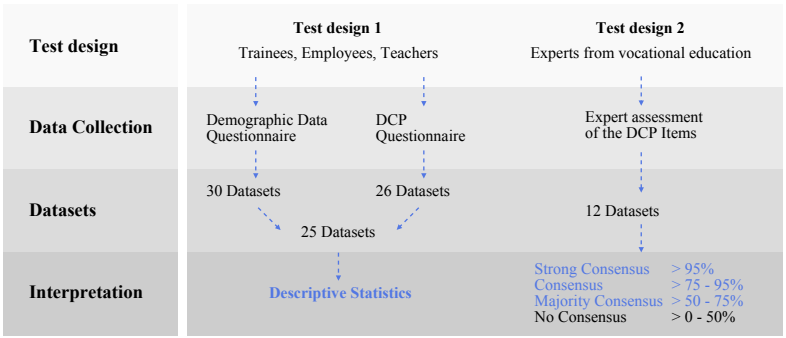

Fig. 2. Test design of the study.

The aim of the second testing was to have experts from vocational education and research rate the items of the DCP according to how relevant they considered these items

to be for digital competence in the target group of teachers and learners in vocational education [21]. A total of 12 participants completed the online questionnaire. Each of the 26 DCP items could be rated as relevant or not. The items selected with more than 50% consensus are interpreted as relevant to digital competence and will be included in the further analysis. The consensus of the 12 experts was classified as follows: above 95% (12 out of 12 experts) strong consensus; above 75% to 95% (10-11 out of 12 experts) consensus; above 50% to 75% (7-9 out of 12 experts) majority consensus; 0% to 50% (0-6 out of 12 experts) no consensus. All data sets from the first and second testing were exported for further analysis using the statistics and analysis software SPSS.

4 Results

4.1 Survey groups

A total of 25 participants (11 female and 14 male) took part in the testing with the DCP and the demographic data questionnaire. The subjects can be divided into three survey groups (see Fig. 3). The first group includes nine trainees (3 female and 6 male) who are currently undertaking vocational training in food occupations. The participants of the second group are 12 employees (6 female and 6 male) in the kitchen area of sheltered workshops. The third group includes four teachers (2 female and 2 male) in vocational education. Most of the trainees are under 20 years old (M=18.9; SD=1.17), while the employees have an age range from under 20 up to over 40 years (M=25.3; SD=11.44). All teachers are older than 40 years (M=58.5; SD=1.73). Eleven participants (44%) did not graduate from school or attended a special school, eight (32%) attended a secondary school, and two (8%) passed the Abitur (German school leaving certificate). Three teachers (12%) have a university degree and one teacher has a (4%) master's certificate. Ten subjects (40%) have no work experience, seven (28%) up to one year, three persons (12%) up to five years, and five (20%) over five years. All four teachers have more than five years of professional experience.

Fig. 3. Bar chart of the three survey groups of the sample with N=25 divided by age group.

The devices that most subjects own themselves are smartphone (96%), computer (72%), game console (48%), smart TV (48%), and tablet (32%). Devices that neither

the participants nor the company or school own include smart home devices (40%), voice assistants (40%), eBook readers (36%), VR or AR glasses (32%), and smartwatches (32%). On average, the subjects use digital technologies for five hours a day (*M*=4.96; *SD*=2.99). Trainees (*M*=5.22; *SD*=2.11) and employees (*M*=5.58; *SD*=3.58) use the technologies about three hours longer a day than teachers (*M*=2.50; *SD*=1.73). Almost all test persons have internet access at home (92%) and use mobile data (96%).

4.2 Expert survey

As Table 3 indicates, the 12 experts from vocational education and research rated the following 13 items of the DCP as relevant for digital competence in the target group of teachers and learners in vocational education: *Creating documents* (Q1), *Creating photos and movies* (Q3), *Managing online accounts* (Q4), *Sending text messages* (Q6), *Making phone calls* (Q7), *Making video telephony* (Q8), *Writing e-mails* (Q9), *Using social media* (Q10), *Using digital maps* (Q13), *Reading articles* (Q14), *Watching videos* (Q15), *Streaming movies* (Q16), and *Managing calendar* (Q20).

In the expert survey four items received majority consensus (Q4, Q10, Q13, Q16), eight items consensus (Q1, Q3, Q7, Q8, Q9, Q14, Q15, Q20), and only one item strong consensus (Q6). In the dimension of epistemological competency, only the item Q20 was selected from the original seven items. In the dimension of technical competency, three out of five items were considered relevant, in the dimension of social competency five out of seven, and in the dimension of informational competency four out of seven.

Table 3. Classification of the 26 DCP items (Q1-Q26) in relation to the consensus.

Dimension	**Items**						
Technical Competency	Q1	Q2	Q3	Q4	Q5		
Social Competency	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Informational Competency	Q13	Q14	Q15	Q16	Q17	Q18	Q19
Epistemological Competency	Q20	Q21	Q22	Q23	Q24	Q25	Q26

Strong Consensus	**Consensus**	**Majority Consensus**	**No Consensus**
Over 95 %	Over 75-95 %	Over 50-75 %	0-50 %

4.3 Frequency and confidence

The frequency and confidence of the 13 items selected by the experts were analyzed (see Table 4). On average, respondents communicate most of all several times a week via text messages (*M*=3.44; *SD*=1.16) and telephone calls (*M*=3.08; *SD*=0.95). 84% use text messages and 76% make phone calls daily to weekly. Participants watch videos several times a week (*M*=3.04; *SD*=0.98), with 80% watching weekly to daily. Social media is used a few times a week (*M*=2.88; *SD*=1.56). 72% use social media daily to weekly. A few times a month, the test persons create photos and videos (*M*=2.48; *SD*=1.16), read articles (*M*=2.24; *SD*=1.62), manage online accounts (*M*=1.84, *SD*=1.52) as well as their calendar (*M*=1.76; *SD*=1.42), and make video calls (*M*=1.72; *SD*=1.28). Only a few times a month do the subjects stream movies (*M*=1.56; *SD*=1.61) and use digital cards (*M*=1.56; *SD*=1.33). The least often, documents are created (*M*=1.16; *SD*=1.55) and e-mails are written (*M*=1.16; *SD*=1.43), with an average use of a few times a year. 56% of the respondents never create digital documents and 48% never write e-mails.

Table 4. Descriptive statistics of the 13 relevant items for frequency and confidence with *N*=25.

Items	M frequency	SD frequency	M confidence	SD confidence
Creating documents	**1.16**	1.55	**1.96**	1.51
Creating photos and videos	2.48	1.16	2.84	0.94
Managing online accounts	1.84	1.52	**2.12**	1.30
Sending text messages	**3.44**	1.16	**3.08**	1.15
Making phone calls	**3.08**	0.95	**3.36**	0.70
Making video calls	1.72	1.28	2.40	1.41
Writing e-mails	**1.16**	1.43	2.36	1.50
Using social media	2.88	1.56	2.64	1.25
Using digital maps	1.56	1.33	2.32	1.35
Reading articles	2.24	1.62	2.60	1.23
Watching videos	3.04	0.98	2.92	1.04
Streaming movies	1.56	1.61	2.16	1.55
Managing calendar	1.76	1.42	2.80	1.12

Notes: N=number; M=mean; SD=standard deviation; Range for frequency: 0=never, 1=few times a year, 2=few times a month, 3=few times a week, 4=daily; Range for confidence: 0=do not know how to use it, 1=not confident, 2=confident, 3=quite confident, 4=very confident.

The calculation of the correlation according to Bravais-Pearson showed a significant positive correlation between the frequency and the confidence for 12 of the 13 items with a medium to strong effect according to Cohen [23]. For all items except *Creating photos and videos*, it is true that the more confident a person is, the more often the action is carried out (and vice versa). The three items with the highest frequency also achieve the highest confidence. *Making phone calls* (*M*=3.36; *SD*=0.70), *Sending text messages* (*M*=3.08; *SD*=1.15), and *Watching videos* (*M*=2.92; *SD*=1.04) are performed quite confidently by the respondents. 48% feel very confident in *Making phone calls*, 44% in *Sending text messages*, and 32% in *Watching videos*. The subjects also feel

quite confident when *Creating photos and videos* (*M*=2.84; *SD*=0.94), *Managing the calendar* (*M*=2.80; *SD*=1.12), *Using social media* (*M*=2.64; *SD*=1.25), and *Reading articles* (*M*=2.60; *SD*=1.23). The items with the lowest confidence are *Creating documents* (*M*=1.96; *SD*=1.51), *Managing online accounts* (*M*=2.12; *SD*=1.30), *Streaming movies* (*M*=2.16; *SD*=1.55), *Using digital maps* (*M*=2.32; *SD*=1.35), *Writing e-mails* (*M*=2.36; *SD*=1.50), and *Making video calls* (*M*=2.40; *SD*=1.41). 32% of the respondents do not know how to create documents and 24% how to stream movies. 20% are overwhelmed when writing e-mails, making video calls, and managing online accounts.

There are some bigger differences between the test groups (see Fig. 4). Teachers create documents more often (*M*=2.25; *SD*=1.26) than employees (*M*=0.83; *SD*=1.59) and trainees (*M*=1.11; *SD*=1.54). Employees (*M*=1.17; *SD*=1.47) manage their online accounts a few times a year, trainees (*M*=2.33, *SD*=1.50) a few times a month, and teachers (*M*=2.75; *SD*=0.96) a few times a week. Employees (*M*=0.42, *SD*=0.67) and trainees (*M*=1.33; *SD*=1.50) use e-mails less often than teachers (*M*=3.00; *SD*=1.41). While trainees (*M*=3.33; *SD*=1.32) and employees (*M*=3.08; *SD*=1.51) use social media a few times a week, teachers use it only a few times a year (*M*=1.25; *SD*=1.50). Teachers read articles much more often (*M*=3.50; *SD*=0.58) than trainees (M=2.0; SD=1.58) and employees (*M*=2.0; *SD*=1.76). Trainees (*M*=3.33; *SD*=0.50) and employees (*M*=3.42; *SD*=0.67) watch videos more often than teachers (*M*=1.25; *SD*=0.50). Teachers manage digital calendars more often (*M*=3.25; *SD*=0.55) than trainees (*M*=1.56; *SD*=1.74) and employees (*M*=1.42; *SD*=1.08). Employees rate their confidence in writing e-mails (*M*=1.75; *SD*=1.77) lower than trainees (*M*=2.78; *SD*=1.09) and teachers (*M*=3.25; *SD*=0.50). While trainees (*M*=2.89; *SD*=0.93) and employees (*M*=2.75; *SD*=1.42) feel quite confident in using social media, teachers (*M*=1.75; *SD*=1.26) report lower confidence. Teachers, on the other hand, feel more confident in reading articles (*M*=3.25; *SD*=0.50) than trainees (*M*=2.78; *SD*=0.97) and employees (*M*=2.25; *SD*=1.49).

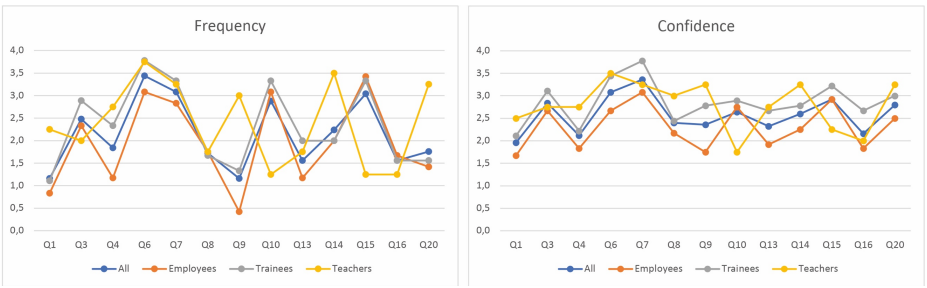

Fig. 4. Line charts of the 13 relevant items (Q1-Q20) for frequency and confidence with *N*=25.

4.4 Index values

The four DCP index values were calculated for each test person: one each for technical (TC), social (SC), informational (IC), and epistemological competency (EC). EC has the lowest mean across all test persons with *M*=1.17 (*SD*=1.13), followed by TC with *M*=2.73 (*SD*=1.81). IC achieved an average of *M*=3.43 (*SD*=2.12) and SC the highest

value with *M*=4.54 (*SD*=2.02). For the index values TC, the trainees have the highest mean in comparison (*M*=3.25; *SD*=1.70), followed by the teachers (*M*=2.72; *SD*=1.13) and then the employees (*M*=2.34; *SD*=2.08). The same applies to the index value SC for the trainees (*M*=5.32; *SD*=1.68), teachers (*M*=4.53; *SD*=0.84), and employees (*M*=3.95; *SD*=2.39). The trainees have the highest IC value (*M*=4.21; *SD*=2.36), followed by the employees (*M*=3.20; *SD*=2.13), and the teachers (*M*=2.38; *SD*=0.99). For EC, the teachers have the highest value (*M*=1.63; *SD*=0.55), followed by the trainees (*M*=1.22; *SD*=1.32), and the employees (*M*=0.97; *SD*=1.16). The index value SC is highest for all test groups and lowest for EC. The t-tests for independent samples did not show any significant differences in arithmetic mean between the three survey groups of employees, trainees, and teachers. They do not differ significantly in their expression of the competence areas TC, SC, IC, and EC.

5 Discussion

5.1 Interpretation

The DCP questionnaires completed by 25 participants from the three test groups of trainees (*N*=9), employees (*N*=12), and teachers (*N*=4) were analyzed and the groups were compared with each other. 12 experts from vocational education and research judged the 26 DCP items regarding their relevance for vocational education. 13 of the original 26 DCP items received over 50% agreement from the experts and were identified as relevant digital competences. The social, informational, and technical competences represent the majority with 12 items. All experts agreed on the item *Sending text messages* to be relevant. The experts rate the use of social media as more relevant than working on shared documents. Reasons could be that the usability of shared platforms and applications is perceived as too high-threshold. In contrast, social media are probably seen as new and exciting tools. Furthermore, photos, videos, and films – in contrast to music and books – are seen as essential for the target group.

Overall, the respondents rate their digital competences as good, feel quite confident to confident in performing the 13 skills, and, with the exception of *Writing e-mails* and *Creating documents*, perform them several times a month or a week. The competences with the highest frequency and confidence in the total sample are the items *Sending text messages*, *Making phone calls,* and *Watching videos*. The item *Creating documents* has the lowest frequency and confidence in the sample. The item *Writing e-mails* also shows a low frequency and *Managing online accounts* a low confidence. Since these competencies have been identified as relevant for vocational education, they should be trained. Exchanges via text messages and phone calls could be preferred to e-mail. Digital and collaborative work methods (Q3, Q4, Q20) are rarely used and have low competency. The items *Sharing Documents, Publishing Content* and *Creating plans* were classified as not relevant by the experts. Although these skills might be essential for the digitization of teaching and education in the future.

For 12 of the 13 items, there was a significant positive correlation between frequency and confidence. Repeating and teaching these skills can therefore lead to an increase in

confidence. There are some differences between the survey groups. Trainees and employees show an affinity for social media and video consumption. Therefore, it can be assumed that formats such as instructional videos and tutorials are more likely to be accepted by learners than working via cooperative learning platforms. Teachers, on the other hand, show higher digital competences in creating documents, writing e-mails, reading articles, and managing calendars. The teachers' skills can be used for providing training in digital working methods. In class, emails could be sent to companies, digital shopping lists could be created, and relevant articles could be searched for and read together. Teachers, meanwhile, should be trained in the creation and use of videos and social media to support learners in their interests.

The index differences show that the social competency (SC) is particularly high in comparison to the epistemological competency (EC) in the sample. EC has the lowest and SC the highest mean across all test persons. For EC, the teachers have the highest value, followed by the trainees, and the employees. For SC, the trainees have the highest mean, followed by the teachers, and then the employees. Overall, the three test groups do not differ significantly in their expression of the competence areas. Creating graphics, plans, diagrams etc. appear to be less the focus of the professional field so far. Social skills seem to be strong in the digital context and can be used for vocational training and digital learning.

The basic prerequisites for teaching digital skills are appropriate technical equipment as well as adequate framework conditions. Teachers use digital technologies for an average of 2.5 hours a day – about three hours less than trainees and employees. The use of them is presumably not yet an integral part of teachers' everyday work. The survey suggests that vocational schools are currently insufficiently equipped with technical devices. Teachers are probably not provided with work equipment and learners with digital learning materials. The aim should be to integrate the teaching and application of digital competences into the vocational education curriculum as a fixed component and to acquire the necessary equipment for this. The digital infrastructure should be further developed to increase the frequency and thus also enable learners and teachers to experience the potential of technology for all areas of life. The design of digital learning applications should be implemented according to needs, taking into account the additional workload of teachers due to the transition. The digital competences of teachers and learners and the technical equipment already available to the majority should be considered.

5.2 Limitations

Limitations result from the specific test group, the DCP test procedure, and the framework conditions of vocational education. The testing was carried out with a small number of participants. The small sample makes it possible to identify initial tendencies and put them up for discussion. For representative results a larger sample is needed. The research has shown that there is currently no ideal questionnaire available with which to assess digital competence in vocational education for people with cognitive impairments. The chosen questionnaire was therefore linguistically adapted to create a version

in understandable language. In the test sessions, however, a test administrator was indispensable, particularly for reading out and explaining the items to the employees of sheltered workshops. Test participants must also be able to differentiate the general frequency with which they perform certain actions and their relative degree of confidence in performing an action on a particular type of device [1]. Making this assessment may not be equally possible for people with cognitive disabilities, and this factor may bias the overall outcome. In addition, digital competences are undergoing constant technical development and therefore need to be regularly updated or supplemented. The results of the DCP are not related to the observed performance of the participants. A combination of survey instrument and observation is costly, but can help to draw reliable conclusions from the test procedure. The adaptation of the DCP items is a first step towards improving usability, but it also does not offer a barrier-free solution.

5.3 Conclusion

This study explores the digital competence of 25 participants from vocational education with and without cognitive disabilities. It uses the linguistically modified DCP test procedure. The aims are to point out possible potential and inabilities, and to identify differences in competencies among the three survey groups of teachers, trainees, and employees of sheltered workshops. Of the original 26 DCP items, 13 were rated by experts as relevant for vocational education. Overall, the participants consider their digital competence to be good. The highest frequency and confidence in the total sample are shown by the items *Sending text messages*, *Making phone calls,* and *Watching videos*. The items *Creating documents*, *Writing e-mails,* and *Managing online accounts* have the lowest frequency and confidence. The index value EC has the lowest and SC the highest mean across all test persons. Differences between the survey groups reveal tendencies that can be observed and used for digital interventions, but the results do not show any significant mean differences between the test groups. Vocational education has the potential to create access to technology enhanced learning with regard to the relevant occupational field. If digital competencies and technologies are integrated into vocational training and the frequency of use increases as a result, confidence in action will also increase [24]. To counteract the multiple challenges, it is necessary to create an appropriate environment for educational institutions, to make digital skills an integral part of the curriculum, and to train teachers on a regular basis. A survey of digital competencies and technical equipment should be used as a baseline for designing user-centered digital interventions and lessons according to the corresponding requirements of the learners. Unfortunately, people with cognitive disabilities have received little or no attention as regards the design of survey instruments for measuring digital competence. Possible adjustments to the DCP for a barrier-free version could include a translation into “Leichte Sprache” (literally: easy language) and illustrated items. Through the systematic training of teachers and learners, the conditions can be created for inclusive learning situations with digital assistance systems and technical support.

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