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Implementation of digital tools in VET: Experienced support and technology acceptance

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Abstract

Among pressures and challenges of the COVID-19 pandemic, progressive digitalisation has resulted in changes in vocational learning environments. Therefore, a well-planned and didactically sensible implementation of digital tools is indispensable. The aim of this article is to discuss how experienced support from teachers/trainers influences trainees' acceptance of digital note-taking apps and video conferencing systems, and what requirements there are for support. These factors were measured based on the technology acceptance model and social support theory using an online questionnaire (mixed methods) of 891 trainees from different training occupations in Germany.

The results show, that 'Support trough instruction/communication/time resources/ organisation' is relevant for the embedding of digital tools at the learning venues schools and workplaces. Experienced support influenced trainees' technology acceptance of the tools. In summary, didactically sensible teaching of basic digital skills ensures progress in the sense of digitalisation and, thus, the future employees of 'Industry 4.0' emerge from 'Vocational Education 4.0'.

Keywords: technology acceptance, digital tools, digital vocational education, experienced support, vocational learning settings

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Introduction

Anchoring digital tools in vocational education and training (VET) is an important means on the path to Industry 4.0, which is characterised by increasing digital networking, automation, flexibilisation, and complexity of business and work processes. Industry 4.0 demands skills on data evaluation and analysis with digital tools, cross-divisional process expertise, and interdisciplinary thinking. According to Bach (2016), future digital skills can only be met if the use of digital tools are established as early as possible in VET (Acatech, 2016; Bach, 2016; Tommasi et al., 2020). The introduction of digital tools has potential to create self-directed and life-long learning, independent of time and workplace (Egloffstein et al., 2012; Jenewein, 2014; Pferdt & Kremer, 2010). To best utilise this potential, a well-planned and didactically supportive implementation in vocational teaching as a pedagogical concept and learning at schools and companies is essential (Cattaneo, 2022). The adaptation of digital tools in VET can be called VET 4.0. In VET 4.0 skills, knowledge and dispositions are to be acquired that prepare trainees for the above-mentioned challenges of Industry 4.0 (Chan, 2012). These are generating/exchanging/organising content and information digitally, using digital tools, integrating prior knowledge, dealing creatively with digital conditions, and also the inner attitude towards technologies (Roll & Ifenthaler, 2020). Successful implementation depends not only on the supply side – technologies offered in VET – but also on the demand side – the involvement of trainees. Implementation can only take place if the needs of trainees in technological education and their self-adaptation are considered and if they are supported in the best possible way from teachers and trainers. To promote the use of digital tools in VET, trainees' technology acceptance needs to be addressed (He et al., 2023).

To have a closer look at the interplay between support provided by teachers/trainers and the development of acceptance, this article examines the influence of support in VET on the technology acceptance on the part of trainees. This assumption is based on the technology acceptance model and social support theory (Berkman et al., 2000; Davis, 1985). Starting point is the question: *How does the support of training and teaching staff, as experienced by trainees, influence the technology acceptance of note-taking apps[1] and video conferencing systems[2] in VET?* To answer this, a survey framed from particularities of the German dual system is used. The system is based on a cooperation between practical training in companies by trainers and theoretical training in vocational schools by teachers (Bartscher et al., 2018). Boundaries between those learning venues have often been identified and addressed in research (Akkerman & Bakker, 2011, 2012; Aprea et al., 2015; Engeström et al., 1995; Kilbrink et al., 2020). Vocational learning should not take place as a transfer of skills/knowledge, but as circular learning between learning locations (Aprea et al., 2015; Sappa et al., 2016).

Different natures of knowledge in school and workplace contexts must be considered. At school, more abstract, formal, and theoretical knowledge is important, whereas in the workplace more implicit, experience-based, and practical application knowledge is required. At school, learning in the workplace should be reflected, in order to promote critical thinking among trainees and create feedback loops (Akkerman & Bakker, 2011; Aprea et al., 2015; Sappa et al., 2016). Digital tools can be used as boundary objects to bridge gaps between learning locations by creating an 'Erfahrraum' ('experiential space') (Aprea et al., 2020; Cattaneo & Aprea, 2018; Schwendimann et al., 2015). In this space, it is possible for trainees to integrate school- and work-based knowledge, a process called integrative competence development (Aprea et al., 2020; Schwendimann et al., 2015).

Furthermore, a geographical gap between vocational schools and companies can make exchanges between teachers and trainees more difficult. The attitude gap is a communication and attitude difference between teachers and trainers. Teachers must take care to communicate all aspects of the curriculum to the trainees and liaise with companies. However, many trainers do not use communication technology in their daily work. There is also a competence gap between teachers and trainers. Teachers and trainers are confronted with different technologies in their day-to-day work and are not always equally able to help the trainees with questions. Also, there are often technological difficulties in using tools at learning locations; some trainees do not have appropriate end devices, or it is not possible to integrate them into the networks. The administrative gap, such as management of platforms/forums, control of content, and the exchange of materials between school and companies, needs to be monitored (Enochsson et al., 2020).

The special requirements of the COVID-19 pandemic have forced stronger implementation of tools in VET, by cancelling training times/opportunities and the shutdown of vocational schools and the shift in theoretical training from face-to-face to online learning. Theoretical training was conducted entirely online with video conferences. In practical training in companies, there was a lack of informal opportunities for exchange, for example about the current status of the trainees among trainers, taking into account hygiene regulations such as distancing regulations and limiting the number of people in rooms (Buschfeld et al., 2020).

Theoretical background

Technology acceptance

To operationalise the term acceptance and its mechanisms of action, this study uses the technology acceptance model, by Davis (1985). In the technology acceptance model, perceived ease of use (PEOU), perceived usefulness (PU), attitude toward using, and behavioural intention generates technology acceptance.[3] PU is '…the degree to which an individual believes that using a particular system would enhance his or her job performance' (Davis, 1985, p. 26) and PEOU '…the degree to which an individual believes that using a particular system would be free of physical and mental effort' (Davis, 1985, p. 26). A tool has a high PU if a trainee believes that the tool supports learning and helps him/her to perform better in VET. A high PEOU value indicates that the trainee experiences freedom from difficulties when using the tool, and that the effort required to use it is low. PEOU influences PU in the technology acceptance model. Attitude towards use originates from the major beliefs of PEOU and PU and refers to the personal attitude of a trainee, towards a digital tool. Behavioural intention, influenced by attitude towards use, is the subjective probability of showing a behaviour (using a tool). This process results in behavioural acceptance, the actual use of tools by trainees (Davis, 1985, 1989; Fishbein & Ajzen, 1975). The technology acceptance model, especially PEOU and PU, is influenced by external variables, such as social factors (Tick, 2018). A sufficient explanatory functionality of the technology acceptance model for development of technology acceptance by external variables, like Image, Subjective Norm, and Enjoyment has been demonstrated in studies such as those of Abdullah et al. (2016) and Venkatesh and Bala (2008). In VET, Alshahrani et al. (2023), Antonietti et al. (2022), and Zarafshani et al. (2020) validated the measurement accuracy of the technology acceptance model. A further development of the technology acceptance model, the 'Unified theory of acceptance and use of technology' by Venkatesh et al. (2003), was validated in VET by Li et al. (2022).

Not only are the influencing factors that affect the technology acceptance model relevant, but also which tools are considered. Jose and Jose (2021) investigated the perceptions of Microsoft Teams[4] by 96 students, measured using the technology acceptance model. A correlation was found between PEOU and PU. In the corporate learning context, Schwind and Yetim (2022) determined the acceptance of the use of Teams with 8 employees. Results showed that attitude and intention to use a system depends on performance, stability, usefulness, user-friendliness, and interaction. Bailey et al. (2022) utilised the technology acceptance model to explain how the use of Zoom[5] influenced the learning outcomes of 321 university students and found that PEOU had a strong influence on PU and the use of Zoom. Monterde et al. (2022), showed that PEOU and PU

significantly predicted students' intentions to use video conferencing applications in an online classroom. In summary, the technology acceptance model as a measurement model for the development of technology acceptance of video conferencing systems has mainly been used in university contexts.

Schlag and Imhof (2017) examined the development of technology acceptance when using note-taking apps. They analysed computer anxiety, job relevance, and the image of Microsoft OneNote, which influences technology acceptance. The more OneNote was rated as a useful tool for learning and teaching, the fewer challenges the test subjects perceived. Petko et al. (2023) investigated a mobile app with the possibility of multimedia note-taking for training. They found that pre-service teachers who used the app together with their mentors showed a similar level of technology acceptance as subjects who used the app exclusively for themselves. Utami et al. (2022), who studied teachers, showed that PU and PEOU do not significantly predict the use of Microsoft software, such as OneNote. The technology acceptance model, as a measurement model for note-taking apps, still raises questions due to the differing results in research. This study aims to contribute to the validation of the technology acceptance model in VET in relation to the tools.

The importance of experienced support for learning in VET

Since the development of technology acceptance is related to external influencing factors, the following sections analyse experienced support in VET contexts in relation to the technology acceptance model. Following Berkman et al.'s (2000) social support theory, experienced support by teaching and training staff could influence digital learning. According to House (1981), support flows between people and can be categorised into informal, emotional, instrumental, and evaluative support. Instrumental support refers to support in problem-solving through concrete help or information teachers/trainers give to trainees in educational settings (Semmer et al., 2008).

According to Billett (2014), learning at the workplace often works through trainees' own construction of knowledge to be learnt through implicit trial and error. Nevertheless, he emphasises the need for guidance from social partners, like trainers, to support the development of knowledge (Billett, 2014). Based on the boundary crossing approach, learning in VET is a circular process between learning venues (Aprea et al., 2015; Sappa et al., 2016). As Schutz (1970) advises, it should not be assumed that connections and synchronisations that trainees make between the knowledge acquired at the learning venues will function optimally. These processes require support and guidance from supervisors like teachers/trainers (Billett, 2014; Schutz, 1970). Furthermore, learning is a social process, even in times of social distancing and online learning during COVID-19. Online learning can complement/replace face-to-face interactions of trainees

with teachers and trainers, but requires constant and individualised support. One example of this is support from a teacher in the event of problems with boundary objects, such as video conferencing systems during online learning. Circular learning processes can only work, if the tools also work (Aprea et al., 2015; Federici & Skaalvik, 2014; Hsiao et al., 2012). The support of teachers and trainers is considered in this paper as part of the teaching process, with a special focus on support dealing with challenges in using digital tools, like issues with handling the apps, internet access and hanging functions/bugs in the apps. The experience of support on the part of trainees is a subjective feeling of receiving help from teachers/trainers (Buunk, 2002). This subjective perception of the trainee is to be measured in this study.

The relationship between experienced support and technology acceptance for learning with digital tools

A study by Weng et al. (2015) showed that social support from superiors has a significant influence on intention to use technology (measured with the technology acceptance model) from employees in training. Masood and Lodhi (2016) also confirmed the influence of experienced support by teachers on students' perceived ease of use (PEOU) and perceived usefulness (PU), regarding SPSS software. The more support the students experienced, the more likely they were to use SPSS. However, the effects found were very small, with social support accounting for 6.3% of the variance of PU and 3.6% of PEOU. The present study examines if the strength of the correlation in VET is different. He et al. (2023) examined the effects of experienced educational and emotional support on technology acceptance and, thus, the intention to use e-learning. They concluded that support has a positive and significant relationship with PEOU and PU. Hsu et al. (2018) also showed that the social support theory and the technology acceptance model are suitable models for investigating intention to use online courses. The learning contexts, such as the above-mentioned studies in higher education, rarely include VET environments. It is difficult to compare VET with those contexts, with its described challenges in Köpsén and Andersson (2018). For example, like the coordination between VET schools, teachers, working life, and the boundary processes. Antonietti et al. (2022), who evaluated the fit of the technology acceptance model in VET through the positive and significant relationship between VET teachers' beliefs and technology acceptance, argued that further investigation of the technology acceptance model in VET would contribute to the validation of the model. As they presented the viewpoint of vocational teachers, this article will present the trainees' side. Weng et al. (2015), in their study on the social influence on the technology acceptance model, also called for further expansion of research to other occupational contexts and systems.

Study approach

Based on the theories outlined above, the present study considers the influence of teachers/trainers on PEOU and PU of the tools by trainees. First, the strength of the correlation with research question 1: *To what extent does the support of training and teaching staff, as experienced by trainees, influence the technology acceptance of note-taking apps[1] and video conferencing systems[2] in VET?* is to be measured. To answer research question 1, hypotheses were formulated. Hypotheses a (1a and 2a) examine the relationship between experienced support and perceived ease of use (PEOU), and b (1b and 2b) the relationship between experienced support and perceived usefulness (PU). Hypothesis 1 deals with the investigation of note-taking apps and hypothesis 2 with video conferencing systems.

- Hypothesis 1a/b: There is a positive relationship between the support, as experienced by trainers/teachers, and the technology acceptance (PEOU (a)/PU (b)) of note-taking apps by trainees.
- Hypothesis 2a/b: There is a positive relationship between the support, as experienced by trainers/teachers, and the technology acceptance (PEOU (a)/PU (b)) of video conferencing systems by trainees.

Figure 1 depicts the hypothesised relationship between experienced support and technology acceptance.

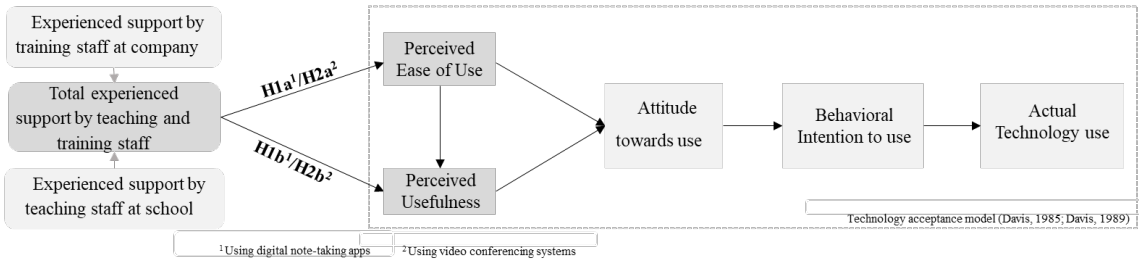

Figure 1. Hypothesised research model.

Research like Masood and Lodhi (2016) is limited to determining the relationship between support and technology acceptance. The present work contributes with knowledge about the strength of the relationship in VET to the boundary objects, video conferencing systems, and note-taking apps. It focusses on the encounter between support of teachers and trainers and the technology acceptance among the addressees of VET, the trainees. In addition, it contributes with knowledge about the specific requirements/needs of trainees for the support of trainees by teachers and trainers by addressing the identified gaps between school and workplace, from a trainees' perspective. According to He et al. (2023), it is

important to consider the needs of students when introducing technologies. Due to the requirements of COVID-19, such as the lack of personal contact between trainees and teachers/trainers, it is nevertheless essential to provide trainees with the best possible support. Therefore, this article aims to investigate research question 2: *What kind of support is perceived by trainees as relevant for learning with note-taking apps and video conferencing systems?*

Methodology and context of the study

The study's data are based on a German digitalisation project in VET, that deals with the use of note-taking apps/video conferencing systems as boundary objects in schools and companies providing training. Teachers, trainers, and trainees were provided with tablets and used the tools over three years (2019–2022). The project was evaluated at the end using a questionnaire for trainees. The aims of the project were to promote the interdisciplinary skill development of trainees, strengthen the individualisation and self-direction of learning, and network the learning location partners in vocational training in line with the requirements of Industry 4.0.

Note-taking apps were used at the learning venues for taking notes of lesson content and training topics before the COVID-19 pandemic in face-to-face teaching and during the pandemic in online learning. The apps were also used to store learning materials by teachers/trainers, and for collaborative and circular learning in learning groups between the trainees, preparation, and follow-up of content and preparation for examinations. Video conferencing systems were used as a substitute for face-to-face classroom teaching in vocational schools/ training groups, for work and feedback in the trainees' learning groups, and for supervision of tests and examinations written online. At the end of the project, various factors such as learning experiences at the dual learning centres, support experienced by teachers/trainers when using the tools and conditions for meaningful use, the acceptance, and usefulness of the tools in VET for learning, were surveyed (Lilge, 2019). Vocational subject content continued to be taught to trainees in online and offline learning environments, such as in digital classes at school or face-to-face at workplaces. Educational content that is taught in the training programmes for the natural sciences includes, for example, basic chemical knowledge of natural sciences, process engineering, health, safety, and so on (Conference of the Ministers of Education and Cultural Affairs, 2018). The primary business subjects were basic computer skills, accounting, and sales (Conference of the Ministers of Education and Cultural Affairs, 2023).

Design

First, a concept questionnaire was developed with the help of teachers/trainers and tested using cognitive interview techniques with trainees from relevant

departments (Döring & Bortz, 2016). The interview techniques used were think-aloud and probing. Think-aloud exercises are suitable for revealing interviewee's mental processes when completing the questionnaire, thus uncovering possible errors. Probing is a non-specific enquiry technique in which suggestions for improvement and errors in the questionnaire are asked after the interview (Prüfer & Rexroth, 2005). After evaluating the interviews, the questionnaire was revised to address weaknesses that had been identified in a questionnaire conference (Döring & Bortz, 2016).

To measure technology acceptance, a 4-point Likert scale of 14 items was developed based on the work of Gorovoj (2019). The trainees were able to rate statements in two questions (separate for note-taking apps and video conferencing systems) using a scale ranging from 'Strongly disagree' to 'Strongly agree'. The items used to measure technology acceptance comprised various statements listed below in Table 1.

Table 1. Survey items 'Technology acceptance'.

Item	Text
a)	Learning with digital note-taking apps/video conferencing systems helps me to better understand how what we learn at school relates to work in the workplace.
b)	Learning with digital note-taking apps/video conferencing systems supports me in adapting the pace and/or scope of learning to my own needs.
c)	Learning with digital note-taking apps/video conferencing systems supports me in organising my own learning process well.
d)	Learning with digital note-taking apps/video conferencing systems helps me to organise exchanges with teachers and/or training staff well.
e)	Learning with digital note-taking apps/video conferencing systems helps me to organise learning together with other trainees well.
f)	Learning with digital note-taking apps/video conferencing systems supports me in acquiring important skills and abilities for my professional practice.
g)	Learning with digital note-taking apps/video conferencing systems is easy for me.
h)	I am familiar with the various functional elements of digital note-taking apps/video conferencing systems.
i)	I have the necessary skills and abilities for learning with digital note-taking apps/video conferencing systems.
j)	I look forward to the areas of my education where digital note-taking apps/video conferencing systems are used.
k)	I limit my learning with digital note-taking apps/video conferencing systems to the bare essentials.
l)	I enjoy learning with digital note-taking apps/video conferencing systems.
m)	Learning with digital note-taking apps/video conferencing systems should be maintained in VET in the future.
n)	Learning with digital note-taking apps/video conferencing systems should be further developed in VET.

After designing the questionnaire, the items of technology acceptance were subjected to an item characteristic analysis (Döring & Bortz, 2016). By testing the characteristics of item variance, discriminatory power, item difficulty and Cronbach's alpha, the inverse coded item k could be excluded.

The four questions to measure experienced support by teaching/training staff, listed below in Table 2, were developed from a five-level single item. Response options were on a scale rang from 'Not well supported at all' to 'Very well supported'.

Table 2. *Survey questions 'Experienced support'.*

Question	Text
1)	How well were you supported by the teachers when learning with note-taking apps?
2)	How well were you supported by the training staff when learning with note-taking apps?
3)	How well were you supported by the teachers when learning with video conferencing systems?
4)	How well were you supported by the training staff when learning with video conferencing systems?

Another two (open) questions in the questionnaire asked the trainees about their wishes/needs for learning, including support, with note-taking apps/video conferencing systems in VET. They were instructed to name their wishes and briefly explain them in the text field. This question will be used to analyse research question 2.

Sampling

The survey was conducted via an online questionnaire and distributed to trainees around December 2021. A total of 1,000 trainees were contacted and a response rate of 89%, 891 trainees (described in Table 3 below), was achieved.

Table 3. Description of trainees' data.

Trainees' data	Numbers	Percentage in sample
Gender		
Male	662	74.3
Female	220	24.7
Diverse	8	0.9
Age range		
15–19 years	406	45.7
20–24 years	396	44.6
25–29 years	78	8.8
30 years and older	8	0.9
Vocational training programme		
Chemical technicians	546	61.28
Chemistry lab technicians	133	14.93
Plant mechanics	73	8.19
Industry mechanics	43	4.83
Physic lab technicians	39	4.38
Industrial trainees	39	4.38
Media trainees	12	1.35
Hotel trainees	3	0.34
Training year		
1st year	391	35.8
2nd year	294	33
3rd year	235	26.4
4th year	30	3.4
Training completed	12	1.3
Total	**891**	**100**

Data analysis

The collected data were evaluated using SPSS. First, using factor loading and a principal component analysis with oblimin rotation, the subscales of the construct of technology acceptance as a criterion were elicited. The scales were named after Davis' (1989) PEOU and PU. PEOU included six standardised items, and subscale PU included seven standardised items for the technology acceptance of note-taking apps. PEOU of video conferencing systems included 11 standardised items and PU two standardised items. Subsequently, the items for factors 1 (perceived ease of use (PEOU)) and 2 (perceived usefulness (PU)) were added together for each kind of tool using a mean value index formation.

The four individual items of the questions about experienced support from teaching staff at vocational schools/training staff at companies were also standardised and evaluated. Afterwards, the items, for each tool separately, were

combined with the help of an equally weighted mean index. This combination was justified because experienced support by both teachers and trainers should be summarised into a simple tangible value, namely the overall experienced support in training.[3] This summary can be justified by the fact that support at the learning venues through the cooperative supervision of trainees by those responsible is only effective if both sides strive for it equally (Federal Institute for Vocational Education and Training, 1997).

To analyse research question 1, a descriptive analysis was carried out for note-taking apps and video conferencing systems tools to test H1a/b and H2a/b. First, quantitative characteristic values were determined for all factors. Then, a regression analysis between experienced support and technology acceptance was conducted. The hypotheses were tested with analysis of variance (ANOVA) tables, with experienced support as predictor of PEOU and PU as criterion.[6] Trainees' data, shown in Table 3, were also analysed as background factors in their influence on technology acceptance using a regression analysis.[6]

To analyse research question 2, the qualitative responses in the open-text field were used. The aim was to derive the trainees' open answers regarding various factors that they considered essential in terms of support from teachers/trainers when using the tools. The answers were inductively divided into different categories. A distinction was made between responses relating to note-taking apps and those relating to video conferencing systems. Then subcategories were formed from the data material, such as 'Training on the tool' and 'Introduction week', which were categorised into superordinate categories such as 'Support trough instruction' (Mayring, 1991; Meier, 2014).

Results

Experienced support and technology acceptance for learning with video conferencing systems and note-taking apps

The following is an overview of the results of the quantitative identification of technology acceptance and a consideration of experienced support by the trainees. First, we present an overview of the evaluation of technology acceptance, the background factors, and experienced support, and then the regression results for research question 1.

An overview of the quantitative evaluation of PEOU and PU for the tools is shown in Table 4.

Table 4. Quantitative results of Technology acceptance (Perceived ease of use (PEOU) and Perceived usefulness (PU)).

	Items (PCA)	***M***	***SD***	***f***
PEOU (Note-taking apps)	6	2.18	0.69	868
PU (Note-taking apps)	7	1.82	0.7	865
PEOU (Video conferencing systems)	11	1.36	0.79	843
PU (Video conferencing systems)	2	2.15	2	854

The one-sample t-test showed that PEOU of note-taking apps and PEOU of video conferencing systems differed significantly ($p < .001$).[6] Cohen's *d* showed a value of 1.194, which indicates a larger effect size (Cohen, 1992). Therefore, PEOU of note-taking apps by trainees was higher than PEOU of the video conferencing systems. Regarding PU for note-taking apps and video conferencing systems, after an evaluation using a t-test, the *M* of 1.82 and 2.15 differed significantly ($p < .001$)[6] from each other. The size of the difference, with a Cohen's *d* of .378, was weaker than that for PEOU of the tools (Cohen, 1992). Thus, PU of video conferencing systems was statistically significantly higher than the value for note-taking apps. The note-taking apps scored slightly lower, with a *M* of 1.82 in PU. Furthermore, the assessment of the technology acceptance of individual tools was gathered for the assessment of experienced support of the teaching/training staff. The results summarised with the equally weighted mean index are shown in Table 5.

Table 5. Quantitative results: Total 'Experienced support' of teaching and training staff.

	Items (mean index)	***M***	***SD***	***f***
Total 'Experienced support' (Note-taking apps)	2	2.3	1.03	844
Total 'Experienced support' (Video conferencing systems)	2	2.15	1	820

The one-sample t-test conducted, showed that total experienced support by teaching/training staff when using note-taking apps differed significantly from the total experienced support when using video conferencing systems ($p < .001$).[6] Cohen's *d* showed a small effect size of .140 (Cohen, 1992).

In the following section, the relationship between total experienced support and technology acceptance is established. To look at the correlations of experienced support with PEOU and PU, the next section uses an ANOVA table to test H1a/b and H2a/b. We argued that experienced support, given by

teaching/training staff to the trainees, affected technology acceptance of note-taking apps and video conferencing systems. Results of the ANOVA tables indicated significant correlations of experienced support from training/teaching staff in VET settings on technology acceptance (PEOU and PU) for trainees for note-taking apps and video conferencing systems. The first hypothesis (H1a/b) suggested a positive relationship between experienced support and PEOU (a) and PU (b) of note-taking apps. These hypotheses are supported: 10% of the variance of the PEOU from note-taking apps can be explained by the experienced support in vocational classrooms ($F(1, 833) = 95.99$, $p < .001$) and 16% of the variance of PU ($F(1, 833) = 160.01$, $p < .001$).[6] The background factors (training year, age, gender, and vocational training programme) were also considered in terms of their influence on PEOU and PU, of note-taking apps. Significant influences of age and training are shown with their effect sizes in Figure 2.[6]

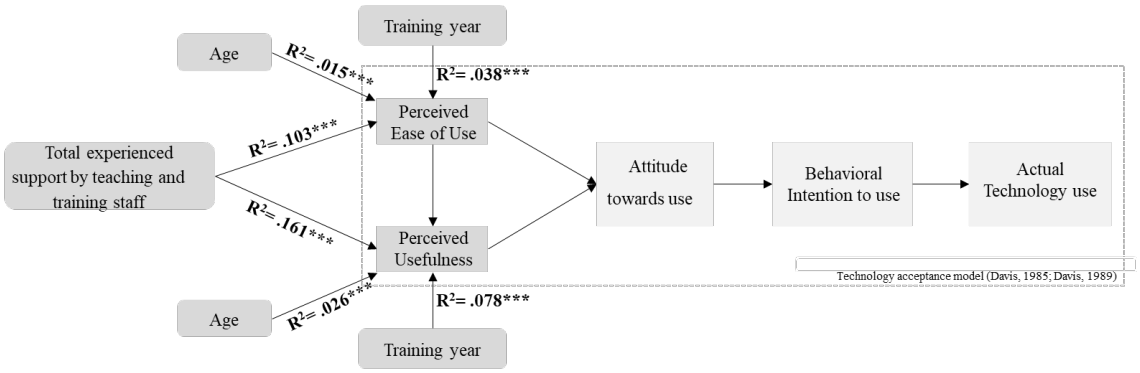

Figure 2. Influence of 'Experienced support' and background factors on 'Technology acceptance' for note-taking apps.

Regarding video conferencing systems, the second hypothesis (H2a/b) proposed a positive relationship between experienced support and PEOU (a) and PU (b) by trainees. Hypotheses H2a and H2b are supported. During the application of video conferencing systems, 21% of the variance of PEOU can be explained by experienced support ($F(1, 803) = 218.33$, $p < .001$) and around 8% of the variance of PU of the tool ($F(1, 811) = 71.63$, $p < .001$).[6] Results of the ANOVA tables of the background factors showed a significant correlation between vocational training programme and PU of video conferencing systems, as shown in Figure 3.[6]

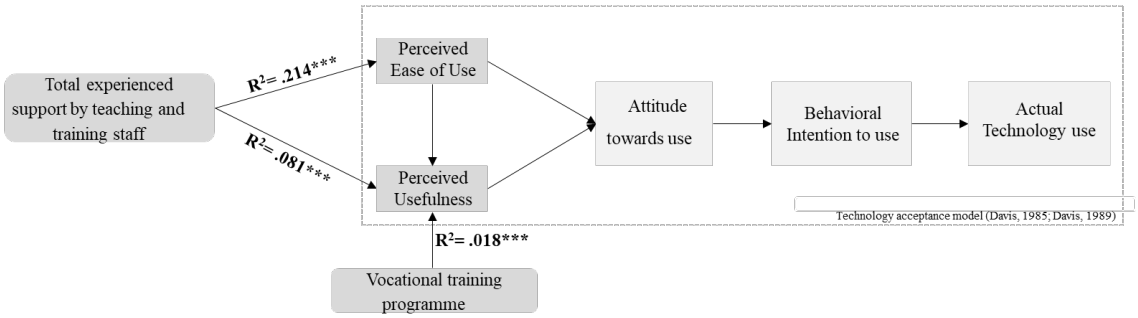

Figure 3. Influence of 'Experienced support' and background factors on 'Technology acceptance' for video conferencing systems.

Trainees' perceived needs for learning with video conferencing systems and note-taking apps

The qualitative answers of the trainees to the open question in the questionnaire about wishes/needs for learning with digital tools, in particular what kind of support from teachers/trainers is important to them when using the digital tools, were inductively categorised according to Mayring (1991).

There were several essential factors regarding support of teachers and trainers that the trainees considered as essential for learning with note-taking apps. The trainees mentioned that 'Support through instruction', such as an introductory week by teachers/trainers, with explanations of the functions of note-taking apps, could improve their use. Training, for example after app updates, was also mentioned, as well as guides to the tool. In category 'Support through communication and empathy', they called for understanding and consideration from teachers/trainers for technical problems. As well as for communication and quick consultation options for open questions about the apps and the improvement of the exchange of trainees about the app through a place of collaboration that is managed by teachers and trainers (shared documentation folder). The consideration of different learning preferences (combination of learning with printed literature and note-taking apps) was also highlighted as important. 'Support through time resources/space' included time that trainees would like to have to explore note-taking apps independently, but also the provision of a contact person for technical questions and allocation of an extra hour in lesson weeks to discuss specific issues with the apps. 'Support through organisation', referring to clear organisation of folder structure in note-taking app by teachers and trainers and provision of suitable worksheets (before the lesson), was requested.

As with note-taking apps, trainees would like 'Support through instruction' through an introductory week about video conferencing systems and training on how to use them spread over the duration of the training programmes. In online

learning, a more detailed explanation of tasks were requested. According to the trainees, 'Support through organisation' helped them to learn by structuring conferences from the outset, ideally with an overview script and a recording of meetings so that they could be viewed afterwards. Regarding learning with video conferencing systems, they also called for 'Support through time resources/ freedoms'. This referred to the time needed to independently explore the systems and understand courses, as well as provision of a specific contact person for technical questions, in addition to teachers and trainers, and the allocation of an extra hour in lesson weeks to discuss specific problems. Another identified need was 'Support through communication and empathy'. This category included the desire for understanding and consideration from teachers/trainers for technical issues, such as connection/sound difficulties in online learning, etc. The trainees also called for teachers and trainers to adapt the lessons to make them more interactive. They mentioned a detailed explanation of tasks in online learning, use of cameras/sound in meetings and incorporation of practical tasks and variety in frontal online lessons through group work in the breakout rooms. They also demanded communication between teachers/trainers and trainees, such as regular meetings to discuss tasks.

Discussion

For the selected boundary objects note-taking apps and video conferencing systems, PEOU and PU differ according to the t-test. The PEOU of the note-taking apps was higher than that of video conferencing systems. These systems were mainly used in online learning formats. It may therefore have been more difficult to fully explain the use of video conferencing systems to trainees after the sudden onset of COVID-19. Note-taking apps also had the advantage of being used in face-to-face lessons, so questions about their use could be clarified more quickly. Such experience-related differences could have led to better PEOU when using apps. They contribute to the digital generation and exchange of content, integration of prior knowledge and digital organisation of information. As boundary objects, note-taking apps therefore contribute to integrative skill development in VET 4.0 (Aprea et al., 2020; Cattaneo & Aprea, 2018; Roll & Ifenthaler, 2020; Schwendimann et al., 2015). Video conferences had a significantly higher PU value than note-taking apps. Although the video conferencing tool was less intuitive to use, it was perceived as more useful. The better results could be because video conferencing systems were used to bridge geographical gaps, such as communication and consultation in vocational learning spaces (Enochsson et al., 2020). According to Davis' definition, '...the use of a particular system would improve his or her job performance' (1985, p. 26). Video conferencing systems may therefore have contributed to the maintenance

of certain learning systems in VET, despite the pandemic. As part of VET 4.0 competences, they enabled the creative use of digital resources, integrating prior knowledge, learning how to use a PC/tablet, and exchanging digital content, for example via chat (Roll & Ifenthaler, 2020).

The results of the ANOVA table tests (H1a/b and H2a/b) are consistent with the studies by He et al. (2023), Masood and Lodhi (2023), and Weng et al. (2015), which also found a statistical correlation between experienced support and PEOU and PU. In this study, experienced support had the strongest influence on the PEOU of video conferencing systems and the least influence on the PU of video conferencing systems. Those respondents with a very positive opinion about experienced support also tended to have a higher technology acceptance. If they have a higher technology acceptance, the inner attitudes towards digital tools changes, which addresses the taxonomy level of interest of Roll and Ifenthaler (2020). Thus, the influence of experienced support and technology acceptance in VET 4.0 skills training is an influencing factor. PEOU and PU are also influenced by the various background factors. PEOU and PU for note-taking apps are also influenced by age of the trainees and their training year. PU of the video conferencing systems can also depend on the vocational training programme. No influence was found for other factors analysed, such as the gender of the trainees. In contrast to Utami et al. (2022), it can be said in the context of this study that the technology acceptance model is a good measurement model for the use of tools such as note-taking apps.

Practical implications for action that can be derived from the results are that the perceived demands of the trainees address the geographical, attitude, competence, adaptive, and the knowledge gap (Akkerman & Bakker, 2011; Aprea et al., 2015; Enochsson et al., 2020; Sappa et al., 2016). The geographical gap and the elimination of face-to-face teaching and instruction can be reduced through online learning with video conferences or through exchanges in special folders on note-taking apps. However, the prerequisite for success is 'Support through instruction'. The need for guidance addressed by Schutz (1970) and Billett (2014) is also experienced by trainees. For connection and synchronisation between the types of knowledge at the learning locations, the trainees must be guided. Circular learning can only work if the tools also work (Billett, 2014; Schutz, 1970). An introduction to the functionalities of the tools, regular training, guidelines, and explanations of tasks are essential for teaching trainees. It should not be forgotten to focus on the needs of individual trainees and not just go to vocational school classes with offers of help when needed. In addition to informational support provided by teaching/training staff, emotional support should not be neglected (House, 1981). The trainees expressed their need for 'Support through communication and empathy', which can help to bridge the attitude gap. They demand mutual understanding and empathy from teachers, trainers, and

trainees for technical problems in video conferences and supporting different learning preferences. In addition, trainees want to feel that they are supported in using tools during the learning phase. An improvement in the exchange between the people involved in the training could create a 'Place of collaboration' that everyone can access or log in to. The 'Place of collaboration' can contribute to boundary crossing, for example to record company experiences and ensure integration and reflection of this knowledge in and with school learning content (Aprea et al., 2015). 'Support through time resources' was also requested. The trainees would like support through the provision of a contact person for technical questions, but also more freedom through time to explore the tools independently. This demand may seem contradictory at first, but it is important to respond to the needs of the individual. It is also important to ask what kind of support they require individually and whether they want to be guided or free to explore the tools. Support in the form of time resources can also be helpful in bridging the attitude gap and skills gap. The provision of an external contact person for technical questions can be helpful for all trainees, trainers, and teachers involved, as well as joint training during the introduction of the tools, in order to bridge a developing skills gap from the outset. Support should be structured from the outset by the demand, according to need (He et al., 2023). There is also the administrative gap that can be bridged with the trainees thoughts on 'Support through organisation'. The trainees addressed here, for example, a clear structure of exchange folders in note-taking apps, which also facilitates the exchange between trainees with teachers and trainers, considering hygiene regulations, by giving all participants access to materials provided by the companies and schools. A clear organisation of the folder structure reduces the administrative effort for teachers/trainers responsible for managing files and facilitates access to relevant documents. The trainees also thematised the exchange via breakout rooms in video conferences with other trainees in the same training year, even if some trainees are currently at school and others at work (Enochsson et al., 2020). As a circular learning process, this exchange can help trainees to link experiences from school and the workplace that are currently present with the experiences of other trainees (Sappa et al., 2016).

Limitations and future research needs

The limitations of the present paper can be seen in its design. Although the questionnaires were tested with the help of pretests, item analysis was only carried out after data collection. Potential confusion of the trainees could have been avoided if the items that were subsequently removed, had already been removed from the Likert scale before the survey. Like the measurement of technology acceptance, the measurement of experienced support should not comprise a single item, but should instead be a scale because otherwise,

measurement errors could occur (Döring & Bortz, 2016). The study cannot distinguish between the actual support provided by teachers and trainers and the individual support experienced by trainees, as the data used for this assessment may have been distorted by the trainees' individual perceptions. Self-reported data do not necessarily reflect actual support given (He et al., 2023; Lin et al., 2015). The quasi-experimental design and the ad hoc sample further limit the validity of the quantitative results. A follow-up test and the additional selection of other training programmes would have improved the validity of the study, especially since an effect of the programme on the PU of video conferencing systems was found (Steiner & Benesch, 2018). In general, it is important to recognise that although the results of the study have confirmed the relationship between experienced support and technology acceptance, for both tools through correlation, future studies could include more background factors and calculate with structural equations. For example, no influence of gender on technology acceptance could be determined here, which could also be due to the unbalanced sample.

Conclusion

In summary, experienced support by trainers/teachers in the use of note-taking apps and video conferencing systems is a possible influencing factor in the development of technology acceptance in VET. Trainees pointed out different types of support that are relevant for learning with the tools, such as 'Support through instruction', 'Support through communication and empathy', 'Support through time resources/freedom', and 'Support through organisation'.

Because of the constant intensive contact of trainees with teachers/trainers, the influence of these persons on the VET target group in the development of technology acceptance is emphasised. It is important for VET 4.0 to consider not only supply sides of learning (schools/workplaces), but also to focus on trainees and their technology acceptance (He et al., 2023). Only if knowledge about how to use digital tools is taught as early as possible during VET, trainees will learn how to use digital tools and their possible applications in a digitally networked industry with its challenges and opportunities. Integration of basic digital skills ensures progress in the sense of digitalisation because the future employees of Industry 4.0 will emerge from VET 4.0.

Endnotes

[1] Note-taking apps considered in the study are the applications OneNote (MS Office) and GoodNotes.
[2] Video conferencing systems considered in the study are the applications MS Teams, BigBlueButton, Zoom, and WebEx.
[3] See Figure 1.
[4] Microsoft Teams is a video conferencing tool from Microsoft. It is manly used for communication in virtual meetings, chatting, and file sharing. (https://www.microsoft.com/de-de/microsoft-teams/group-chat-software).
[5] Zoom is a video conferencing tool from Zoom Video Communication, Inc.. It enables users to have virtual meetings, with chats, screen sharing and other opportunities (https://zoom.us/).
[6] The significance level is $\alpha = .01$, which is the maximum probability of error when rejecting a null hypothesis. The *p*-value is compared to this significance level to see if the results are statistically significant.

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References

Abdullah, F., Ward, R., & Ahmed, E. (2016). Investigating the influence of the most commonly used external variables of TAM on students' Perceived ease of use (PEOU) and Perceived usefulness (PU) of e-portfolios. *Computers in Human Behavior, 63*, 75–90. https://doi.org/10.1016/j.chb.2016.05.014

Acatech. (2016). *Kompetenzen für die Industrie 4.0: Qualifizierungsbedarfe und Lösungsansätze* [Competences for Industry 4.0: Qualification requirements and solution approaches]. Herbert Utz Verlag.

Akkerman, S. F., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research*, *81*(2), 132–169. https://doi.org/10.3102/0034654311404435

Akkerman, S. F., & Bakker, A. (2012). Crossing boundaries between school and work during apprenticeships. *Vocations and Learning*, *5*, 153–173. https://doi.org/10.1007/s12186-011-9073-6

Alshahrani, S. M., Mohamed, H., Mukhtar, M., & Mokhtar U. A. (2023). The adoption of the e-portfolio management system in the Technical and Vocational Training Corporation (TVTC) in Saudi Arabia. *International Journal of Information Management Data Insights*, *3*(1), 1–14. https://doi.org/10.1016/j.jjimei.2022.100148

Antonietti, C., Cattaneo, A. A. P., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior*, *132*(107266), 1–9. https://doi.org/10.1016/j.chb.2022.107266

Aprea, C., Cattaneo, A. A. P., & Sappa, V. (2015). Mind the Gap: Boundary-Crossing an den Übergängen von informellem und formalem Lernen in der beruflichen Bildung [Mind the gap: Boundary-crossing at the transitions between informal and formal learning in vocational education and training]. In G. Niedermair (Ed.), *Informelles Lernen: Annäherungen, Problemlagen, Forschungsbefunde* (pp. 265–276). Trauner Verlag.

Aprea, C., Sappa, V., & Tenberg, R. (2020). An introduction to the special issue. In C. Aprea, V. Sappa, & R. Tenberg (Eds.), *Connectivity and integrative competence development in vocational and professional education and training (VET/PET)* (pp. 13–16). Franz Steiner Verlag.

Bach, A. (2016). Nutzung von digitalen Medien an berufsbildenden Schulen: Notwendigkeit, Rahmenbedingungen, Akzeptanz und Wirkungen [Use of digital media at vocational schools: Necessity, framework conditions, acceptance and effects]. In J. Seifried, S. Seeber, & B. Ziegler (Eds.), *Jahrbuch der berufs- und wirtschaftspädagogischen Forschung 2016* (pp. 107–123). Verlag Babara Budrich. https://doi.org./10.3224/84740588

Bailey, D. R., Almusharraf, N., & Almusharraf, A. (2022). Video conferencing in the e-learning context: Explaining learning outcome with the Technology Acceptance Model. *Education and Information Technologies*, *27*(6), 7679–7698. https://doi.org/10.1007/s10639-022-10949-1

Bartscher, T., Krumme, J. H., Schmid, J., Klenk, J., & Nissen, R. (2018, February 19). *Duale Berufsausbildung* [Dual vocational training]. Gabler Wirtschaftslexikon. https://wirtschaftslexikon.gabler.de/definition/duale-berufsausbildung-34057/version-257572

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, *51*(6), 843–857. https://doi.org/10.1016/S0277-9536(00)00065-4

Billett, S. (2014). Integrating learning experiences across tertiary education and practice settings: A socio-personal account. *Educational Research Review*, *12*, 1–13. https://doi.org/10.1016/j.edurev.2014.01.002

Buschfeld, D., Bylinski, U., Giezek, B., Klös, H. P., Kohlrausch, B., Sloane, P. F. E., & Solga, H. (2020). Auswirkung der Corona-Pandemie auf die berufliche Bildung [Impact of the coronavirus pandemic on vocational training]. *ZBW-Zeitschrift für Berufs- und Wirtschaftspädagogik*, *116*(4), 682–695. https://doi.org/1025162/zbw-2020-0028

Buunk, B. P. (2002). Affiliation, zwischenmenschliche Anziehung und enge Beziehungen [Affiliation, interpersonal attraction and close relationships]. In W. Stroebe, K. Jonas, & M. Hewstone (Eds.), *Sozialpsychologie* (pp. 415–447). Springer. https://doi.org/10.1007/978-3-662-08008-5_12

Cattaneo, A. A. P. (2022). Digitales Lernen: Nutzen wir alle Möglichkeiten? Überlegung zur Integration von Technologien in die Berufsbildung [Digital learning: Are we utilising all the possibilities? Considering the integration of technologies in vocational education and training]. *BWP – Berufsbildung in Wissenschaft und Praxis*, *3*, 8–12.

Cattaneo, A. A. P., & Aprea, C. (2018). Visual technologies to bridge the gap between school and workplace in vocational education. In D. Ifenthaler (Ed.), *Digital workplace learning: Briding formal and informal learning with digital technologies* (pp. 251–270). Springer. https://doi.org/10.1007/978-3-319-46215-8_14

Chan, S. (2021). *Digitally enabling 'learning by doing' in vocational education: Enhancing 'learning as becoming' processes*. Springer. https://doi.org/10.1007/978-981-16-3405-5

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science*, *1*(3), 98–101. https://doi.org/10.1111/1467-8721.ep10768783

Conference of the Ministers of Education and Cultural Affairs. (2018). *Rahmenlehrplan für den Ausbildungsberuf Chemikant/Chemikantin* [Framework curriculum for the training occupation of chemical technician]. https://www.elementare-vielfalt.de/fileadmin/docs/digitalisierung/Chemikant-B2B/Chemikant00-12-01idF_18-02-23-E.pdf

Conference of the Ministers of Education and Cultural Affairs. (2023). *Rahmenlehrplan für den Ausbildungsberuf Industriekaufmann/Industriekauffrau* [Framework curriculum for the training occupation of industrial trainees]. https://www.kmk.org/fileadmin/Dateien/pdf/Bildung/BeruflicheBildung/rlp/Industriekaufleute_2023-12-15-mitEL.pdf

Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* [Doctoral dissertation, Massachusetts Institute of Technology]. https://core.ac.uk/download/pdf/4387241.pdf

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Döring, N., & Bortz, J. (Eds.) (2016). *Forschungsmethoden und Evaluation in den Human- und Sozialwissenschaften* [Research methods and evaluation in the humantities and social sciences] (5th ed.). Springer. https://doi.org/10.1007/978-3-642-41089-5

Egloffstein, M., Kögler, K., & Kärner, T. (2012). Unterrichtserleben in Notebook-Klassen: Eine explorative Studie im kaufmännischen Unterricht [Teaching experience in notebook classes: An exploratory study in commercial classes]. In R. Schulz-Zander, B. Eickelmann, H. Moser, H. Niesyto, & P. Grell (Eds.), *Jahrbuch Medienpädagogik 9* (pp. 223–245). Springer VS. https://doi.org/10.1007/978-3-531-94219-3_11

Engeström, Y., Engeström, R., & Kärkkäinen, M. (1995). Polycontextuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. *Learning and Instruction*, *5*(4), 319–336. https://doi.org/10.1016/0959-4752(95)00021-6

Enochsson, A.-B., Kilbrink, N., Andersén, A., & Ådefors, A. (2020). Connecting school and workplace with digital technology: Teachers' experiences of gaps that can be bridged. *Nordic Journal of Vocational Education and Training*, *10*(1), 43–64. https://doi.org/10.3384/njvet.2242-458X.2010143

Federal Institute for Vocational Education and Training. (1997). *Empfehlung des Hauptausschusses des Bundesinstituts für Berufsbildung zur Kooperation der Lernorte* [Recommendation of the board of the Federal Institute for Vocational Education and Training on cooperation between learning venues]. https://www.bibb.de/dokumente/pdf/HA099.pdf

Federici, R. A., & Skaalvik, E. M. (2014). Students' perception of instrumental support and effort in mathematics: The mediating role of subjective task values. *Social Psychology of Education, 17*(3), 527–540. https://doi.org/10.1007/s11218-014-9264-8

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research.* Addison-Wesley.

Gorovoj, A. (2019). *Technologieakzeptanz Digitaler Medien bei Universitäts-studierenden verschiedener Fächer und Berufstätigen gleichen Alters: Eine Studie zu den psychologischen Determinanten und Hintergründen der Akzeptanz Digitaler Medien auf der Basis eines neu ausgerichteten Messinstruments* [Technology acceptance of digital media among university students of different subjects and professionals of the same age: A study on the psychological determinants and backgrounds of digital media acceptance based on a newly designed measurement instrument] [Doctoral dissertation, University of Siegen]. https://dspace.ub.uni-siegen.de/bitstream/ubsi/1659/4/Dissertation_Alexander_Gorovoj.pdf

He, S., Jiang, S., Zhu, R., & Hu, X. (2023). The influence of educational and emotional support on e-learning acceptance: An integration of social support theory and TAM. *Education and Information Technologies*, *28*, 11145–11165. https://doi.org/10.1007/s10639-023-11648-1

House, J. S. (1981). *Work stress and social support*. Addison-Wesley Publishing Company.

Hsiao, H. C., Tu, Y. L., & Chung, H. N. (2012). Perceived social supports, computer self-efficacy, and computer use among high school students. *The Turkish Online Journal of Educational Technology*, *11*(2), 167–177.

Hsu, J. Y., Chen, C. C., & Ting, P. F. (2018). Understanding MOOC continuance: An empirical examination of social support theory. *Interactive Learning Environments, 26*(8), 1100–1118. https://doi.org/10.1080/10494820.2018.1446990

Jenewein, K. (2014). Digitale Lernsysteme: Potentiale für die berufliche Bildung durch Blended Learning [Digital learning systems: Potential for vocational training trough blended learning]. *lernen & lehren*, *114*(2), 47–53.

Jose, J., & Jose, B. J. (2021). Learners' perception of using Microsoft Teams predicted by technology acceptance model at University of Technology and Applied Sciences, Oman. *Webology*, *18*(6), 21–32.

Kilbrink, N., Enochsson, A.-B., & Söderlind, L. (2020). Digital technology as boundary objects: Teachers' experiences in Swedish vocational education. In C. Aprea, V. Sappa, & R. Tenberg (Eds.), *Connectivity and integrative competence development in vocational and professional education and training (VET/PET)* (pp. 233–251). Franz Steiner Verlag.

Köpsén, S., & Andersson, P. (2018). Boundary processes in connection with students' workplace learning: Potentials for VET teachers' continuing professional development. *Nordic Journal of Vocational Education and Training*, *8*(1), 58–75. https://doi.org/10.3384/njvet.2242-458X.188158

Li, Z., Islam, A. Y. M. A., & Spector, J. M. (2022). Unpacking mobile learning in higher vocational education during the COVID-19 pandemic. *International Journal of Mobile Communications*, *20*(2), 129–149. https://doi.org/10.1504/IJMC.2022.121465

Lilge, V. (2019, November 7). *Bildungsministerium und BASF stärken Digitalisierung in der dualen Ausbildung* [Ministry of Education and BASF strengthen digitalisation in dual vocational training]. BASF. https://www.basf.com/global/de/who-we-are/organization/locations/europe/german-sites/ludwigshafen/the-site/news-and-media/news-releases/2019/11/p-19-383.html

Lin T. C., Hsu, J. S. C., Cheng, H. L., & Chiu, C. M. (2015). Exploring the relationship between receiving and offering online social support: A dual social support model. *Information & Management*, *52*(3), 371–383. https://doi.org/10.1016/j.im.2015.01.003

Masood, A., & Lodhi, R. N. (2016). Determinants of behavioral intentions to use SPSS among students: Application of technology acceptance model (TAM). *FWU Journal of Social Sciences*, *10*(2), 146–157.

Mayring, P. (1991). Qualitative Inhaltsanalyse [Qualitative content analysis]. In U. Flick, E. v. Kardoff, H. Keupp, L. v. Rosenstiel, & S. Wolff (Eds.), *Handbuch qualitative Forschung: Grundlagen, Konzepte, Methoden und Anwendungen* (pp. 209–213). Beltz- Psychologie Verlag Union.

Meier, S. (2014, November 26). *Qualitative Inhaltsanalyse* [Qualitative content analysis]. Forschen im Praxissemester: Überblick, Methoden, Beispiele. https://blogs.uni-paderborn.de/fips/2014/11/26/qualitative-inhaltsanalyse/

Monterde, R. B. H., Ramos, D. B. E., Francisco, K. J. A., & Lim, R. A. (2022). The viability of video conferencing applications in an online classroom through the lens of technology acceptance model. *International Journal of Research in English Education*, *7*(3), 80–89. https://doi.org/10.52547/ijree.7.3.1

Petko, D., Cantieni, A., Schmid, R., Müller, L., Krannich, M., & Michos, K. (2023). Technology acceptance of a mobile portfolio app for teacher education: Pre-service teachers views on multimedia-based note-taking and mentoring in internships. *Journal of Digital Learning in Teacher Education*, *39*(1), 57–71. https://doi.org/10.1080/21532974.2022.2142990

Pferdt, F. G., & Kremer, H. H. (2010). Berufliches Lernen mit Web 2.0: Medien(entwicklungs)kompetenz und berufliche Handlungskompetenz im Duell? [Vocational learning with Web 2.0: Media(development)competence and vocational action competence in a duel?]. In B. Herzig, D. M. Meister, H. Moser, & H. Niesyto (Eds.), *Jahrbuch Medienpädagogik 8 – Medienkompetenz und Web 2.0* (pp. 289–307). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-92135-8_16

Prüfer, P., & Rexroth, M. (2005). *Kognitive Interviews* [Cognitive interviews] *(GESIS-how-to, No. 15)*. Mannheim–Zentrum für Umfragen. https://www.gesis.org/fileadmin/upload/forschung/publikationen/gesis_reihen/howto/How_to15PP_MR.pdf

Roll, M., & Ifenthaler, D. (2020). Competence development across different learning contexts in Industry 4.0-development of multidisciplinary digital competence in dual vocational education from instructor perspective. In C. Aprea, V. Sappa, & R. Tenberg (Eds.), *Connectivity and integrative competence development in vocational and professional education and training (VET/PET)* (pp. 186–209). Franz Steiner Verlag.

Sappa, V., Choy, S., & Aprea, C. (2016). Stakeholders' conceptions of connecting learning at different sites in two national VET systems. *Journal of Vocational Education & Training*, *68*(3), 283–301. https://doi.org/10.1080/13636820.2016.1201845

Schlag, M., & Imhof, M. (2017). Does perceived ease of use mitigate computer anxiety and stimulate self-regulated learning for pre-service teacher students? *International Journal of Higher Education*, *6*(3), 154–168. https://doi.org/10.5430/ijhe.v6n3p154

Schutz, A. (1970). *Alfred Schutz on phenomenology and social relations*. The University of Chicago Press.

Schwendimann, B. A., Cattaneo, A. A. P., Dehler Zufferey, J., Gurtner, J. L., Bétrancourt, M., & Dillenbourg, P. (2015). The 'Erfahrraum': A pedagogical model for designing educational technologies in dual vocational systems. *Journal of Vocational Education & Training*, *67*(3), 367–396. https://doi.org/10.1080/13636820.2015.1061041

Schwind, J., & Yetim, F. (2022). Akzeptanzanalyse von Microsoft Teams als eKollaborationssystem bei standortverteilten und agilen Entwicklungsteams eines mittelständischen Unternehmens [Acceptance analysis of Microsoft Teams as an e-collaboration system for distributed and agile development teams in a medium-sized company]. *HMD-Praxis der Wirtschaftsinformatik*, *59*(4), 1197–1215. https://doi.org/10.1365/s40702-021-00776-2

Semmer, N. K., Elfering, A., Jacobshagen, N., Perrot, T., Beehr, T. A., & Boos, N. (2008). The emotional meaning of instrumental social support. *International Journal of Stress Management, 15*(3), 235–251. https://doi.org/10.1037/1072-5245.15.3.235

Steiner, E., & Benesch, M. (2018). *Der Fragebogen: Von der Forschungsidee zur SPSS-Auswertung* [The questionnaire: From the research idea to SPSS analysis] (5th ed.). Facultas.

Tick, A. (2018, June 21–23). *IT security as a special awareness at the analysis of the digital/e-learning acceptance strategies of the early Z generation* [Conference paper]. 22nd IEEE International Conference on Intelligent Engineering Systems, Las Palmas de Gran Canaria, Spain. https://doi.org/10.1109/INES.2018.8523964

Tommasi, F., Franceschinis, I., Perini, M. & Sartori, R. (2020, June 27–29). *A systematic scoping review on skills variety for VET in the Industry 4.0* [Conference paper]. International Conference on Education and New Developments 2020, Zagreb, Croatia (Online). https://doi.org/10.36315/2020end101

Utami, I. Q., Fahmiyah, I., Ningrum, R. A., Fakhruzzaman, M. N., Pratama, A. I., & Triangga, Y. M. (2022). Teacher's acceptance toward cloud-based learning technology in Covid-19 pandemic era. *Journal of Computers in Education*, 9(4), 571–586. https://doi.org/10.1007/s40692-021-00214-8

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Weng, C., Tsai, C. C., & Weng, A. (2015). Social support as a neglected e-learning motivator affecting trainee's decisions of continuous intentions of usage. *Australasian Journal of Educational Technology*, *31*(2), 177–192. https://doi.org/10.14742/ajet.1311

Zarafshani, K., Solaymani, A., D'Itri, M., Helms, M. M., & Sanjabi, S. (2020). Evaluating technology acceptance in agricultural education in Iran: A study of vocational agriculture teachers. *Social Sciences & Humanities Open*, *2*(1), 1–8. https://doi.org/10.1016/j.ssaho.2020.100041