Development and Validation of a Test to Assess Teachers' Knowledge About Operating Technology (T-TK)

Tim Fütterer[1], Ronja Steinhauser[2], Steffen Zitzmann[1], Katharina Scheiter[1, 2], Andreas Lachner[1], and Kathleen Stürmer[1]

[1] University of Tübingen, Tübingen, Germany

[2] Department of Psychology, Ludwigsburg University of Education, Ludwigsburg, Germany

[3] Multiple Representations Lab, Leibniz-Institut für Wissensmedien, Tübingen, Germany

Author Note

Tim Fütterer https://orcid.org/0000-0001-5399-9557

Ronja Steinhauser https://orcid.org/0000-0001-7118-4386

Steffen Zitzmann https://orcid.org/0000-0002-7595-4736

Katharina Scheiter https://orcid.org/0000-0002-9397-7544

Andreas Lachner https://orcid.org/0000-0001-5866-7164

Kathleen Stürmer https://orcid.org/0000-0001-9916-0589

Correspondence concerning this article should be addressed to Tim Fütterer, Hector Research Institute of Education Sciences and Psychology, University of Tübingen, Europastraße 6, 72072 Tübingen, Germany. Email: tim.fuetterer@uni-tuebingen.de

Acknowledgements

Data collection was supported by funds from the Dr. Hans Riegel Foundation, Bonn, Germany.

Funded by the Federal Ministry of Education and Research (BMBF) and the Baden-Württemberg Ministry of Science as part of the Excellence Strategy of the German Federal and State Governments

This research was supported by the LEAD Graduate School & Research Network [GSC1028], which was funded within the framework of the Excellence Initiative of the German federal and state governments.

This research was supported by the Postdoctoral Academy of Education Sciences and Psychology of the Hector Research Institute of Education Sciences and Psychology, Tübingen, funded by the Baden-Württemberg Ministry of Science, Research, and the Arts.

This project is part of the 'Qualitätsoffensive Lehrerbildung', a joint initiative of the Federal Government and the *Länder* which aims to improve the quality of teacher training. The program is funded by the Federal Ministry of Education and Research.

Declaration

An ethics committee approved the study and the collection of the data and confirmed that the procedures were in line with ethical standards of research with human subjects (pilot study: date of approval: 28/01/2021, file number: AZ.: A2.5.4-151_ns; main study: date of approval: 03/12/2020, file number: AZ.: A2.5.4-148_ns).

We have no known conflicts of interest to disclose. The authors are responsible for the content of this publication.

Abstract

To teach effectively using technology, teachers require specific competences. Especially when teachers are novices (i.e., first-time users of technology) as a foundation they need knowledge about operating technology, that is, knowledge on how to handle digital devices and software programs. However, knowledge about operating technology as a facet of technological knowledge (TK), has so far been assessed mainly using self-reports. Self-assessments are insufficient for assessing knowledge as the validity of self-report instruments is limited. Moreover, the few tests that exist to measure TK show weaknesses (e.g., lack ecological validity, outdated items). This paper presents a test assessing teachers' TK that is independent of specific operating systems, covers technology that is relevant in everyday teaching, and is grounded in acknowledged psychometric modelling principles. Iteratively we developed a test comprising 26 items (T-TK), utilizing cognitive testing, expert feedback, and two studies ($N_{pilot\ study}$ = 268 pre-service and in-service teachers, $N_{main\ study}$ = 233 in-service teachers) to filter items that did not match in content and were not Rasch-conform. T-TK showed a satisfactory Andrich's reliability (Rel_{Andrich} = .73). Using the sample $N_{main\ study}$, correlations between T-TK and technological knowledge (self-report, r = .52), pedagogical knowledge (test scores, r = .18), and technological-pedagogical knowledge (self-report, r = .33; test scores, r = .46) indicated convergent and discriminant validity. Thus, the T-TK proves to be a reliable and valid instrument to capture teachers' TK that can be easily used both by practitioners (i.e., timesaving, without statistical knowledge), for instance, to provide tailored support (e.g., providing differentiated and adaptive professional development) and in research on the on the relationship of teachers' TK to other knowledge domains like technological-pedagogical knowledge.

Keywords: technological knowledge, knowledge about operating technology, teachers, test, Rasch

Highlights

- We present a unidimensional Rasch conform, reliable, and valid test to assess teachers' knowledge about operating technology.
- The test is explicitly developed for the target group of teachers.
- Test items are independent of operating systems such as Windows.
- Test items cover generic (e.g., word processing programs) and school-specific (e.g., open-source web tools) technology.

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Date of submission: 31.05.2022

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1. Introduction

Integrating technology (e.g., digital devices or software programs) in classrooms is an important goal of education systems in the 21st century (European Union et al., 2013; Fraillon et al., 2020; OECD, 2016). For instance, traditional analog media (e.g., books, blackboards) are increasingly being supplemented by digital media (e.g., tablet computer; Hammer et al., 2021). In educational contexts, technology offers numerous potentials to enrich teaching and learning (e.g., creating new ways of presenting and handling information, embedding learning in different social contexts; Scheiter, 2017, 2021; Stürmer & Lachner, 2017). To exploit these potentials for successful student learning, teachers must thus integrate technology in a way that enhances teaching quality (Fütterer et al., 2022; Petko et al., 2017). Therefore, teachers are referred to as "keystone species" (Davis et al., 2013, S. 439) or "essential agents" (Almerich et al., 2016, S. 111) when it comes to the use of technology in the classroom. However, to make high-quality integration of technology in the classroom more likely, an important prerequisite is that teachers possess professional knowledge like technological knowledge (TK) or technological-pedagogical knowledge (TPK; M. J. Koehler et al., 2014; Mishra & Koehler, 2006). Although the successful use of technology in the classroom obviously requires much more than TK (e.g., knowing how to use devices and applications ; Janssen et al., 2013), such professional knowledge is a fundamental prerequisite (Falloon, 2020; Gao et al., 2020). In other words, if teachers do not possess knowledge about how to operate technology, pedagogical-psychological or subject-didactic considerations regarding the use of technology are invalid. Indeed, TK showed a positive association with the frequency of using technology for teaching (e.g., Cheng & Xie, 2018; Guggemos &

Seufert, 2021). Furthermore, TK is important for the development of technology-related skills like technological-pedagogical skills (Guggemos & Seufert, 2021; Pamuk et al., 2015). Accordingly, Dong et al. (2015), for instance, found that TK predicts TPK and TCK. However, teachers' TK has predominantly been measured using self-reports (M. J. Koehler et al., 2012; Willermark, 2018) that entail various disadvantages such as their fallibility due to biases in the evaluation of one's own abilities (Willermark, 2018). Tests that assess TK are scarce and show weaknesses. For instance, items often refer to outdated technology or are formulated depending on specific operating systems (e.g., Windows). The absence of tests limits the ability to study teachers' TK and its role in digitalized teaching. Moreover, targeted support of teachers (e.g., by providing differentiated professional development) can only be realized to a limited extent because precise individual diagnostics are made difficult by the lack of objective instruments.

Therefore, we introduce a test to assess teachers' TK aiming to overcome such known weaknesses of existing tests. Notably, the T-TK was developed to capture teachers' professional knowledge reliably and validly about how to handle generic (e.g., word processing programs) and school-specific (e.g., open-source web tools) technology that are relevant to everyday teaching across subjects and operating systems.

2. Theoretical Framework

2.1 The Construct "Teachers' Technological Knowledge"

Nowadays, there is almost no way around for teachers to use technology in their classroom. Thus, teachers must be equipped with professional knowledge to be able to use technology. The term (digital) *technology* encompasses hardware (physical features of computer technology such as keyboard or memory unit) and/or software components that can be used with computer technology (e.g., word processing software; M. J. Koehler et al., 2013;

M. J. Koehler & Mishra, 2009). In order to conceptualize required professional knowledge facets, Mishra and Koehler (2006) added TK in their *Technological Pedagogical And Content Knowledge* (TPACK) framework as a third general knowledge facets beside the well-known knowledge facets *pedagogical* and *content knowledge* postulated by Shulman (1986). For instance, Koehler et al. (2014, p. 102) specified TK as "knowledge about traditional and new technology" that can be used in the classroom. That is, the TPACK framework distinguishes between general knowledge domains like *pedagogical knowledge* (PK) and technology-related knowledge facets like TK or the intersection of PK and TK labeled as *technological pedagogical knowledge* (TPK; M. J. Koehler et al., 2014). All of these knowledge facets are considered important for effective use of technology in the classroom (Koh, Chai, & Tay, 2014; Scherer et al., 2018a).

One important facet of TK is the knowledge about operating technology representing the core in traditional TK definitions (Mishra & Koehler, 2006). However, due to the rapid development of technology (M. J. Koehler et al., 2012, 2013) and ambiguous conceptualizations of TK (C. R. Graham, 2011; Voogt et al., 2013), a definition of TK is vague, malleable, and differ regarding the hardware and software covered by the term technology as well as regarding the type of knowledge addressed (e.g., declarative, conceptual or procedural knowledge). Thus, after their initial TK definition, Koehler and Mishra (2013; 2009) linked TK to the notion of Fluency of Information Technology (FITness; National Research Council, 1999). FITness requires "that persons understand information technology broadly enough to apply it productively at work and in their everyday lives, to recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology" (M. J. Koehler et al., 2013, S. 15). This definition emphasizes that TK needs to develop in line with technological innovation. That is, TK is in a "state of flux" and evolves over a lifetime (M. J. Koehler et al.,

2013). With respect to teachers, this means that teachers must constantly learn how to deal with new technology. Accordingly, Angeli and Valanides' (2009) defined TK (more precisely, ICT knowledge) as "knowing how to operate a computer and knowing how to use a multitude of tools/software as well as troubleshoot in problematic situations".

Teachers must possess both TK related to generic technology and school-specific technology. Generic technology are digital devices and software programs that are used by a broad range of users and that not specifically developed for teaching (see also the definition of operational technology: Gao et al., 2020). But some of these technology are regularly used for teaching (e.g., word processing programs; Fraillon et al., 2020). School-specific technology are digital devices and software programs that have been specifically designed for teaching and learning (e.g., Fraillon et al., 2020; Horz, 2015; see also the definition of pedagogical technology: Gao et al., 2020) and used by teachers mainly in a professional context (e.g., drill and practice programs: Hillmayr et al., 2020).

Nevertheless, although the successful use of technology in the classroom requires much more than TK (e.g., knowing how to use devices and applications; Janssen et al., 2013), TK and especially professional knowledge on how to handle digital devices and software applications is a fundamental prerequisite (Falloon, 2020; Gao et al., 2020; Horz, 2020). In other words, if teachers do not possess knowledge about operating technology, pedagogical-psychological or subject-didactic considerations regarding the use of technology are invalid. Moreover, as professional knowledge is an inseparable part of teachers' competencies (Blömeke et al., 2015; Kunter et al., 2013), TK is an important aspect of technological competencies. Thus, TK is an important aspect in numerous frameworks of technological competencies (e.g., teacher digital competency framework: Falloon, 2020; European framework for the digital competence of educators [DigCompEdu]: Redecker et al., 2017; for an overview, see Almerich et al., 2016). All these frameworks include technological

knowledge as a central underlying prerequisite for effective teaching with technology. For instance, Falloon (2020) distinguishes between *technical* (i.e., knowledge of mechanical fundamentals of technology) and *technological* knowledge (i.e., knowledge about the role and potential of technology in teaching). Following this conceptualization and in line with updated conceptualizations of the TPACK framework (M. J. Koehler et al., 2013; M. J. Koehler & Mishra, 2009), we understand TK as a three-dimensional construct: a) knowledge about how to operate technology, b) knowledge about technology-specific potentials of technology (e.g., advantages over analogue media), c) knowledge about technology-specific limitations of technology (e.g., data protection issues). All three facets focus on technological aspects. This means, for instance, that knowledge about technology-related potentials and not potentials relating to pedagogical-didactic aspects are intended. This conception establishes a distinction of TK from the other knowledge facets such as TPK. However, as TK is often discussed as knowledge about a technology's affordances for learning and teaching, it is discussed controversial how TK can precisely be seperated from other knowledge domains such as TPK (C. R. Graham, 2011).

Findings from previous research show that, TK is positively associated with technological-pedagogical-content knowledge (TPACK; Dong et al., 2015; Pamuk et al., 2015) and with TPK (Baier & Kunter, 2020; Celik et al., 2014; Dong et al., 2015; Koh, Chai, & Tsai, 2014; Lachner et al., 2019). For instance, Schmidt et al. (2009) found a medium positive association between self-reported TK and TPK (r = .40). In general, their findings indicate that teachers' technology-related knowledge facets constitute an own component of teachers' professional knowledge (Lachner et al., 2019; Scherer et al., 2018a). This is in line with findings, for instance, of Kaya & Dag (2013) showing that TK was weak correlated with all other knowledge facets that are related to TK in the TPACK framework (e.g., TPK). As TPACK knowledge facets are predominantly measured with self-reports (M. J. Koehler et al.,

2014), it is difficult to get more certainty about the relationships of TK to other knowledge domains. However, the distinction from other general knowledge facets such as PK is apparent in previous findings. For instance, Lachner et al. (2019) found a weak positive association between test-based TK and PK (r = .27). Schmidt et al (2009) also found a weak positive association between self-reported TK and TPK (r = .21).

2.2 Measuring Teachers' Technological Knowledge

Teachers' TK has predominantly been measured using self-reports (M. J. Koehler et al., 2012; Voogt et al., 2013; Willermark, 2018). In these self-report measures, teachers are asked to report how well they can solve technical problems (Schmidt et al., 2009), how much they know about using word processing, spreadsheet, and presentation programs (Sahin, 2011), or how well they can, for instance, operate an interactive whiteboard (Jang & Tsai, 2012). However, the validity of self-report instruments is limited (M. J. Koehler et al., 2012; Kopcha et al., 2014). The accuracy of self-reports is affected by teachers' ability to assess their knowledge (Abbitt, 2011; Drummond & Sweeney, 2017; Dunning et al., 2004; Willermark, 2018) or social desirability (van de Mortel, 2008). Moreover, self-reports tend to map a person's self-confidence or self-efficacy (Aesaert et al., 2017; Scherer et al., 2018b) as opposed to reflecting true knowledge in a specific domain (Lachner et al., 2019; Lawless & Pellegrino, 2007; Scherer et al., 2017, 2018b; Siddiq et al., 2016). That is, self-reports probably only partially capture the true knowledge level of individuals. Other ways of measuring teachers' TK are design tasks (e.g., creating lesson plans; Brantley-Dias & Ertmer, 2013) and teacher observations (Brantley-Dias & Ertmer, 2013; Schmidt-Crawford et al., 2016; for an instrument see: Hofer et al., 2011). However, teachers' TK is difficult to observe (see Schmidt-Crawford et al., 2016) and observations are (e.g., due to the necessity of observer training) time- and cost-intensive (Brantley-Dias & Ertmer, 2013).

Against the backdrop of weaknesses of self-reports and observations, tests are an objective and efficient way to measure teachers' TK. A few tests already exist that measure TK or TK-related constructs (e.g., Bradlow et al., 2002; Richter et al., 2010; Senkbeil & Ihme, 2015a, 2020; Wagener, 2003). However, existing tests show some weaknesses that limit their use in assessing teachers' TK. First, most of existing tests were not developed for the target group of teachers. That is, technology relevant to teachers (e.g., learning management systems) are almost not represented. However, the inclusion of such technology is important considering the validity of the measured skills and abilities in the tests for everyday teaching with technology (ecological validity). Second, some tests do not specifically capture TK but a broader construct such as ICT literacy that includes TK. For instance, such tests make it difficult to assess how TK relates to other knowledge domains. Third, existing tests are often focused on a specific operating system (e.g., Windows). As a quarter of computer users work with other operating systems, such as macOS or Linux (Statista, 2021), tests focusing on a specific operating system discriminate against users of other operating systems. That is, the question arise how valid test results are, if a teacher who uses macOS is tested with a test focusing on Windows. Forth, due to the state of flux of TK some tests utilize outdated items (e.g., knowledge about defragmentation). This means that, in line with the ongoing development of technology, new test items are always needed to obtain reliable and valid statements on levels of TK.

2.3 Aims and Hypotheses

Tests that measure teachers' TK are scarce (see Baier & Kunter, 2020) and some show serious weaknesses. The absence of tests limits the ability to study teachers' TK and its role in digitalized teaching. Moreover, targeted support of teachers (e.g., by providing differentiated professional development [PD] opportunities based on an objective diagnostic) is hardly possible. Against this backdrop, this study presents a validated test of teachers'

knowledge about operating technology (T-TK) as one facet of the broader construct TK. We focused one knowledge facet as knowledge facets are not easy to measure in such a way that they can be clearly distinguished from other but related knowledge facets. For this reason, it is advisable to proceed more gradually. T-TK was developed to meet requirements according to the limitations of existing tests mentioned above. First, T-TK should assess teachers' conceptual knowledge about operating technology. Conceptual knowledge is defined as static knowledge about facts, concepts and principles which is used to solve problems (de Jong & Ferguson-Hessler, 1996) and that supports procedural knowledge (Hurrell, 2021). That is, the T-TK should assess knowledge about facts, concepts, and principles of technology relevant for teaching (ecological validity), for instance, to be able to distinguish TK from other knowledge domains. Second, T-TK should be independent of specific operating systems (e.g., Windows), manufacturers, tools, or applications, to ensure that teachers who use different operating systems or applications are not discriminated against by the wording of the items. Third, T-TK should encompass technology that are currently relevant in everyday teaching. Furthermore, we aimed the T-TK to be valid across school subjects (e.g., mathematics, English) and to satisfy psychometric properties (e.g., reliability).

Regarding the test's validation, four assumptions based on previous research were investigated. First, as correlations between test scores and self-reports in general are often weak to moderate (Dunning et al., 2004), we expected moderate positive correlations between T-TK and self-reported TK (*convergent validity*; assumption 1). Second, moderate positive correlations between self-reported TK and self-reported technological-pedagogical knowledge (TPK) were found in previous studies (e.g., Guggemos & Seufert, 2021; Schmidt et al., 2009). Accordingly, we expected moderate positive correlations between T-TK and self-reported TPK due to weaker correlations between test scores and self-reports in general (assumption 2). Third, based on findings by Lachner et al. (2019) who report weak positive

correlations between test-based TK and test-based TPK, we expected a at most weak positive correlation between T-TK and test-based TPK (assumption 3). Fourth, as TK and pedagogical knowledge (PK) are general knowledge facets that can be separated from each other and based on the weak positive correlation between test-based TK and test-based PK reported by Lachner et al. (2019), we expected a weak positive correlation between T-TK and test-based PK (*discriminant validity*; assumption 4).

3. Methodology

As we understand knowledge about how to operate technology as a unidimensional facet of TK with different content domains, our goal was to develop a test (T-TK) whose psychometric properties correspond to a unidimensional model. The advantage of a unidimensional model is that the sum score is a sufficient statistic for the measured ability (Baker & Kim, 2017; Zwitser & Maris, 2016). This means, for instance, that the test T-TK can be easily used by practitioners who have little prior statistical experience. For example, teacher educators can use the test as part of PD courses on the use of technology in the classroom for evaluation or to differentiate PD activities to match participants' ability. For a reliable statement about the ability of the participants, the raw values only must be summed up. Further information on the Rasch model and its advantages can be found in Appendix A.

3.1 Development of the Test T-TK

The development of the test was divided into two phases. In phase 1, a theoretical concept was developed, and items were generated accordingly as well as revised after feedback that we received in a group discussion with experts. In phase 2, preselected items were piloted.

3.1.1 Phase 1: Theoretical Conception and Item Creation´

We defined TK as a three-dimensional construct: a) knowledge about how to operate technology, b) knowledge about technology-specific potentials of technology (e.g., advantages over analogue media), c) knowledge about technology-specific limitations of technology (e.g., data protection issues), whereby we focused on the first facet. We defined knowledge about operating technology as a unidimensional facet of TK that encompasses different content areas (i.e., knowledge how to operate generic technology and school-specific technology).

Furthermore, we stated that teachers need knowledge of both general and school-specific technology that are important in everyday teaching (e.g., Fraillon et al., 2020). We included word processing, presentation, spreadsheet, email, and image and video processing programs as well as web browsers and digital devices. We categorized school-specific technology according to core teaching activities (i.e., "practices that occur with high frequency in teaching" Grossman et al., 2009, S. 277). Based on teaching activities related to the use of technology named in previous studies (e.g., Drossel et al., 2019; Redecker et al., 2017), we adapted four categories (Table 1).

Insert Table 1 about here

However, school-specific technology can be can be further differentiated in technology that was not (e.g., spreadsheets) or was primarily developed to promote learning processes (e.g., learning apps, digital textbooks) which are already didactically designed (Gao et al., 2020). The latter technology was not considered as this technology often require little knowledge about how to operate them by the teacher.

To capture conceptual knowledge of teachers about operating technology used in teaching situations, we based the item formulation on the ideas of situational judgment tests (Whetzel & McDaniel, 2009), in which people are asked to make judgments regarding situations encountered in the work place. 138 single choice items were generated based on

the theoretical conceptualization of TK and especially knowledge about operating technology. Each item consisted of a task (item stem) and four possible solutions, one of which is correct. A direct reference to teaching was provided in the item stem. User manuals and the functionality of the technology were considered to ensure that all items can be answered without knowledge of specific technology.

The items were developed in several feedback loops in exchange with experts and teachers.

3.1.2 Phase 1: Expert Discussion

We invited leading national experts with many years of experience in research on technology enhanced teaching and learning to critically review all items. We sent all items and the underlying theoretical conceptualization as well as the objectives of the test to be developed to all the experts who agreed. We asked the experts both to give general feedback (e.g., item wording) and to provide a reasoned decision about whether an item should be excluded, included, or included but modified considering the goals of the test and the theoretical construct TK. That is, in a first step, six experts reviewed the item formulations and made their decisions individually. In a second step, all experts discussed the items intensively several hours in a focus group setting (Morgan, 1996). The focus group procedure is a highly structured survey method to obtain both individual and group statements on the items and thus to collect as broad a range of opinions as possible. It should be emphasized that specific issues and problems regarding the construct TK were also identified at that time. The discussion revealed that the theoretical understanding of a multidimensional construct of TK was reaffirmed. In this regard, weaknesses of several items became apparent, which did not allow a clear delineation between the different facets of TK. In addition, the experts provided a lot of feedback about item content and formulations. Based on the feedback of the experts, 53 items were preselected after a critical review of the content (i.e., fit to the

construct of knowledge about operating technology) and adjusted in content and item formulation by the first and the second author with the advice from the co-authors. Afterwards, the items were checked for content accuracy by a computer scientist. An overview of all items can be found in Table A, example items are shown in Table 2.

Insert Table 2 about here

3.1.3 Phase 2: Cognitive Pretesting

In Phase 2, cognitive pretesting was applied to the 53 items (Lenzner et al., 2015). To this end, four teachers were given the 53 items with a request to assess comprehensibility, certainty in answering, and relevance of the questioned topic for teaching for each item. In addition, teachers were given the possibility to provide feedback for each item. All items were kept because none of the items showed alarming ratings of the teachers. However, small changes in wording were made due to these ratings.

3.1.4 Phase 2: Pilot Study

Next, a pilot study (*pilot study*; 60 minutes online survey) was conducted to identify items with suboptimal fit to the Rasch model and to get a first impression of the distribution of item difficulties as well as the reliability of the status of the test. For the pilot study a sample of $N = 268$ pre-service and in-service teachers were recruited. 77% of the participants were female with a mean age of $M = 26.56$ years ($SD = 7.99$). Statistical analyses were conducted using R 4.0.4 (R Core Team, 2021) and the package *eRm* (Mair et al., 2016). Missing item answers were defined as missing values as this approach delivers almost unbiased results in competence tests (Pohl et al., 2014). After specifying a Rasch model with all 53 items, item difficulties were first estimated using *Conditional Maximum Likelihood* estimation, and then, person parameters were estimated using *Maximum Likelihood*. Two item fit statistics were inspected: 1) the *Unweighted-Mean-Square-Statistic* (MNSQ; outfit), and 2) the *Weighted-Mean-Square-Statistic* (WMNSQ; infit; Wright & Masters, 1982). As a

rule of thumb, infit and outfit values between 0.7 and 1.3 are acceptable (Wright & Linacre, 1994). Due to economic reasons (i.e., acceptable test length for use in research projects), in the pilot study, we chose even stricter criteria. That is, values below 0.7 were defined as indicating overfit, whereas values above 1.1 indicated underfit. Overfitting indicates that the item fits the model better than expected by the Rasch model (less variation/noise than expected), whereas underfitting indicates too little item-model fit (more variation/noise than expected; Linacre, 2002). Items that were above or below the thresholds of infit and/or outfit were excluded. After excluding 17 items 36 items were used in the subsequent main study (for detailed information of the selection process see the online supplement material).

3.1.5 Phase 2: Main Study

A second study (*main study*; 60 minutes online survey) was conducted to further test the items. For the main study data from $N = 233$ academic track (Gymnasium) teachers were collected between May and June 2021 as part of a PD course that focused on an effective use of technology in the classroom. 75% of the participants were female with a mean age of $M = 43.25$ years ($SD = 9.24$) and an average of $M = 12.94$ years of teaching experience ($SD = 8.12$). Participants were given the 37 items, the 36 resulting items from the pilot study and one additional item, which we decided to keep for content reasons. The statistical analyses and procedures were the same as those used in the pilot study. For detailed information of statistical properties (e.g., ICCs) and the selection process see the online supplement material. We selected 26 items for the final T-TK. 21 items cover generic technology, and 5 items cover school-specific technology. Items covering the topics *presenting and sharing information* and *regulating learning processes* were eliminated and are thus not part of the final test anymore (see also Discussion).

3.3 Validation of the Test

3.3.1 Sample

The sample of the main study was used to validate the T-TK.

3.3.2 Measures

3.3.2.1 Self-Reported Technological Knowledge. Teachers' self-reported technological knowledge (TK) was assessed with seven items (e.g., "I know how to solve my own technical problems") of the TPACK survey by Schmidt et al. (2009). The items were rated on a 5-point rating scale (1 = *strongly disagree* to 5 = *strongly agree*). We computed a manifest scale score. In our data, Cronbach's Alpha (α) of α = .95 indicated an excellent internal consistency (Taber, 2018).

3.3.2.2 Self-Reported Technological-Pedagogical Knowledge. Teachers' self-reported TPK was assessed with four items (e.g., "I can select technology that enhance the teaching approach for a lesson") of the TPACK survey by Schmidt et al. (2009). The items were rated on a 5-point rating scale (1 = *strongly disagree* to 5 = *strongly agree*). We computed a manifest scale score. In our data, internal consistency was satisfactory (α = .71; Taber, 2018).

3.3.2.3 Test-Based Technological-Pedagogical Knowledge. A test was used to assess teachers' technological-pedagogical knowledge (TPK) consisting of eight open-ended questions where teachers are confronted with different teaching situations (Table 3; Franke et al., in preparation). For each teaching situation, teachers were asked to answer whether and how technology can be used in a didactically meaningful way.

Insert Table 3 about here

In total, a maximum of 3 points could be achieved for each task. The decisive factor for awarding points was the relation to the quality of instruction (e.g., cognitive activation), whether a teacher uses technology as a replacement, amplification, or transformation (RAT framework; Hughes et al., 2006), and the quality of the justification of the answer. Responses were scored by two extensively trained raters based on a coding manual. Tests from 40 participants (17%) were rated by both raters. A weighted kappa of $\kappa = .81$ ($p < .001$)

indicated a satisfactory inter-rater reliability (Wirtz & Caspar, 2002). As recommended by the authors, the sum score was used in the analyses of this study.

3.3.2.4 Test-Based Pedagogical Knowledge. Teachers' pedagogical knowledge (PK) was assessed using the short-scale *teaching* of the PK test (Kunter et al., 2017) consisting of 15 single- and multiple-choice items with four response options each (Table 4).

Insert Table 4 about here

This short scale has proven to be reliable (.65 < EAP/PV < .76: Kunter et al., 2017). 2 points were awarded for each correct single-choice task. For multiple-choice tasks, points were awarded as follows: 0 points for 0 or 1 correct response, 1 point for 2 or 3 correct responses, and 2 points for 4 correct responses. As recommended by the authors, the sum score was used in the analyses of this study.

3.3.3 Statistical Analyses

For the subsequent analyses, the R package *lavaan* (Rosseel, 2012) was used.

We employed a structural equation model (SEM) approach to test whether the data fit the Rasch model. As recommended for models with dichotomous items (Brown, 2015), estimation was carried out with robust weighted least squares (WLSMV).

Andrich's reliability was chosen as the reliability estimate of the test (Andrich, 1988). This reliability can be interpreted similarly to Cronbach's α (Andrich & Marais, 2019).

To investigate discriminant and convergent validity of the T-TK, correlations between the participants' abilities (i.e., person parameters from the Rasch model) and constructs of interest (i.e., self-reported TK, self-reported and test-based TPK, and test-based PK) were calculated. As Spearman rank-order correlations are known to be robust against violations of the normal distribution assumption (Hauke & Kossowski, 2011), they were computed to test associations between the constructs. To evaluate the statistically significance of the correlations, type 1 error rate was fixed at 5% (two-sided).

Only a few missings occurred on the variables of interest (0.5%). Therefore, as recommended by Graham et al. (2003), the casewise deletion was applied in order to treat missing values.

4. Results

First, to get an overview of the measures used, we looked at the descriptive statistics. As can be seen in Table 5, the mean values of test-based TPK were low, whereas the mean values of the other scales were in the expected range.

Insert Table 5 about here

For the 26 final test items of the T-TK, a Rasch model was specified. Means, standard deviations, item difficulties, infit, and outfit statistics of the items are presented in Table 6.

Insert Table 6 about here

Mean values were between $M_{TK16/TK20}$ = 0.50 and M_{TK5} = 0.94 and item difficulties between σ_{TK5} = -2.11 and σ_{TK16} = 1.08. The ICCs for all 26 items are shown in Figure 1.

Insert Figure 1 about here

A graphical representation of the distribution of item difficulties can be found in the Wright map (Figure 2).

Insert Figure 2 about here

As can be seen, most items are approximately located between 0 and 1 logits. Some items can also be found between -2 and 0 logits. Few items were located above 1 logit. That is, the high ability range (> 1 logit) was barely covered by items. The majority of the teachers surveyed fall within the range of 0 to 2 logits in terms of their ability.

Following Bentler (1992) Comparative fit index (CFI) = .928 and following Hu and Bentler (1998) root mean square error of approximation (RMSEA) = .027 (90% CI [.009, .039]) indicated a satisfactory fit of the model, whereas the χ^2-goodness-of-fit-test (χ^2 [324,

$N = 233] = 373.25$, $p = .031$) and following Hu and Bentler (1998) the standardized root mean square residual (SRMR) = .131 indicated an unsatisfactory model fit. However, the χ^2-test has to be interpreted with caution as it is influenced by factors such as the sample size (Bagozzi, 2010). As most of the absolute and incremental fit indices (χ^2 excluded) indicated an acceptable model fit, the model fit was considered to be valid. Andrich's coefficient was $Rel_{\text{Andrich}} = .73$, which indicated acceptable reliability.

The T-TK correlated statistically significant with all other constructs assessed (Table 7). The Spearman rank-order correlations were calculated because the Shapiro-Wilk test indicated that the data were not normally distributed (T-TK test: $W[233] = 0.98$, $p = .006$; self-reported TK: $W[233] = 0.97$, $p < .001$; self-reported TPK: $W[233] = 0.99$, $p = .033$; TPK test: $W[233] = 0.99$, $p = .054$; PK test: $W[233] = 0.98$, $p = .002$).

Insert Table 7 about here

As predicted in assumption 1, we found a moderate positive (Cohen, 1988) statistically significant correlation between T-TK and self-reported TK ($r = .52$, $p < .001$), indicating convergent validity of the T-TK. Bearing in mind that that the self-report instrument by Schmid et al. (2009) captures TK in rather general terms (e.g., "I know about many different technology"), whereas items of the T-TK assess the knowledge about specific technology that are relevant in teaching, the strength of the correlation is remarkable. However, findings from Akyuz (2018) indicate that a greater correlation between self-reports and tests is plausible in knowledge domains that do not include a pedagogy aspect (e.g., TK).

As predicted in assumption 2 and in line with theory stating that TK and TPK are related but distinct constructs (Mishra & Koehler, 2006), we found a weak positive statistically significant correlation between T-TK and self-reported TPK ($r = .33$, $p < .001$).

As predicted in assumption 3, we found a moderate positive statistically significant correlation between the T-TK and the TPK test ($r = .46$, $p < .001$). This is largely in line with

findings from previous research showing moderate correlations between the two constructs (e.g., Schmidt et al., 2009). However, Lachner et al. (2019) found weaker correlations, for instance. It should however be noted that these authors used the TILT (Senkbeil et al., 2013) to capture teachers' TK, which was not specifically tailored to teachers and does not capture TK as precisely as the T-TK but rather a broader construct (i.e., ICT literacy). Furthermore, TK was assessed without any direct reference to teaching. Nevertheless, it can be debated whether these findings indicate validity of the T-TK (see discussion).

Regarding assumption 4 and as expected, we found a weak positive statistically significant correlation between the T-TK and the PK test (r = .18, p = .005). This correlation is even weaker than the one found by Lachner et al. (2019). That is, our correlation indicates further evidence of discriminant validity of the T-TK.

5. Discussion

This study contributes to the research on teachers' digital competence by presenting the test T-TK, which measures teachers' knowledge about operating technology. More specifically, T-TK captures teachers' professional knowledge about how to handle generic (e.g., word processing programs) and school-specific (e.g., open-source web tools) technology that is relevant in everyday teaching across subjects and operating systems (e.g., Windows). Our findings suggested that the T-TK can measure teachers' knowledge about operating technology economically, reliably, and validly. For instance, the moderate correlation of T-TK with self-reported TK indicated convergent validity, whereas weak correlations with other constructs (e.g., PK) indicated discriminant validity.

5.1 Limitations

Despite the promising findings, some limitations should be mentioned. First, the independence of the T-TK from technology (e.g., specific applications) and operating

systems as one of the major strengths of the test is at the same time a weakness. That is, if the similarity in operating certain technology was too low, we did not create an item. Thus, outweighing relevance by uniformity in operation could have led to relevant content not being queried. For instance, learning management systems (LMS) differ greatly in their operations, and this led us to survey quite general operations, such as drag & drop. In other studies, however, specific LMS and their operations were surveyed (e.g., Gerick et al., 2019). Furthermore, the items were presented exclusively in text format. In other studies, graphical supports are often provided (e.g., screenshots; Senkbeil et al., 2013b) that may make application scenarios more realistic. Nevertheless, the use of multiple-choice tasks seems to be appropriate for assessing TK (Senkbeil & Ihme, 2020).

Second, during the test development, many items covering school-specific technology had to be excluded, due to insufficient fit to the Rasch model. Items covering the topics *presenting and sharing information* and *regulating learning processes* were eliminated completely. Koehler et al.'s (2014, S. 102) definition of TK as the "knowledge about traditional and new technology" that can be used in the classroom actually implies that the T-TK should cover also a wide range of school-specific technology that are important for teaching and learning processes. However, a test that covers all technology that could potentially be used in the classroom (e.g., feedback systems, collaborative software) may discriminate those who do not use this technology in their teaching practice.

5.2 Implications and Future Research

Teachers' can significantly benefit from the T-TK because test results can be used for individual diagnostic to provide teachers objectively determined demands support, such as effective (e.g., adaptive and differentiated) professional development (PD; Lawless & Pellegrino, 2007). Whereas teachers have often experienced a one-size-fits-all PD approach for technology integration in the past (M. J. Koehler et al., 2013), tests like the T-TK allow

PD providers to monitor teachers levels of TK and to offer individualized (differentiated) PD (Desimone & Garet, 2015). That is, the simultaneous use of different tests measuring facets of professional knowledge could give insights into whether a teacher needs more support in technological or technological-pedagogical topics. With a scope of 26 multiple-choice items, the T-TK can be used in a time-saving manner. The scoring of the test is easy as the sum score is a sufficient statistic for a test taker's ability. However, to enable even better economical usability of the test in practice, future research should be conducted on a short version or a computer-adaptive version.

Unlike previous research on teachers' TK, which has mainly relied on self-reports, future research with the T-TK allows one to investigate a variety of research questions test-based. First, it is thus possible to gain more robust insights into the role of TK regarding successful teaching with technology and its effect on teaching practices and students' learning. Second, the use of T-TK can also help to better understand how TK evolves and what role TK plays in the acquisition of TPK compared to PK.

Regarding the focus of T-TK on knowledge about how to operate technology, which is only one aspect of TK, and due to the fast development of technology, future research should further develop the T-TK. First, items tapping into the knowledge of the potential and limitations of technology (e.g., data protection aspects) should be added, and items on outdated technology should be replaced by items on technology that may find their way into classrooms in the future (e.g., virtual reality). Second, the high practical relevance and application proximity of the T-TK should be critically reviewed, especially with respect to school-specific technology. Third, T-TK is intended to be usable by teachers at different school types, different school subjects, and different levels of TK. However, the final version of the T-TK has been developed based on a sample of academic track teachers in a PD context. That is, the sample is not representative of all teachers. The specific sample could

also be a reason for the moderate correlation between T-TK and self-reported TK as teachers in this study could have been more proficient in assessing their abilities especially because they may have reflected on their abilities before participating in the PD. Other studies are based on pre-service teachers (e.g., Baier & Kunter, 2020; Voss et al., 2011) who are assumed to be less able to assess their abilities than in-service teachers due to a lack of experience (Baier & Kunter, 2020). Thus, T-TK should be further validated, and more items of a high difficulty range should be included to better assess and differentiate teachers with higher TK. Fourth, the correlation between the T-TK and the TPK should be critically analyzed. On the one hand, this correlation may be an indication of insufficient validity of the T-TK. On the other hand, this correlation could be due to the text vignette-based test used to assess TPK. That is, no traditional knowledge test utilizing closed-response formats was used. Thus, this relationship should be investigated in future studies using more established tests of TPK. In general, following Baier and Kunter (2020) who advised using instruments other than self-reports to assess validity, future research could validate T-TK against other tests like the TILT for adults (Senkbeil et al., 2013; Senkbeil & Ihme, 2015b). Finally, future research should investigate whether teachers' knowledge about operating technology is indeed a unidimensional construct as most items covering school-specific technology showed an insufficient fit to the Rasch model. This could be an indication that teachers' TK consists of two or even more facets: knowledge of generic technology, which is acquired in private and professional contexts, and knowledge of school-specific technology, which is acquired exclusively in professional teaching contexts. Moreover, it is possible that a general cross-subject factor of knowledge about operating technology (i.e., generic applications) and other subject-dependent aspects of teachers' knowledge about operating technology (i.e., knowledge about technology in mathematics) exist. The latter idea is supported by studies

that consider the use of technology in the classroom from a subject-specific viewpoint (e.g., Akyuz, 2018; Hillmayr et al., 2020).

To sum up, T-TK is a first attempt for a test to measure teachers' knowledge about how to operate technology as a facet of TK. On the one hand, T-TK is convincing by being Rasch conform, reliable and valid as well as by containing items that are independent of operating systems and that cover both generic and school-specific technology. On the other hand, T-TK should be optimized in future studies and extended with respect to further facets of TK.

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7. Tables

Table 1

Core Categories of Teaching Activities Related to Technology

	Presenting and sharing information	**Organizing learning processes**	**Regulating learning processes**	**Learning and content management systems**
Description	All technology used to *display or transmit information*.	All technology used to *support the organization of learning processes*.	All technology used to *support self-regulated learning* (e.g., assessment, feedback, adaptive teaching).	All technology used to *organize digital distance teaching and learning* like internet-based courses.
Examples	screencasts, clouds	*knowledge management* (e.g., Etherpads, mindmap tools), *collaboration* (e.g., chats), *interactivity* (e.g., video conferencing tools)	audience response systems, quizzes	learning management systems

Note. Technology used for teaching can be categorized in technology that was not (e.g., spreadsheets) or were primarily developed to promote learning processes (e.g., learning apps, digital textbooks) which are already didactically designed. The latter technology was not considered as this technology often require little knowledge about how to operate them by the teacher.

Table 2

Example of an Item of T-TK

Item wording	Response options
Generic Technology	
What do you do if you want to email ten of your students without them seeing each other's email addresses?	**I compose an email, then put the ten students in the Bcc, and finally send the email.**
	I first create a distribution list with the email addresses of the ten students, then compose the email, and finally send the email to me and as a copy to the email addresses in the distribution list.
	I compose an email, then put the ten students in the cc, and finally send the email.
	I compose an email, then put the email addresses of the ten students into ten different address lines, and finally send the email.
School-Specific Technology	
You want your students to work on a collaborative writing document. You use a common web based Etherpad for this. You want to be able to tell different students' entries apart. What specific features do Etherpads offer?	**I activate the feature that the author colors are visible.**
	I activate the function that the students' name abbreviations are displayed before each of their entries.
	I activate the function that only one student writes on the pad at a time.
	I can activate the function that each student writes on his or her own pad.

Note. The correct response options are printed in bold type.

Table 3

Example Item of the Technological-Pedagogical Knowledge Test

Item wording	Subquestion
In the previous lesson, your students learned a new basic skill. As a teacher, you want your students to continue practising and consolidating this skill as a homework.	1) How could you use educational technologies to support the students practising? Please give reasons for your answer. 2) From a societal and ethical point of view, what are the chances and risks of your choices? Please give reasons for your answer.

Note. An open-ended response format was used.

Table 4

Example Item of the Pedagogical Knowledge Test

Item wording	Subquestion
	through the interplay of students' experience of autonomy, social inclusion and experience of competence in the classroom.
A positive learning climate is created ...	**, when teaching is determined by mutual respect, adherence to rules, shared responsibility, justice and caring.**
	, when project work is used more frequently in the classroom.
	, when students can choose materials independently.

Note. Correct response options are printed in bold type.

Table 5

Descriptive Statistics for the Measures Used for Validation

	N	*M*	*SD*	*Min*	*Max*
T-TK test[a]	232	1.12	1.12	-1.66	4.33
TK (self-reported)	233	3.32	1.04	1	5
TPK (self-reported)	233	3.31	0.65	1	5
TPK test	230	7.84	2.93	0.5	14
PK test	233	19.89	2.82	12	27

Note. T-TK = teachers' knowledge about operating technology; TK = technological knowledge;

TPK = technological-pedagogical knowledge; PK = pedagogical knowledge.

Table 6

Means, Standard Deviations, Item Difficulties and Infit and Outfit Statistics for T-TK

Item name	*n*	*M*	*SD*	σ	Infit	Outfit
TK1	232	0.88	0.32	-1.25	1.00	0.98
TK2	231	0.54	0.50	0.87	1.07	1.09
TK3	232	0.89	0.31	-1.35	0.90	0.63
TK4	233	0.94	0.23	-2.11	0.96	0.84
TK5	227	0.76	0.43	-0.30	0.98	0.94
TK6	226	0.73	0.44	-0.13	0.99	1.02
TK7	230	0.88	0.33	-1.21	0.98	1.15
TK8	229	0.81	0.39	-0.59	0.91	0.90
TK9	226	0.68	0.47	0.21	1.00	0.93
TK10	222	0.55	0.50	0.84	0.95	0.91
TK11	221	0.69	0.46	0.12	0.91	0.87
TK12	231	0.83	0.38	-0.75	0.98	0.91
TK13	231	0.88	0.32	-1.25	0.86	0.97
TK14	227	0.50	0.50	1.08	1.03	1.03
TK15	222	0.64	0.48	0.38	1.11	1.15
TK16	220	0.57	0.50	0.75	0.99	0.97
TK17	219	0.53	0.50	0.90	1.06	1.07
TK18	228	0.50	0.50	1.06	0.82	0.77
TK19	228	0.65	0.48	0.33	1.02	1.03
TK20	224	0.75	0.43	-0.24	1.04	1.02
TK21	224	0.71	0.45	0.01	1.09	1.13
TK22	220	0.56	0.50	0.80	1.11	1.22
TK23	217	0.52	0.50	0.99	0.90	0.91
TK24	223	0.53	0.50	0.93	1.05	1.06
TK25	225	0.68	0.47	0.22	0.90	0.87
TK26	220	0.76	0.43	-0.31	1.04	1.05

Note. σ = Item Difficulty; Infit = Weighted-Mean-Square-Statistic; Outfit = Unweighted-Mean-Square-Statistic.

Table 7

Correlations Among T-TK, TK Self-Reports, TPK Self-Reports, PK Test, and TPK test

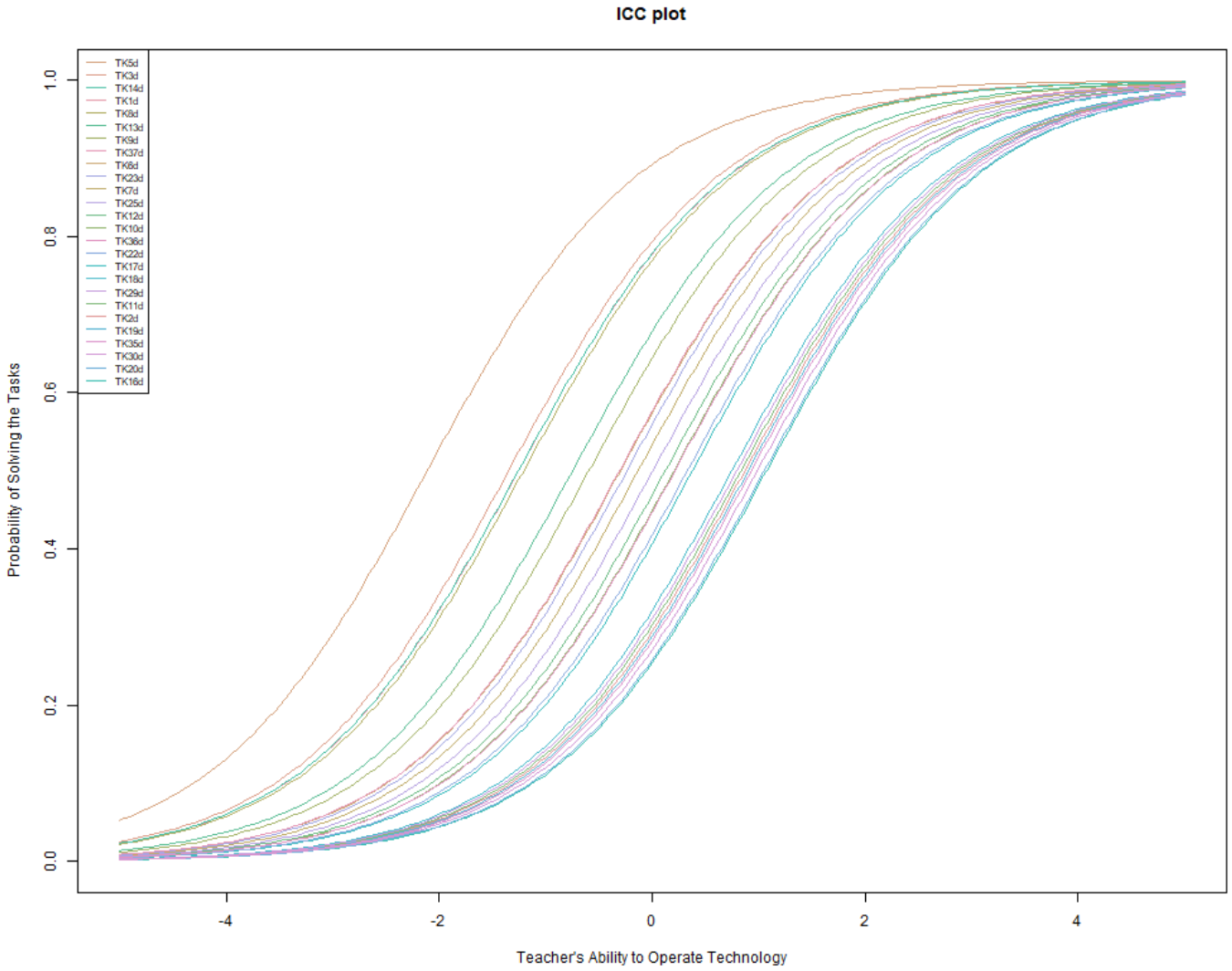
	(1)	(2)	(3)	(4)	(5)
(1) T-TK (test)	1				
(2) TK (self-reported)	.52, $p < .001$	1			
(3) TPK (self-reported)	.33, $p < .001$	.52, $p < .001$	1		
(5) TPK (test)	.46, $p < .001$	.30, $p < .001$	.27, $p < .001$	1	1
(4) PK (test)	.18, $p = .005$	.02, $p = .705$	.17, $p = .011$	.23, $p < .001$	1

Note. T-TK = teachers' knowledge about operating technology; TK = technological knowledge; TPK = technological-pedagogical knowledge; PK = pedagogical knowledge.

Figures

Figure 1

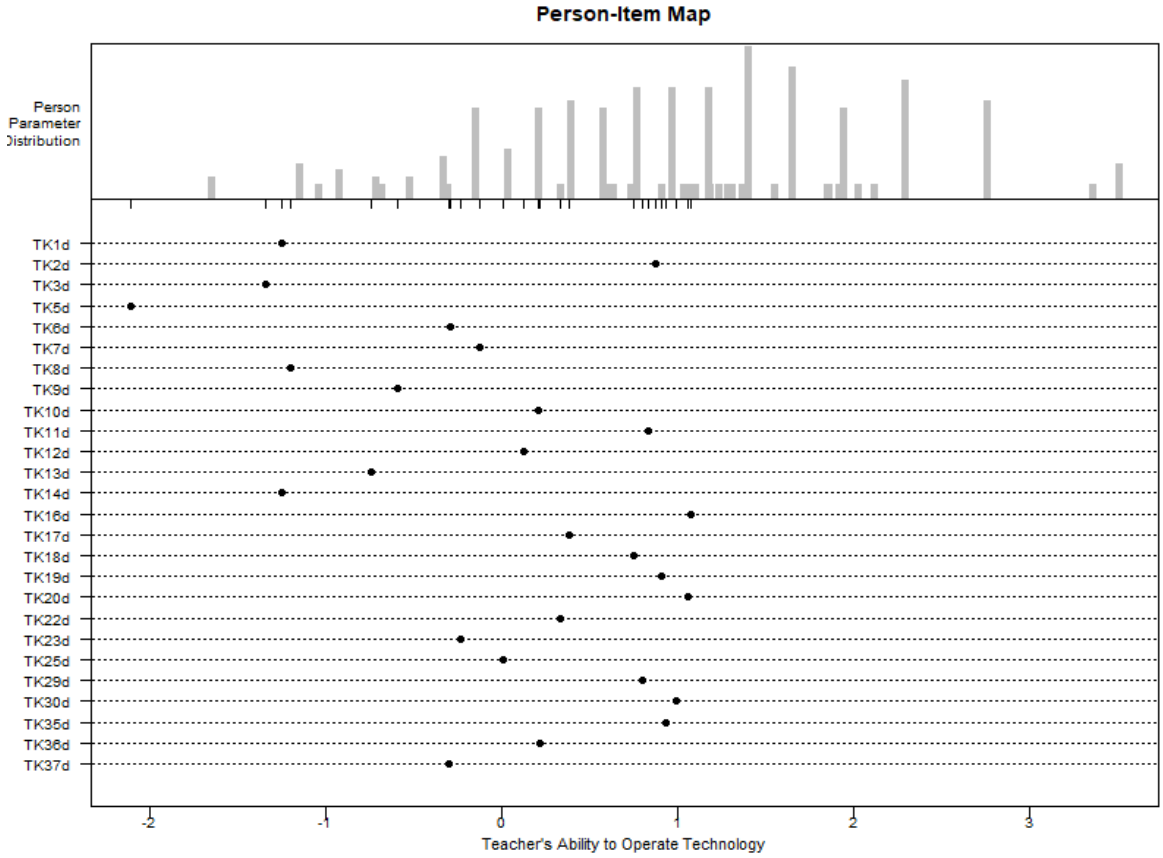
Item Characteristic Curves (ICC) for the Final Test T-TK Existing of 26 Items



Note. On the x-axis, the person's ability is mapped. On the y-axis, the probability of solving an item is depicted. The point at which the probability of solving an item correctly is 0.5 represents the item difficulty.

Figure 2

Wright Map of the Final Test T-TK Existing of 26 Items



Note. The columns in the upper part of the figure describe the distribution of participants' knowledge organized from lowest knowledge (left side) to highest knowledge (right side). The dots represent the item difficulties from most easy (left side) to most difficult (right side).

9. Appendices

Appendix A

We followed item response theory (IRT; Hambleton & Swaminathan, 1985; Lord, 2012), which allowed us to address some limitations of classical test theory (e.g., sample dependency; Embretson & Reise, 2013). More precisely, we used the Rasch model, which is equivalent with a 1 parameter-logistic (1-PL) model, to scale the test T-TK (Baker & Kim, 2017; Kean et al., 2018). As shown in the equation for this model, whether an item of the test is answered correctly depends only on the test taker's latent ability (person parameter ξ_v) and the item's difficulty (item parameter σ_i).

Equation: $$P(+|\xi_v, \sigma_i,) = \frac{e^{(\xi_v - \sigma_i)}}{1+e^{(\xi_v - \sigma_i)}}$$

In addition, the assumption of local stochastic independence applies. That is, the probability of solving an item depends exclusively on the test taker's ability but not on their response to other items (Baker & Kim, 2017). Rasch modeling allows for generalizability across samples and items.

Table A

Overview of the Item Wording and Response Options

Item name (pilot study)	Item name (main study)	Item name (T-TK)	Item wording	Response options
Generic Technology				
Word Processing Programs				
TK1	TK1	TK1	Q1 [ENGLISH] You are compiling a collection of materials for your students. You want to include an automatic table of contents. Which statement about an automatic table of contents is true? Q1 [GERMAN] Sie stellen für Ihre Schülerinnen und Schüler eine Materialsammlung zusammen. Sie möchten ein automatisches Inhaltsverzeichnis einfügen. Welche Aussage zu einem automatischen Inhaltsverzeichnis stimmt?	A1.1 [ENGLISH] **For an automatic table of contents, only those headings can be included that have been clearly defined as such by the user in the document.** A1.1 [GERMAN] **Für ein automatisches Inhaltsverzeichnis können nur diejenigen Überschriften einbezogen werden, die als solche von dem Benutzer eindeutig im Dokument definiert wurden.** A1.2 [ENGLISH] For an automatic table of contents, only those headings can be included that are printed in bold in the document. A1.2 [GERMAN] Für ein automatisches Inhaltsverzeichnis können nur diejenigen Überschriften einbezogen werden, die im Dokument fett gedruckt sind. A1.3 [ENGLISH] An automatic table of contents can only be created after the entire document has been completed. A1.3 [GERMAN] Ein automatisches Inhaltsverzeichnis kann erst nach der Fertigstellung des gesamten Dokumentes erstellt werden. A1.4 [ENGLISH] For an automatic table of contents, only those headings can be included that are printed in bold in the document and are in a separate line.

				A1.4 [GERMAN] Für ein automatisches Inhaltsverzeichnis können nur diejenigen Überschriften einbezogen werden, die im Dokument fett gedruckt sind und in einer eigenen Zeile stehen.
TK2	TK2	TK2	Q2 [ENGLISH]You are giving feedback to a student on a text she has written in a word processing program and you make changes in some places (e.g., formatting). You want the student to be able to see what you have changed later. What specific feature do word processing programs provide for this? Q2 [GERMAN] Sie geben einer Schülerin Rückmeldung zu einem Text, den diese in einem Textverarbeitungsprogramm geschrieben hat und nehmen an einigen Stellen Änderungen vor (z.B. Formatierungen). Sie möchten, dass die Schülerin später sehen kann, was Sie geändert haben. Welche spezifische Funktion bieten Textverarbeitungsprogramme dafür?	A2.1 [ENGLISH] **I can activate the function in word processing programs that all changes are tracked or recorded.** A2.1 [GERMAN] **Ich kann bei Textverarbeitungsprogrammen die Funktion aktivieren, dass alle Änderungen nachverfolgt beziehungsweise aufgezeichnet werden.** A2.2 [ENGLISH] I can activate the function in word processing programs that all changes are printed in bold. A2.2 [GERMAN]Ich kann bei Textverarbeitungsprogrammen die Funktion aktivieren, dass alle Änderungen fett gedruckt werden. A2.3 [ENGLISH]I can activate the function in word processing programs that a copy of the file is created on my computer each time a change is made. A2.3 [GERMAN]Ich kann bei Textverarbeitungsprogrammen die Funktion aktivieren, dass bei jeder Änderung eine Kopie der Datei auf meinem Rechner erstellt wird. A2.4 [ENGLISH] I can activate the function in word processing programs that I am prompted for comments at the places where I have made changes. A2.4 [GERMAN] Ich kann bei Textverarbeitungsprogrammen die Funktion aktivieren, dass ich an den Stellen, an denen ich Änderungen vorgenommen habe, zu Kommentaren aufgefordert werde.
TK3	TK3	TK3	Q3 [ENGLISH] You are creating a worksheet and you want to set an important heading to start on a new, following page, even if you insert more text before the heading. What	A3.1 [ENGLISH] **I navigate with the mouse to the ribbon and activate the function "page break".** A3.1 [GERMAN] **Ich navigiere mit der Maus zum Menüband und aktiviere die Funktion "Seitenumbruch".**

			procedure do you choose so that this heading starts on a new, following page? Q3 [GERMAN] Sie erstellen ein Arbeitsblatt und möchten einstellen, dass eine wichtige Überschrift auf einer neuen, folgenden Seite beginnt, selbst wenn man weiteren Text vor der Überschrift einfügt. Welches Vorgehen wählen Sie, damit diese Überschrift auf einer neuen, folgenden Seite beginnt?	A3.2 [ENGLISH] I select the corresponding text passage and define it as a heading in the formatting settings. A3.2 [GERMAN] Ich markiere die entsprechende Textstelle und definiere diese in den Formatierungseinstellungen als Überschrift. A3.3 [ENGLISH] I press the tab key several times in succession until the heading is indented so far that it starts on a new, following page. A3.3 [GERMAN] Ich drücke die Tabulatortaste so oft hintereinander, bis die Überschrift so weit eingerückt ist, dass diese auf einer neuen, folgenden Seite beginnt. A3.4 [ENGLISH] I press the enter key (e.g., [Enter] key in Windows) so often in succession until so many blank lines have been inserted that the heading starts on a new, following page. A3.4 [GERMAN] Ich drücke die Eingabetaste (z.B. [Enter]-Taste bei Windows) so oft hintereinander, bis so viele Leerzeilen eingefügt wurden, dass die Überschrift auf einer neuen, folgenden Seite beginnt.
TK4	TK4	-	Q4 [ENGLISH] You want to reuse a worksheet from the previous school year. To do this, you need to adjust the year number often listed in the worksheet to match the current year. Which procedure do you choose to adjust all the years in the document at once? Q4 [GERMAN] Sie wollen ein Arbeitsblatt aus dem vorherigen Schuljahr wieder verwenden. Dazu müssen Sie die im Arbeitsblatt oft aufgeführte Jahreszahl entsprechend des aktuellen Jahres anpassen. Welches Vorgehen wählen Sie, um alle Jahreszahlen im Dokument auf einmal anzupassen?	A4.1 [ENGLISH] **I select the function "search and replace" in the ribbon and define in a first step which year number should be replaced and which should be inserted. In a second step I activate the function that all year numbers to be replaced are replaced.** A4.1 [GERMAN] **Ich wähle im Menüband die Funktion "Suchen und Ersetzen" und definiere in einem ersten Schritt, welche Jahreszahl ersetzt und welche eingefügt werden soll. In einem zweiten Schritt aktiviere ich die Funktion, dass alle zu ersetzenden Jahreszahlen ersetzt werden.** A4.2 [ENGLISH] I select the function "replace" in the ribbon and activate in a first step the function "repeat replace". In a second step I define the year to be replaced and the year to be inserted. In

				a third step, I confirm the replacement by pressing the enter key (e.g., [Enter] key in Windows). A4.2 [GERMAN] Ich wähle im Menüband die Funktion "Ersetzen" und aktiviere in einem ersten Schritt die Funktion "Ersetzen wiederholen". In einem zweiten Schritt definiere ich die zu ersetzende und einzufügende Jahreszahl. In einem dritten Schritt bestätige ich die Ersetzung, indem ich die Eingabetaste drücke (z.B. [Enter]-Taste bei Windows). A4.3 [ENGLISH] I select the function "replace case by case" in the ribbon and define in a first step the year to be replaced and inserted. In a second step, I confirm the replacement by pressing the Enter key (e.g., [Enter] key on Windows). A4.3 [GERMAN] Ich wähle im Menüband die Funktion "Fallweise Ersetzen" und definiere in einem ersten Schritt die zu ersetzende und einzufügende Jahreszahl. In einem zweiten Schritt bestätige ich die Ersetzung, indem ich die Eingabetaste drücke (z.B. [Enter]-Taste bei Windows). A4.4 [ENGLISH] I select the function "search and replace" in the ribbon and search in a first step for the year number which should be replaced. In a second step, I replace the year with the year to be replaced by pressing the Enter key (e.g., [Enter] key on Windows). A4.4 [GERMAN] Ich wähle im Menüband die Funktion "Suchen und Ersetzen" und suche in einem ersten Schritt nach der Jahreszahl, die ersetzt werden soll. In einem zweiten Schritt ersetze ich die Jahreszahl mit der zu ersetzenden Jahreszahl, indem ich die Eingabetaste drücke (z.B. [Enter]-Taste bei Windows).
TK5	TK5	TK4	Q5 [ENGLISH] You are writing a text for a class assignment and want all lines of your text to have the same width. Which procedure do you choose?	A5.1 [ENGLISH] **I activate the "justification" function.** A5.1 [GERMAN] **Ich aktiviere die Funktion "Blocksatz".** A5.2 [ENGLISH] I activate the "center axis set" function. A5.2 [GERMAN] Ich aktiviere die Funktion "Mittelachsensatz".

			Q5 [GERMAN] Sie verfassen einen Text für eine Klassenarbeit und möchten, dass alle Zeilen Ihres Textes die gleiche Breite haben. Welches Vorgehen wählen Sie?	A5.3 [ENGLISH] I activate the "automatic hyphenation" function. A5.3 [GERMAN] Ich aktiviere die Funktion "automatische Silbentrennung". A5.4 [ENGLISH] I activate the "automatic margin width" function. A5.4 [GERMAN] Ich aktiviere die Funktion "automatische Randbreite".
Presentation programs				
TK6	TK6	TK5	Q6 [ENGLISH] To explain a complex issue step-by-step to your students, use a presentation with animations in a presentation program. You want to insert a new animation for an element on a slide with existing animations. Which procedure do you choose so that the animation is executed at the right moment of the presentation? Q6 [GERMAN] Um Ihren Schülerinnen und Schülern einen komplexen Sachverhalt schrittweise zu erklären, nutzen Sie eine Präsentation mit Animationen in einem Präsentationsprogramm. Sie möchten eine neue Animation für ein Element auf einer Folie mit bestehenden Animationen einfügen. Welches Vorgehen wählen Sie, damit die Animation zum richtigen Moment der Präsentation ausgeführt wird?	A6.1 [ENGLISH] **I create the animation for the element and then adjust the order of the animations.** A6.1 [GERMAN] **Ich erstelle die Animation für das Element und passe anschließend die Reihenfolge der Animationen an.** A6.2 [ENGLISH] I create the animation for the element and then adjust the display duration of the animations. A6.2 [GERMAN]Ich erstelle die Animation für das Element und passe anschließend die Anzeigedauer der Animationen an. A6.3 [ENGLISH] I create the animation for the element and then adjust the naming of the animations. A6.3 [GERMAN]Ich erstelle die Animation für das Element und passe anschließend die Benennung der Animationen an. A6.4 [ENGLISH] I create the animation for the element and then adjust the animation paths of the animations. A6.4 [GERMAN]Ich erstelle die Animation für das Element und passe anschließend die Animationspfade der Animationen an.
TK7	-	-	Q7 [ENGLISH] What problem can occur when you save a presentation in a presentation program as a PDF to show it to your students? Q7 [GERMAN] Welches Problem kann auftreten, wenn Sie eine Präsentation in einem	A7.1 [ENGLISH] **If animated elements (e.g., images, texts) were included in the presentation, it may happen that the elements cover each other in the PDF.**

			Präsentationsprogramm als PDF speichern, um diese Ihren Schülerinnen und Schülern zum Lernen zur Verfügung zu stellen?	A7.1 [GERMAN] **Wurden in der Präsentation animierte Elemente (z.B. Bilder, Texte) eingebunden, dann kann es vorkommen, dass sich die Elemente in der PDF gegenseitig verdecken.** A7.2 [ENGLISH] If animated images were included in the presentation, these images may be marked in red in the PDF. A7.2 [GERMAN] Wurden in der Präsentation animierte Bilder eingebunden, kann es vorkommen, dass diese Bilder in der PDF rot markiert sind. A7.3 [ENGLISH] If animated texts were included in the presentation, these texts may be marked in red in the PDF. A7.3 [GERMAN] Wurden in der Präsentation animierte Texte eingebunden, dann kann es vorkommen, dass diese Texte in der PDF rot markiert sind. A7.4 [ENGLISH] If animated images were included in the presentation, these images may no longer be visible in the PDF. A7.4 [GERMAN] Wurden in der Präsentation animierte Bilder eingebunden, dann kann es vorkommen, dass diese Bilder in der PDF nicht mehr sichtbar sind.
TK8	TK7	TK6	Q8 [ENGLISH] To illustrate an issue to your students, you have created a chart in a presentation program. Several elements (e.g., shapes, graphics) together form the chart. How do you proceed so that adjustments are implemented for all elements at the same time and each element can still be adjusted individually afterwards? Q8 [GERMAN] Um Ihren Schülerinnen und Schülern einen Sachverhalt zu veranschaulichen, haben Sie in einem Präsentationsprogramm ein Schaubild erstellt. Dabei bilden mehrere Elemente (z.B. Formen, Grafiken) gemeinsam das	A8.1 [ENGLISH] **I select the appropriate elements and group them or combine them and then make the adjustments.** A8.1 [GERMAN] **Ich markiere die entsprechenden Elemente und gruppiere diese bzw. fasse diese zusammen und führe anschließend die Anpassungen durch.** A8.2 [ENGLISH] I create a screenshot of the corresponding elements, then delete the elements and paste the screenshot in the chart and then continue working with the screenshot. A8.2 [GERMAN] Ich erstelle einen Screenshot der entsprechenden Elemente, lösche dann die Elemente und füge den Screenshot in dem Schaubild ein und arbeite anschließend mit dem Screenshot weiter.

			Schaubild. Wie gehen Sie vor, damit Anpassungen für alle Elemente gleichzeitig umgesetzt werden und jedes Element anschließend weiterhin individuell anpassbar ist?	A8.3 [ENGLISH] I select individual elements and move them to the background to be able to adjust elements of the same layer together. A8.3 [GERMAN] Ich markiere einzelne Elemente und verschiebe diese in den Hintergrund, um Elemente derselben Ebene gemeinsam anpassen zu können. A8.4 [ENGLISH] I select the appropriate elements and then choose a WordArt from the ribbon. A8.4 [GERMAN] Ich markiere die entsprechenden Elemente und wähle dann aus dem Menüband eine WordArt aus.
TK9	TK8	TK7	Q9 [ENGLISH] You use a presentation in a presentation program in class. How do you go about seeing what you want to say about each slide during your presentation? Q9 [GERMAN] Sie nutzen im Unterricht eine Präsentation in einem Präsentationsprogramm. Wie gehen Sie vor, um während Ihres Vortrags zu sehen, was Sie zu den jeweiligen Folien sagen möchten?	A9.1 [ENGLISH] **During the creation of the presentation, I use the option to make notes or annotations on the respective slides and activate the speaker view during the presentation.** A9.1 [GERMAN] Während der Erstellung der Präsentation nutze ich die Option, Notizen bzw. Anmerkungen zu den jeweiligen Folien anzufertigen und aktiviere während der Präsentation die Referentenansicht. A9.2 [ENGLISH] During the creation of the presentation, I use the option to leave comments at the appropriate places and activate the speaker view during the presentation. A9.2 [GERMAN] Während der Erstellung der Präsentation nutze ich die Option, Kommentare bei den entsprechenden Stellen zu hinterlassen und aktiviere während der Präsentation die Referentenansicht. A9.3 [ENGLISH] While creating the presentation, I use the option to insert SmartArts at the appropriate places and activate the speaker view during the presentation. A9.3 [GERMAN] Während der Erstellung der Präsentation nutze ich die Option, SmartArts an den entsprechenden Stellen einzufügen und aktiviere während der Präsentation die Referentenansicht.

				A9.4 [ENGLISH] While creating the presentation, I use the option to insert text boxes on the respective slides and activate the speaker view during the presentation. A9.4 [GERMAN] Während der Erstellung der Präsentation nutze ich die Option, Textfelder auf den jeweiligen Folien einzufügen und aktiviere während der Präsentation die Referentenansicht.
Spreadsheet programs				
TK10	TK9	TK8	Q10 [ENGLISH] In your lesson, you use a table in a spreadsheet program. A student points out to you that there is an incorrect value entered in "D8". To which value is your student referring? Q10 [GERMAN] In Ihrem Unterricht nutzen Sie eine Tabelle in einem Tabellenkalkulationsprogramm. Ein Schüler weist Sie darauf hin, dass in "D8" ein falscher Wert eingetragen ist. Auf welchen Wert bezieht sich Ihr Schüler?	A10.1 [ENGLISH] **My student refers to the value in the cell: 8th row, 4th column.** A10.1 [GERMAN] **Mein Schüler bezieht sich auf den Wert in der Zelle: 8. Zeile, 4. Spalte.** A10.2 [ENGLISH] My student refers to the value in the 8th row. A10.2 [GERMAN] Mein Schüler bezieht sich auf den Wert in der 8. Zeile. A10.3 [ENGLISH] My student refers to the value in the 8th column. A10.3 [GERMAN] Mein Schüler bezieht sich auf den Wert in der 8. Spalte. A10.4 [ENGLISH] My student refers to the value in the cell: 4th row, 8th column. A10.4 [GERMAN] Mein Schüler bezieht sich auf den Wert in der Zelle: 4. Zeile, 8. Spalte.
TK11	TK10	TK9	Q11 [ENGLISH] You record in a table which of the ten tasks set your students have worked on (1 = worked on, 0 = not worked on). The names of the students are entered in column A, each task in a separate column from B to K. What does the formula "=SUM(B2:K2)" calculate? Q11 [GERMAN] Sie erfassen in einer Tabelle, welche der zehn gestellten Aufgaben Ihre	A11.1 [ENGLISH] **Calculation of the number of processed tasks of the students in the second row.** A11.1 [GERMAN] **Berechnung der Anzahl bearbeiteter Aufgaben der Schülerinnen/der Schüler in der zweiten Zeile.** A11.2 [ENGLISH] Calculation of the number of completed tasks of the students in the first and tenth task.

			Schülerinnen und Schüler bearbeitet haben (1 = bearbeitet, 0 = nicht bearbeitet). Die Namen der Schülerinnen und Schüler sind in Spalte A eingetragen, jede Aufgabe in einer eigenen Spalte von B bis K. Was berechnet die Formel "=SUMME(B2:K2)"?	A11.2 [GERMAN] Berechnung der Anzahl bearbeiteter Aufgaben der Schülerinnen/der Schüler der ersten und zehnten Aufgabe. A11.3 [ENGLISH] Calculation of the sum of completed tasks of the students in the second row of the values in B1, B2, K1 and K2. A11.3 [GERMAN] Berechnung der Summe bearbeiteter Aufgaben der Schülerinnen/der Schüler in der zweiten Zeile der Werte in B1, B2, K1 und K2. A11.4 [ENGLISH] Calculation of the average number of completed tasks per student. A11.4 [GERMAN] Berechnung des Durchschnitts bearbeiteter Aufgaben pro Schülerin/pro Schüler.
TK12	-	-	Q12 [ENGLISH] You have created a formula with cell references to calculate the grade point average of your class for a class test. You now want to use this formula for the same class for another class test and therefore copy the formula. In doing so, the reference to the cell in which the class size is noted moves with it, although you do not want this (e.g., "A1" becomes "A2"). Which procedure do you choose? Q12 [GERMAN] Sie haben eine Formel mit Zellbezügen angelegt, um den Notendurchschnitt Ihrer Klasse bei einer Klassenarbeit zu berechnen. Sie wollen diese Formel nun für dieselbe Klasse für eine andere Klassenarbeit verwenden und kopieren deshalb die Formel. Dabei wandert der Bezug zur Zelle, in der die Klassengröße notiert ist, mit, obwohl Sie dies nicht möchten (z.B. wird aus "A1" "A2"). Welches Vorgehen wählen Sie?	A12.1 [ENGLISH] **I mark the corresponding cell reference in the formula with "$" characters.** A12.1 [GERMAN] **Ich kennzeichne den entsprechenden Zellbezug in der Formel mit "$"-Zeichen.** A12.2 [ENGLISH] I extend the formula with FIXATESUM (...). A12.2 [GERMAN] Ich erweitere die Formel um FIXATESUM (...). A12.3 [ENGLISH] I press the "F2" key when I edit the cell in question. A12.3 [GERMAN] Ich drücke die "F2"-Taste, wenn ich die betreffende Zelle bearbeite. A12.4 [ENGLISH] I double-click on the cell in question. A12.4 [GERMAN] Ich klicke doppelt auf die betreffende Zelle.

TK13	TK11	TK10	Q13 [ENGLISH] You work with a weekly schedule in your class. You want to give all students an up-to-date overview of the percentage of assignments that have already been handed in. To do this, you document the status of the assignments in a table in a spreadsheet program that can be viewed by the students. What procedure do you choose to ensure that all students who have submitted more than 75% of the assignments automatically receive a "well done" note? Q13 [GERMAN] Sie arbeiten in Ihrer Klasse mit einem Wochenplan. Sie wollen allen Schülerinnen und Schülern stets einen aktuellen Überblick über den prozentualen Anteil bereits abgegebener Aufgaben geben. Dafür dokumentieren Sie den Status der Aufgabenbearbeitung in einer für die Schülerinnen und Schüler einsehbaren Tabelle in einem Tabellenkalkulationsprogramm. Welches Vorgehen wählen Sie, damit bei allen Schülerinnen und Schülern, die mehr als 75% der Aufgaben abgegeben haben, automatisiert "gut gemacht" vermerkt wird?	A13.1 [ENGLISH] **I use a function to calculate the percentage of submitted tasks and then use an "if-then" function.** A13.1 [GERMAN] **Ich berechne mit einer Funktion den prozentualen Anteil abgegebener Aufgaben und nutze anschließend eine "Wenn-Dann"-Funktion.** A13.2 [ENGLISH] I use a function to calculate the percentage of submitted tasks and then use a "find and replace" function to find the number "75" and replace it with "well done". A13.2 [GERMAN] Ich berechne mit einer Funktion den prozentualen Anteil abgegebener Aufgaben und nutze anschließend eine "Suchen und Ersetzen"-Funktion, um die Zahl "75" zu suchen und durch "gut gemacht" zu ersetzen. A13.3 [ENGLISH] I use a function to calculate the percentage of submitted tasks and then use the command function [SEARCH(75); "well done"]. A13.3[GERMAN] Ich berechne mit einer Funktion den prozentualen Anteil abgegebener Aufgaben und nutze anschließend die Befehlsfunktion [SEARCH(75); "gut gemacht"]. A13.4 [ENGLISH] I use a function to calculate the percentage of surrendered tasks and then use the command function [SEARCH(75); REPLACE("well done")]. A13.4 [GERMAN] Ich berechne mit einer Funktion den prozentualen Anteil abgegebener Aufgaben und nutze anschließend die Befehlsfunktion [SEARCH(75); REPLACE("gut gemacht")].
TK14	TK12	TK11	Q14 [ENGLISH] In a spreadsheet program you create an overview with tasks (entered in column A) and corresponding solutions (entered in column B). You want to show your students on your computer only the tasks but not the solutions. What function does the program offer	A14.1 [ENGLISH] **I can use the function in the spreadsheet program to hide column B.** A14.1 [GERMAN] **Ich kann im Tabellenkalkulationsprogramm die Funktion nutzen, die Spalte B auszublenden.**

			you if you do not want to create a new table for this and do not want to delete any row or column or contents at the same time? Q14 [GERMAN] Sie erstellen in einem Tabellenkalkulationsprogramm eine Übersicht mit Aufgaben (eingetragen in Spalte A) und zugehörigen Lösungen (eingetragen in Spalte B). Sie wollen Ihren Schülerinnen und Schülern auf Ihrem Rechner nur die Aufgaben aber nicht die Lösungen zeigen. Welche Funktion bietet Ihnen das Programm, wenn Sie dafür zugleich keine neue Tabelle erstellen und keine Zeile oder Spalte bzw. Inhalte löschen wollen?	A14.2 [ENGLISH] I can use the function in the spreadsheet program to fix column A. A14.2 [GERMAN] Ich kann im Tabellenkalkulationsprogramm die Funktion nutzen, die Spalte A zu fixieren. A14.3 [ENGLISH] I can use the function in the spreadsheet program to separate columns A and B. A14.3 [GERMAN] Ich kann im Tabellenkalkulationsprogramm die Funktion nutzen, die Spalten A und B voneinander zu trennen. A14.4 [ENGLISH] I can use the function in the spreadsheet program to make the font of the entries in column B transparent. A14.4 [GERMAN] Ich kann im Tabellenkalkulationsprogramm die Funktion nutzen, die Schrift der Einträge in Spalte B transparent zu setzen.
E-mail programs				
TK15	TK13	TK12	Q15 [ENGLISH] How do you go about emailing ten of your students without them seeing each other's email addresses? Q15 [GERMAN] Wie gehen Sie vor, wenn Sie zehn Ihrer Schülerinnen und Schüler eine E-Mail schreiben wollen, ohne dass diese gegenseitig ihre E-Mail-Adressen sehen?	A15.1 [ENGLISH] **I compose the email, then put the ten students in the Bcc, and finally send the email.** A15.1 [GERMAN] **Ich verfasse die E-Mail, setze dann die zehn Schülerinnen und Schüler ins Bcc und verschicke schließlich die E-Mail.** A15.2 [ENGLISH] I compose the email, then put the email addresses of the ten students into ten different address lines, and finally send the email. A15.2 [GERMAN] Ich verfasse die E-Mail, setze dann die E-Mail-Adressen der zehn Schülerinnen und Schüler in zehn verschiedene Adresszeilen und verschicke schließlich die E-Mail. A15.3 [ENGLISH] I first create a distribution list with the email addresses of the ten students, then compose the email, and finally send the email to me and as a copy to the email addresses in the distribution list. A15.3[GERMAN] Ich erstelle zunächst einen Verteiler mit den E-Mail-Adressen der zehn Schülerinnen und Schüler, verfasse

				dann die E-Mail, und verschicke schließlich die E-Mail an mich und als Kopie an die Mailadressen im Verteiler. A15.4 [ENGLISH] I compose the email, then put the ten students in the cc, and finally send the email. A15.4 [GERMAN] Ich verfasse die E-Mail, setze dann die zehn Schülerinnen und Schüler ins Cc und verschicke schließlich die E-Mail.
TK16	TK14	TK13	Q16 [ENGLISH] You regularly provide a class with teaching materials via e-mail. What procedure do you choose so that you don't have to add all the students' email addresses individually to the address line? Q16 [GERMAN] Sie versorgen eine Klasse regelmäßig via E-Mail mit Unterrichtsmaterialien. Welches Vorgehen wählen Sie, damit Sie nicht alle E-Mailadressen der Schülerinnen und Schüler einzeln zu der Adresszeile hinzufügen müssen?	A16.1 [ENGLISH] **In the e-mail program, I create an e-mail distribution list for the class.** A16.1 [GERMAN] **Im E-Mail-Programm erstelle ich einen E-Mail-Verteiler für die Klasse.** A16.2 [ENGLISH] In the e-mail program, I create an address book with the e-mail addresses of the students. A16.2 [GERMAN] Im E-Mail-Programm erstelle ich ein Adressbuch mit den E-Mail-Adressen der Schülerinnen und Schüler. A16.3 [ENGLISH] In the e-mail program, I create a chain e-mail. A16.3 [GERMAN] Im E-Mail-Programm erstelle ich eine Ketten-E-Mail. A16.4 [ENGLISH] In the e-mail program I create a folder for the class. A16.4 [GERMAN] Im E-Mail-Programm erstelle ich einen Ordner für die Klasse.
TK17	-	-	Q17 [ENGLISH] You accidentally deleted an important email from a student's inbox in your email program. What procedure do you choose to recover the deleted email? Q17 [GERMAN] Sie haben aus Versehen eine wichtige E-Mail eines Schülers aus dem Posteingang in Ihrem E-Mail-Programm gelöscht.	A17.1 [ENGLISH] **I move the e-mail from the "Deleted" or "Trash" folder to the "Inbox" folder.** A17.1 [GERMAN] **Ich verschiebe die E-Mail aus dem "Gelöscht-Ordner" bzw. "Papierkorb" in den Ordner "Posteingang".** A17.2 [ENGLISH] I ask that the student resend the email to me because the email is irrevocably deleted.

			Welches Vorgehen wählen Sie, um die gelöschte E-Mail wiederherzustellen?	A17.2 [GERMAN] Ich bitte darum, dass der Schüler mir die E-Mail noch einmal zusendet, da die E-Mail unwiderruflich gelöscht ist. A17.3 [ENGLISH] I use a software program to recover deleted emails. A17.3 [GERMAN] Ich nutze ein Softwareprogramm zur Wiederherstellung von gelöschten E-Mails. A17.4 [ENGLISH] I move the e-mail from the "Drafts folder" to the "Inbox" folder. A17.4 [GERMAN] Ich verschiebe die E-Mail aus dem "Entwürfe-Ordner" in den Ordner "Posteingang".
TK18	TK15	-	Q18 [ENGLISH] The subject of an e-mail says "Fwd:"/"WG:". What does that mean? Q18 [GERMAN] Im Betreff einer E-Mail steht "Fwd:"/"WG:". Was bedeutet das?	A18.1 [ENGLISH] **The e-mail was forwarded to me.** A18.1 [GERMAN] **Die E-Mail wurde an mich weitergeleitet.** A18.2 [ENGLISH] The e-mail contains an attachment. A18.2 [GERMAN] Die E-Mail enthält einen Anhang. A18.3 [ENGLISH] The e-mail was sent incorrectly. A18.3 [GERMAN] Die E-Mail wurde fehlerhaft versendet. A18.4 [ENGLISH] The e-mail was answered. A18.4 [GERMAN] Die E-Mail wurde beantwortet.
TK19	TK16	TK14	Q19 [ENGLISH] You receive a large number of e-mails every day. Which function of e-mail programmes do you use so that the e-mails are sorted automatically? Q19 [GERMAN] Sie erhalten täglich eine Vielzahl von E-Mails. Welche Funktion von E-Mail-Programmen nutzen Sie, damit die E-Mails automatisch sortiert werden?	A19.1 [ENGLISH] **I use the "rule/filter" function and define the sorting for incoming e-mails.** A19.1 [GERMAN] **Ich nutze die Funktion "Regel/Filter" und definiere die Sortierung für eingehende E-Mails.** A19.2 [ENGLISH] I use the function to colour-code e-mails and mark related e-mails with the same colour so that they are automatically sorted in the future. A19.2 [GERMAN] Ich nutze die Funktion, E-Mails farblich zu markieren und markiere zusammengehörige E-Mails mit

				derselben Farbe, sodass diese zukünftig automatisch sortiert werden. A19.3 [ENGLISH] Since common e-mail programmes do not offer an automatic sorting function, I create a folder system so that I can move the e-mails manually and thus sort them. A19.3 [GERMAN] Da gängige E-Mail-Programme keine Funktion einer automatischen Sortierung bieten, erstelle ich ein Ordnersystem, sodass ich die E-Mails händisch verschieben und dadurch sortieren kann. A19.4 [ENGLISH] I use the "wall/stockade" function and activate automatic sorting for incoming e-mails. A19.4 [GERMAN]Ich nutze die Funktion "Wall/Stockade" und aktiviere die automatische Sortierung für eingehende E-Mails.
Image and Video Editing Programs				
TK20	TK17	TK15	Q20 [ENGLISH] You use a common image editing programme (e.g., GIMP) to superimpose two images on a worksheet. How do you go about making the contents of both pictures visible (e.g., to show differences between the two pictures)? Q20 [GERMAN] Sie nutzen ein gängiges Bildbearbeitungsprogramm (z.B. GIMP), um bei einem Arbeitsblatt zwei Bilder übereinander zu legen. Wie gehen Sie vor, dass die Inhalte beider Bilder zu sehen sind (z.B. um Unterschiede zwischen den beiden Bildern zu verdeutlichen)?	A20.1 [ENGLISH] **I insert the images on two different editing layers and then work with transparency settings, for example.** A20.1 [GERMAN] **Ich füge die Bilder auf zwei unterschiedlichen Bearbeitungsebenen ein und arbeite dann beispielsweise mit Transparenzeinstellungen.** A20.2 [ENGLISH] I insert the images on one layer and mark for each area which image should be in the foreground. A20.2 [GERMAN] Ich füge die Bilder auf einer Ebene ein und kennzeichne für jeden Bereich, welches Bild im Vordergrund sein soll. A20.3 [ENGLISH] I cut out the section of the image that interests me and merge the sections of the image into one base image. A20.3 [GERMAN] Ich schneide den jeweilig interessierenden Bildausschnitt aus und füge die Bildausschnitte auf einem Basisbild zusammen. A20.4 [ENGLISH] I paste the images on one layer and use masks for both images, which I then combine.

				A20.4 [GERMAN] Ich füge die Bilder auf einer Ebene ein und nutze Masken für beide Bilder, die ich dann kombiniere.
TK21	TK18	TK16	Q21 [ENGLISH] You use a common video editing programme (e.g., iMovie) to create an explanatory video for your lessons. How do you proceed if you want to underlay the video with music and explanation, each of which you want to edit separately? Q21 [GERMAN] Sie nutzen ein gängiges Videobearbeitungsprogramm (z.B. iMovie), um ein Erklärvideo für Ihren Unterricht zu erstellen. Wie gehen Sie vor, wenn Sie das Video mit Musik und Erklärung unterlegen wollen, die Sie jeweils getrennt voneinander bearbeiten wollen?	A21.1 [ENGLISH] **I insert the video in the editing area and then insert two audio tracks into each of which I load the audio components (music and explanations).** A21.1 [GERMAN] **Ich füge das Video im Bearbeitungsbereich ein und füge dann zwei Tonspuren ein, in die ich jeweils die Audiokomponenten (Musik und Erklärungen) lade.** A21.2 [ENGLISH] I insert the video in the editing area and separate the audio component from the video and insert it as a separate audio track. A21.2 [GERMAN] Ich füge das Video im Bearbeitungsbereich ein und trenne die Audiokomponente vom Video ab und füge diese als separate Tonspur ein. A21.3 [ENGLISH] I insert the video in the editing area. Then, with the music playing, I record the explanations and add them in an audio track. A21.3 [GERMAN] Ich füge das Video im Bearbeitungsbereich ein. Anschließend nehme ich bei laufender Musik die Erklärungen auf und füge diese in einer Tonspur hinzu. A21.4 [ENGLISH] I insert the video in the editing area, the video editing programme then automatically takes over the separation of video and audio components (music and explanations). A21.4 [GERMAN] Ich füge das Video im Bearbeitungsbereich ein, das Videobearbeitungsprogramm übernimmt dann automatisiert die Trennung von Video- und Audiokomponenten (Musik und Erklärungen).
TK22	TK19	TK17	Q22 [ENGLISH] With a common video editing programme (e.g., iMovie) you create an	A22.1 [ENGLISH] **I add a new text element to the timeline in a new editing track.**

			explanatory video for your pupils. How do you proceed if, in addition to video and audio, a text is to be inserted that you want to edit in the video editing programme? Q22 [GERMAN] Mit einem gängigen Videobearbeitungsprogramm (z.B. iMovie) erstellen Sie ein Erklärvideo für Ihre Schülerinnen und Schüler. Wie gehen Sie vor, wenn zusätzlich zu Video und Audio ein Text eingeblendet werden soll, den Sie im Videobearbeitungsprogramm bearbeiten wollen?	A22.1 [GERMAN] **Ich füge ein neues Textelement zur Timeline in einer neuen Bearbeitungsspur hinzu.** A22.2 [ENGLISH] I insert the text in the original video, which I then load into the video editing programme. A22.2 [GERMAN] Ich füge den Text im Originalvideo ein, welches ich anschließend in das Videobearbeitungsprogramm lade. A22.3 [ENGLISH] I add a new text element to the video track. A22.3 [GERMAN] Ich füge ein neues Textelement in der Videospur hinzu. A22.4 [ENGLISH] I first delete the audio file before a text can be inserted, because the simultaneous insertion of video, audio and text is not yet possible in common video editing programmes. A22.4 [GERMAN] Ich lösche zunächst die Audiodatei bevor ein Text eingeblendet werden kann, weil das gleichzeitige Einfügen von Video, Audio und Text in gängigen Videobearbeitungsprogrammen bisher nicht möglich ist.
TK23	-	-	Q23 [ENGLISH] You are using a common image editing programme (e.g., GIMP) to edit an image for a worksheet. Which function of the image editing programme can you use to detach a motif from the background (cropping objects)? Q23 [GERMAN] Sie nutzen ein gängiges Bildbearbeitungsprogramm (z.B. GIMP), um für ein Arbeitsblatt ein Bild zu bearbeiten. Welche Funktion des Bildbearbeitungsprogrammes können Sie nutzen, um ein Motiv vom Hintergrund abzulösen (Freistellen von Objekten)?	A23.1 [ENGLISH] **The function "masks / layer masks".** A23.1 [GERMAN] **Die Funktion "Masken / Ebenenmasken".** A23.2 [ENGLISH] The "preview" function. A23.2 [GERMAN] Die Funktion "Vorschau". A23.3 [ENGLISH] The function "filter / layer filter". A23.3 [GERMAN] Die Funktion "Filter / Ebenenfilter". A23.4 [ENGLISH] The "alpha channel" function. A24.4 [GERMAN] Die Funktion "Alpha-Kanal".
Web browser				

TK24	TK20	TK18	Q24 [ENGLISH] Which function of common web browsers (e.g., Chrome) do you use if you want to ensure that your search terms are not stored on your computer during an internet search (e.g., with Google)? Q24 [GERMAN] Welche Funktion von gängigen Webbrowsern (z.B. Chrome) verwenden Sie, wenn Sie sicherstellen möchten, dass Ihre Suchbegriffe bei einer Internetrecherche (z.B. mit Google) nicht auf Ihrem Rechner gespeichert werden?	A24.1 [ENGLISH] **I use a private browser window for internet research.** A24.1 [GERMAN] **Ich verwende für die Internetrecherche ein privates Browserfenster.** A24.2 [ENGLISH] All web browsers save search terms, this cannot be turned off at the moment. A24.2 [GERMAN] Alle Webbrowser speichern Suchbegriffe, das lässt sich derzeit nicht ausstellen. A24.3 [ENGLISH] I close all browser windows properly after the internet search. A24.3 [GERMAN] Ich schließe nach der Internetrecherche alle Browserfenster ordnungsgemäß. A24.4 [ENGLISH] I make sure that the web browser's antivirus programme is active before I do my internet research. A24.4 [GERMAN] Ich stelle vor der Internetrecherche sicher, dass das Virenschutzprogramm des Webbrowsers aktiv ist.
TK25	-	-	Q25 [ENGLISH] You are researching the topic "video conferencing tools" using a common search engine (e.g., Google). Which search query do you use if you want to exclude search results about the tool "videochatde"? Q25 [GERMAN] Sie recherchieren mit einer gängigen Suchmaschine (z.B. Google) zum Thema "Videokonferenztools". Welche Suchanfrage verwenden Sie, wenn Sie Suchergebnisse über das Tool "videochatde" ausschließen wollen?	A25.1 [ENGLISH] **I enter "videoconferencetools - videochatde" in the search box.** A25.1 [GERMAN] **Ich gebe "Videokonferenztools - videochatde" in das Suchfeld ein.** A25.2 [ENGLISH] I enter "videoconferencetools*videochatde*" in the search box. A25.2 [GERMAN] Ich gebe "Videokonferenztools*videochatde*" in das Suchfeld ein. A25.3 [ENGLISH] I enter "videoconferencingtools WITHOUT videochatde" in the search box. A25.3 [GERMAN] Ich gebe "Videokonferenztools WITHOUT videochatde" in das Suchfeld ein. A25.4 [ENGLISH] I enter "video conferencing tools ~ videochatde" in the search box. A25.4 [GERMAN] Ich gebe "Videokonferenztools ~ videochatde" in das Suchfeld ein.

TK26	TK21	-	Q26 [ENGLISH] You are using a common web browser (e.g., Chrome) and find a web page with learning material that you want to visit more often in the future. Which web browser feature do you use to create a link to the webpage that allows you to conveniently return to it again and again? Q26 [GERMAN] Sie nutzen einen gängigen Webbrowser (z.B. Chrome) und finden eine Webseite mit Lernmaterial, die Sie in Zukunft noch öfter besuchen wollen. Welche Funktion von Webbrowsern nutzen Sie, um einen Link zu der Webseite zu erstellen, mit dem Sie bequem immer wieder zu dieser Webseite zurückkehren können?	A26.1 [ENGLISH] **I use the "bookmarks" or " favorites" function.** A26.1 [GERMAN] **Ich nutze die Funktion "Lesezeichen" bzw. "Favoriten".** A26.2 [ENGLISH] I use the "quick path" function. A26.2 [GERMAN] Ich nutze die Funktion "Schnellpfad". A26.3 [ENGLISH] I use the "save as" function. A26.3 [GERMAN] Ich nutze die Funktion "Speichern unter". A26.4[ENGLISH] I use the "history" function. A26.4 [GERMAN] Ich nutze die Funktion "Verlauf" bzw. "Geschichte".
TK27	-	-	Q27 [ENGLISH] Your students have created posters and sent them to you as image files. The image files are available in a resolution of 300 dpi (dots per inch), which is optimal for printing the poster. Now all the work from the project week is to be displayed on the school's website. What resolution is required for a web presentation (with any file size)? Q27 [GERMAN] Ihre Schülerinnen und Schüler haben Plakate erstellt und Ihnen diese als Bilddateien zugeschickt. Die Bilddateien liegen in einer Auflösung von 300 dpi (dots per inch) vor, was für einen Druck des Plakates optimal ist. Nun sollen alle Arbeiten der Projektwoche auf der Webseite der Schule dargestellt werden. Welche Auflösung muss für eine Webdarstellung vorliegen (bei beliebiger Dateigröße)?	A27.1 [ENGLISH] **No matter, since the number of pixels is relevant.** A27.1 [GERMAN] **Egal, da die Anzahl der Pixel relevant ist.** A27.2 [ENGLISH] 72 dpi A27.2 [GERMAN] 72 dpi A27.3 [ENGLISH] 100 dpi A27.3 [GERMAN] 100 dpi A27.4 [ENGLISH] also 300 dpi A27.4 [GERMAN] ebenfalls 300 dpi
Basic functions of digital devices				

TK28	TK22	TK19	Q28 [ENGLISH] You want to show your students a web page on an interactive whiteboard (no: smartboard and no integrated computer). Which statement is true? Q28 [GERMAN] Sie möchten Ihren Schülerinnen und Schülern eine Webseite auf einem interaktiven Whiteboard (kein: Smartboard und kein integrierter Computer) zeigen. Welche Aussage stimmt?	A28.1 [ENGLISH] **The connected computer must have an internet connection.** A28.1 [GERMAN] **Der angeschlossene Computer muss eine Internetverbindung haben.** A28.2[ENGLISH] An internet connection is not necessary. A28.2 [GERMAN] Eine Internetverbindung ist nicht notwendig. A28.3 [ENGLISH] The interactive whiteboard must have an internet connection. A28.3 [GERMAN] Das interaktive Whiteboard muss eine Internetverbindung haben. A28.4 [ENGLISH] The connected computer and the interactive whiteboard must have an internet connection. A28.4 [GERMAN] Der angeschlossene Computer und das interaktive Whiteboard müssen eine Internetverbindung haben.
TK29	TK23	TK20	Q29 [ENGLISH] You are working with a smartboard and want to limit the time students have available for an activity (e.g., group work). Which function of a smartboard do you choose if you want all students to see the remaining time during group work? Q29 [GERMAN] Sie arbeiten mit einem Smartboard und wollen die Zeit begrenzen, die Schülerinnen und Schülern für eine Aktivität (z.B. Gruppenarbeit) zur Verfügung haben. Welche Funktion eines Smartboards wählen Sie, wenn alle Schülerinnen und Schüler während der Gruppenarbeit die verbleibende Zeit sehen sollen?	A29.1 [ENGLISH] **I limit the processing time for this activity by setting a timer/countdown on the smartboard.** A29.1 [GERMAN] **Ich begrenze die Bearbeitungszeit für diese Aktivität, indem ich bei dem Smartboard einen Timer/Countdown einstelle.** A29.2 [ENGLISH] The smartboard does not have a timer function, so I limit the time by setting the alarm on my smartphone. A29.2 [GERMAN] Das Smartboard bietet keine entsprechende Funktion, weshalb ich die Bearbeitungszeit begrenze, indem ich den Wecker an meinem Smartphone stelle. A29.3 [ENGLISH] I limit the time by using a stopwatch on the smartboard. A29.3 [GERMAN] Ich begrenze die Bearbeitungszeit, indem ich eine Stoppuhr des Smartboards nutze. A29.4 [ENGLISH] I limit the editing time by showing the clock on the Smartboard. A29.4 [GERMAN] Ich begrenze die Bearbeitungszeit, indem ich die Uhr des Smartboards einblende.

TK30	-	-	Q30 [ENGLISH] You are showing your students an internet video on a smartboard, but you notice that the sound being played is too low, even though the volume on the smartboard is set to the highest value and the speakers are not defective. What do you do to make the sound louder? Q30 [GERMAN] Sie zeigen Ihren Schülerinnen und Schülern ein Internetvideo auf einem Smartboard, stellen aber fest, dass der abgespielte Ton zu leise ist, obwohl die Lautstärke am Smartboard auf den höchsten Wert eingestellt ist und die Lautsprecher nicht defekt sind. Was unternehmen Sie, um den Ton lauter zu stellen?	A30.1 [ENGLISH] **I adjust the volume of my sound card and / or the software programme.** A30.1 [GERMAN] **Ich stelle die Lautstärke meiner Soundkarte und / oder des Softwareprogramms ein.** A30.2 [ENGLISH] I press "+ / arrow up" on the volume button on the remote control of the smartboard. A30.2 [GERMAN] Ich drücke bei der Volumen Taste auf der Fernbedienung des Smartboards "+ / Pfeil nach oben". A30.3 [ENGLISH] I reload the internet video. A30.3 [GERMAN] Ich lade das Internetvideo erneut. A30.4 [ENGLISH] I restart the smartboard and then load the internet video again. A30.4 [GERMAN] Ich starte das Smartboard neu und lade anschließend das Internetvideo erneut.
TK31	TK24	-	Q31 [ENGLISH] During a video conference the transmission is jerky. What procedure do you choose to try to improve the transmission quality? Q31 [GERMAN] Während einer Videokonferenz ruckelt die Übertragung. Welches Vorgehen wählen Sie, um zu versuchen, die Übertragungsqualität zu verbessern?	A31.1 [ENGLISH] **I turn off my camera and ask the students to turn off their cameras as well.** A31.1 [GERMAN] **Ich schalte meine Kamera aus und bitte die Schülerinnen und Schüler ihre Kameras ebenfalls auszuschalten.** A31.2 [ENGLISH] I turn off my microphone and ask the students to turn off their microphones as well. A31.2 [GERMAN] Ich schalte mein Mikrofon aus und bitte die Schülerinnen und Schüler ihre Mikrofone ebenfalls auszuschalten. A31.3 [ENGLISH] I ask the students to turn off the grid mode. A31.3 [GERMAN] Ich bitte die Schülerinnen und Schüler den Rastermodus zu deaktivieren. A31.4 [ENGLISH] I ask the students to close word processors, spreadsheets and the like. A31.4 [GERMAN] Ich bitte die Schülerinnen und Schüler Textverarbeitungsprogramme, Tabellenkalkulationsprogramme u.Ä. zu schließen.

TK32	TK25	TK21	Q32 [ENGLISH] You want to compare the solutions of two students (e.g., two text files) on your digital end device with one screen. Which function can you use to see the documents side by side? Q32 [GERMAN] Sie wollen auf Ihrem digitalen Endgerät mit einem Bildschirm die Lösungen zweier Schüler (z.B. zwei Textdateien) vergleichen. Welche Funktion können Sie nutzen, um die Dokumente nebeneinander zu sehen?	A32.1 [ENGLISH] **The function "split view".** A32.1 [GERMAN] **Die Funktion "Bildschirm teilen/split view".** A32.2 [ENGLISH] The function "screen connect". A32.2 [GERMAN] Die Funktion "Bildschirm verbinden/screen connect". A32.3 [ENGLISH] The function “monitor connect” A32.3 [GERMAN] Die Funktion "Monitore verbinden/monitor connect". A32.4 [ENGLISH] The function "desktop view". A32.4 [GERMAN] Die Funktion "Desktop teilen/desktop view".
School-Specific Technology *Presenting and sharing information*				
TK33	-	-	Q33 [ENGLISH] You want to send several files (e.g., PDF, images) to your students by e-mail. The attached files exceed the total size limit of your email service for attached files. How can you proceed so that you can still send the files lossless in one email? Q33 [GERMAN] Sie wollen Ihren Schülerinnen und Schülern mehrere Dateien (z.B. PDF, Bilder) per E-Mail schicken. Die angehängten Dateien übersteigen insgesamt die Begrenzung Ihres E-Mail-Dienstes für die Größe angehängter Dateien. Wie können Sie vorgehen, damit Sie die Dateien trotzdem verlustfrei in einer E-Mail verschicken können?	A33.1 [ENGLISH] **I use a programme (e.g., 7-Zip) to put the files into a ZIP file format and then send the ZIP file.** A33.2 [GERMAN] **Ich nutze ein Programm (z.B. 7-Zip), um die Dateien in ein ZIP-Dateiformat zu bringen und verschicke dann die ZIP-Datei.** A33.2 [ENGLISH] I use a programme (e.g., CCleaner) to remove the largest file and then send the remaining files. A33.2 [GERMAN] Ich nutze ein Programm (z.B. CCleaner), um die größte Datei zu entfernen und verschicke dann die restlichen Dateien. A33.3 [ENGLISH] Since files cannot be compressed without loss, I use a programme for sending large files (e.g., WeTransfer) to send the files. A33.3 [GERMAN] Da Dateien nicht verlustfrei komprimiert werden können, nutze ich ein Programm zum Versenden von großen Dateien (z.B. WeTransfer), um die Dateien zu verschicken.

				A33.4 [ENGLISH] I move all the files into a folder (container) and then send the folder instead of the individual files. A33.4 [GERMAN] Ich verschiebe alle Dateien in einen Ordner (Container) und verschicke dann den Ordner anstelle der einzelnen Dateien.
TK34	TK26	-	Q34 [ENGLISH] How do you proceed if you want to make folders and files available to your students in a common cloud (e.g., OneDrive, Dropbox)? Q34 [GERMAN] Wie gehen Sie vor, wenn Sie Ihren Schülerinnen und Schülern Ordner und Dateien in einer gängigen Cloud (z.B. OneDrive, Dropbox) zur Verfügung stellen wollen?	A34.1 [ENGLISH] **I upload the folders and files to the cloud and provide the students with an access link to the cloud.** A34.1 [GERMAN] **Ich lade die Ordner und Dateien in die Cloud und stelle den Schülerinnen und Schülern einen Zugangslink zur Cloud zur Verfügung.** A34.2 [ENGLISH] I upload the folders and files to the cloud and set up desktop synchronisation with my students' digital devices. A34.2 [GERMAN] Ich lade die Ordner und Dateien in die Cloud und richte eine Desktop-Synchronisierung mit den digitalen Endgeräten meiner Schülerinnen und Schüler ein. A34.3 [ENGLISH] I upload the folders and files to the cloud and share my screen with my students. A34.3 [GERMAN] Ich lade die Ordner und Dateien in die Cloud und teile meinen Bildschirm mit meinen Schülerinnen und Schülern. A34.4 [ENGLISH] I upload the folders and files to the cloud and set up a VPN connection for my students. A34.4 [GERMAN] Ich lade die Ordner und Dateien in die Cloud und richte meinen Schülerinnen und Schülern eine VPN-Verbindung ein.
TK35	TK27	-	Q35 [ENGLISH] Which statement about common clouds (e.g., OneDrive, Dropbox) is true? Q35 [GERMAN] Welche Aussage zu gängigen Clouds (z.B. OneDrive, Dropbox) stimmt?	A35.1 [ENGLISH] **Data uploaded to the cloud is available on digital devices (e.g., smartphones) at any time ("on demand").** A35.1 [GERMAN] **Daten, die in die Cloud geladen wurden, stehen jederzeit auf digitalen Endgeräten (z.B. Smartphones) zur Verfügung („on Demand“).**

				A35.2 [ENGLISH] In contrast to local hard drives, clouds offer unlimited storage capacities. A35.2 [GERMAN] Im Gegensatz zu lokalen Festplatten bieten Clouds unbegrenzte Speicherkapazitäten. A35.3 [ENGLISH] With clouds (cloud computing) there is no central provider of resources, i.e., the control of resources is decentralised. A35.3 [GERMAN] Bei Clouds (Cloud-Computing) gibt es keinen zentralen Anbieter von Ressourcen, d.h. die Steuerung der Ressourcen ist dezentralisiert. A35.4 [ENGLISH] All clouds that one uses as a private person are "private clouds". A35.4 [GERMAN] Alle Clouds, die man als Privatperson nutzt sind "Private Clouds".
TK36	-	-	Q36 [ENGLISH] You want to explain to your students how to use a website in a screen video (screencast). You create a screencast with a common screencast tool (e.g., with Camtasia, Screencast-o-Matic, Captivate). How do you proceed if you only want to record the website but not the address line of your browser? Q36 [GERMAN] Sie wollen Ihren Schülerinnen und Schülern die Bedienung einer Webseite in einem Bildschirmvideo (Screencast) erklären. Sie erstellen einen Screencast mit einem gängigen Screencast-Tool (z.B. mit Camtasia, Screencast-o-Matic, Captivate). Wie gehen Sie vor, wenn Sie nur die Website aber nicht die Adresszeile Ihres Browsers aufzeichnen wollen?	A36.1 [ENGLISH] **I click on the displayed frame of the recording area and move the borders so that the area of the screen I want to record is enclosed.** A36.1 [GERMAN] **Ich klicke auf den angezeigten Rahmen des Aufzeichnungsbereiches und verschiebe die Ränder so, dass der Bereich des Bildschirms, den ich aufnehmen möchte, eingeschlossen ist.** A36.2 [ENGLISH] I activate censor elements (e.g., black bar) to cover those areas of the screen that I do not want to record. A36.2 [GERMAN] Ich aktiviere Zensurelemente (z.B. schwarzer Balken), um diejenigen Bereiche des Bildschirmes zu überdecken, die nicht aufgezeichnet werden sollen. A36.3 [ENGLISH] I switch to the recording settings and set the size of the recording area to "active window". A36.3 [GERMAN] Ich wechsle zu den Aufnahmeeinstellungen und stelle die Größe des Aufzeichnungsbereiches auf "Aktives Fenster".

				A36.4 [ENGLISH] Since common screencast tools do not yet offer any selection options for the recording area, I record the full screen and then trim the video. A36.4 [GERMAN] Da gängige Screencast-Tools bisher keine Auswahlmöglichkeiten des Aufzeichnungsbereiches bieten, nehme ich das Vollbild auf und schneide das Video anschließend zurecht.
TK37	TK28	-	Q37 [ENGLISH] Screencasts are often used to explain teaching content. Which statement about common screencast tools (e.g., with Camtasia, Screencast-o-Matic, Captivate) is true? Q37 [GERMAN] Bildschirmvideos (Screencasts) werden häufig zur Erklärung von Unterrichtsinhalten herangezogen. Welche Aussage zu gängigen Screencast-Tools (z.B. mit Camtasia, Screencast-o-Matic, Captivate) stimmt?	A37.1 [ENGLISH] **The recording of a video can be stopped in between.** A37.1 [GERMAN] **Die Aufnahme eines Videos kann zwischendurch gestoppt werden.** A37.2 [ENGLISH] Recorded videos can be saved in any file format (e.g., .mp4, .wmv, .mov). A37.2 [GERMAN] Aufgenommene Videos können in jedem Dateiformat (z.B. .mp4, .wmv, .mov) gespeichert werden. A37.3 [ENGLISH] Recording can be started with the shortcut "Command key - S". A37.3 [GERMAN] Die Aufnahme kann mit dem Shortcut "Befehlstaste - S" gestartet werden. A37.4 [ENGLISH] One records the desktop, for other video sources other tools must be used. A37.4 [GERMAN] Man nimmt den Desktop auf, für andere Videoquellen müssen andere Tools verwendet werden.
TK38	-	-	Q38 [ENGLISH] As part of a project work, you work with your students on a blog (content management system-based website, e.g., Wordpress) on which the students publish their work results. How do you go about customising	A38.1 [ENGLISH] **I open the programming environment of the blog's website in the browser (backend) and edit the design aspects of the blog.** A38.1 [GERMAN] **Ich öffne die Programmierumgebung der Webseite des Blogs im Browser (Backend) und bearbeite die Designaspekte des Blogs.**

			design aspects such as the background colour and logo of the blog? Q38 [GERMAN] Im Rahmen einer Projektarbeit arbeiten Sie mit Ihren Schülerinnen und Schülern an einem Blog (Content-Management-System-basierte Webseite, z.B. Wordpress), auf welchem die Schülerinnen und Schüler ihre Arbeitsergebnisse veröffentlichen. Wie gehen Sie vor, um Designaspekte wie die Hintergrundfarbe und das Logo des Blogs anzupassen?	A38.2 [ENGLISH] I open the blog's website in the browser (frontend), display the page source text in the browser and make the changes in the source text. A38.2 [GERMAN] Ich öffne die Webseite des Blogs im Browser (Frontend), lasse mir den Seitenquelltext im Browser anzeigen und nehme die Änderungen im Quelltext vor. A38.3 [ENGLISH] I open the web page of the blog in the browser (frontend), select the option "edit/make settings" and edit the design aspects of the blog. A38.3 [GERMAN] Ich öffne die Webseite des Blogs im Browser (Frontend), wähle die Option "Bearbeiten/Einstellungen vornehmen" und bearbeite die Designaspekte des Blogs. A38.4 [ENGLISH] I open the programming environment of the blog's website in the browser (backend) and set up new fonts according to the design aspects of the blog. A38.4 [GERMAN] Ich öffne die Programmierumgebung der Webseite des Blogs im Browser (Backend), und richte neue Fonts, entsprechend der Designaspekte des Blogs ein.
Organizing learning process				
TK39	TK29	TK22	Q39 [ENGLISH] You want your students to work on a collaborative writing document. You use a common web-based Etherpad (collaborative real-time editor; e.g., edupad.ch, ZUMpad). You want to be able to distinguish the entries of different students. What specific function do etherpads offer you? Q39 [GERMAN] Sie wollen, dass Ihre Schülerinnen und Schüler an einem gemeinsamen Schreibdokument arbeiten. Sie verwenden dafür	A39.1 [ENGLISH] **I can activate the function that the author colours are visible.** A39.1 [GERMAN] **Ich kann die Funktion aktivieren, dass die Autorenfarben sichtbar sind.** A39.2 [ENGLISH] I can activate the function that each student writes on his or her own pad. A39.2 [GERMAN] Ich kann die Funktion aktivieren, dass jeder Schüler und jede Schülerin an einem eigenen Pad schreibt. A39.3 [ENGLISH] I can activate the function that the students' name abbreviations are displayed before each of their entries.

			ein gängiges webbasiertes Etherpad (collaborative real-time editor; z.B. edupad.ch, ZUMpad). Sie wollen die Einträge unterschiedlicher Schülerinnen und Schüler auseinanderhalten können. Welche spezifische Funktion bieten Ihnen Etherpads?	A39.3 [GERMAN] Ich kann die Funktion aktivieren, dass die Namenskürzel der Schülerinnen und Schüler vor jedem ihrer Einträge angezeigt werden. A39.4 [ENGLISH] I can activate the function that only one student writes on the pad at a time. A39.4 [GERMAN] Ich kann die Funktion aktivieren, dass immer nur eine Schülerin/ein Schüler zur selben Zeit an dem Pad schreibt.
TK40	TK30	TK23	Q40 [ENGLISH] Your students work together on a dictionary of technical terms in a wiki (e.g., with Wikihost, Wikia, Wikidot, Wikispaces). A student accidentally deletes some parts of a student's text. What procedure do you choose to restore the deleted text parts? Q40 [GERMAN] Ihre Schülerinnen und Schüler arbeiten gemeinsam an einem Fachbegriffslexikon in einem Wiki (z.B. mit Wikihost, Wikia, Wikidot, Wikispaces). Eine Schülerin löscht aus Versehen einige Textteile eines Schülers. Welches Vorgehen wählen Sie, um die gelöschten Textteile wieder herzustellen?	A40.1 [ENGLISH] **Since each wiki has its own archiving system, I retrace the changes and take them back.** A40.1 [GERMAN] **Da jedes Wiki ein eigenes Archivsystem besitzt, vollziehe ich die Veränderungen nach und nehme diese zurück.** A40.2 [ENGLISH] I upload the last backup copy (backup) of the wiki, which I regularly store myself as a backup copy on my computer. A40.2 [GERMAN] Ich lade die letzte Sicherungskopie (Backup) des Wikis hoch, welche das Wiki regelmäßig und automatisiert als Sicherungskopie auf meinem Rechner hinterlegt. A40.3 [ENGLISH] Wikis are live applications, which is why they do not provide a backup system. Therefore, I ask the students to repost the deleted text parts to the wiki. A40.3 [GERMAN] Wikis sind live Anwendungen, weshalb sie kein Backupsystem bieten. Daher bitte ich die Schülerinnen und Schüler, die gelöschten Textteile erneut ins Wiki zu schreiben. A40.4 [ENGLISH] I upload the last backup copy (backup) of the wiki, which I regularly store myself as a backup copy on my computer. A40.4 [GERMAN] Ich lade die letzte Sicherungskopie (Backup) des Wikis hoch, die ich regelmäßig selbst als Sicherungskopie auf meinem Rechner hinterlege.

TK41	-	-	Q41 [ENGLISH] You communicate with your students via chat. What is the difference between this and communicating via email? Q41 [GERMAN] Sie kommunizieren mit Ihren Schülerinnen und Schülern über einen Chat. Welchen Unterschied gibt es zu der Kommunikation über E-Mail?	A41.1 [ENGLISH] **With standard factory settings, the most recent message appears at the top of the message history for emails, and at the bottom for a chat.** A41.1 [GERMAN] **Bei Standard-Werkseinstellungen erscheint bei E-Mails die neueste Nachricht im Nachrichtenverlauf ganz oben, bei einem Chat ganz unten.** A41.2 [ENGLISH] An email can be sent to fewer people than a chat message. A41.2 [GERMAN] Eine E-Mail kann an weniger Personen versendet werden als eine Chat-Nachricht. A41.3 [ENGLISH] A chat message is limited to 920 characters. Documents cannot be sent in a chat. A41.3 [GERMAN] Eine Chat-Nachricht ist auf 920 Zeichen begrenzt. A41.4 [ENGLISH] Documents cannot be sent in a chat. A41.4 [GERMAN] In einem Chat können keine Dokumente versendet werden.
TK42	-	-	Q42 [ENGLISH] As part of a project work, you work with your students on a web blog (short blog, e.g., created with Wordpress), on which work results are published. Which statement about a blog is true? [GERMAN] Im Rahmen einer Projektarbeit arbeiten Sie mit Ihren Schülerinnen und Schülern an einem Webblog (kurz Blog, z.B. erstellt mit Wordpress), auf welchem Arbeitsergebnisse veröffentlichen werden. Welche Aussage zu einem Blog stimmt?	A42.1 [ENGLISH] **Each entry has a unique and non-changing permanent web address ("permalink").** A42.1 [GERMAN] **Jeder Eintrag besitzt eine eindeutige und sich nicht verändernde, permanente Webadresse („Permalink“).** A42.2 [ENGLISH] If blogger A links to a post by blogger B, this is automatically displayed on the linked page via the "web feed". A42.2 [GERMAN] Wenn der Blogger A einen Beitrag von Blogger B verlinkt, wird dies über die "Web-Feed" automatisch auf der verlinkten Seite angezeigt. A42.3 [ENGLISH] For web blogs, every comment is always displayed immediately. A43.3 [GERMAN] Bei Webblogs wird jeder Kommentar immer sofort angezeigt.

				A42.4 [ENGLISH] Blogposts are always listed chronologically. A42.4 [GERMAN] Blogposts werden immer chronologisch aufgelistet.
TK43	TK31	-	Q43 [ENGLISH] How do you proceed when you want your 28 students to work in random groups of four to complete an assignment during a conference in a common video conferencing tool (e.g., BigBlueButton, Webex)? Q43 [GERMAN] Wie gehen Sie vor, wenn Ihre 28 Schülerinnen und Schüler zur Bearbeitung einer Aufgabe während einer Konferenz in einem gängigen Videokonferenztool (z.B. BigBlueButton, Webex) in zufällig zusammengestellten Vierergruppen arbeiten sollen?	A43.1 [ENGLISH] **I use the "breakout rooms/group rooms" feature and create seven groups to which I automatically assign students.** A43.1 [GERMAN] **Ich nutze die Funktion "Breakouträume/Gruppenräume" und erstelle sieben Gruppen, in die ich die Schülerinnen und Schüler automatisch zuteilen lasse.** A43.2 [ENGLISH] I randomly create groups and use the "split conference" function so that one student from each group can create a separate conference for the group. A43.2 [GERMAN] Ich stelle zufällig Gruppen zusammen und nutze die Funktion "Konferenz teilen" damit je ein/eine Schüler/in aus jeder Gruppe eine eigene Konferenz für die Gruppe erstellen kann. A43.3 [ENGLISH] I use the "breakout rooms/group rooms" function and press the number "7" on my keyboard and then select "random". A43.3 [GERMAN] Ich nutze die Funktion "Breakouträume/Gruppenräume" und drücke auf meiner Tastatur die Ziffer "7" und wähle dann "random" aus. A43.4 [ENGLISH] I select all students in the video conferencing tool and press the number "7" on my keyboard. A43.4 [GERMAN] Ich markiere alle Schülerinnen und Schüler im Videokonferenztool und drücke auf meiner Tastatur die Ziffer "7".
TK44	-	-	Q44 [ENGLISH] When sharing the screen (so-called screensharing) during a conference in a	A44. 1[ENGLISH] **all participants of the conference can see the document.**

			common video conferencing tool (e.g., BigBlueButton, Webex) ... Q44 [GERMAN] Beim Teilen des Bildschirms (sogenannte Bildschirmübertragung / Screensharing) bei einer Konferenz in einem gängigen Videokonferenztool (z.B. BigBlueButton, Webex) ...	A44.1 [GERMAN] **können alle Teilnehmerinnen und Teilnehmer der Konferenz das Dokument sehen.** A44.2 [ENGLISH] all participants of the conference can download the document. A.44.2 [GERMAN] können alle Teilnehmerinnen und Teilnehmer der Konferenz das Dokument herunterladen. A44.3 [ENGLISH] all participants of the conference can work on the shared document. A44.3 [GERMAN] können alle Teilnehmerinnen und Teilnehmer der Konferenz am geteilten Dokument arbeiten. A44.4 [ENGLISH] the document that is open is sent to all participants of the conference. A44.4 [GERMAN] wird das Dokument, das geöffnet ist, an alle Teilnehmerinnen und Teilnehmer der Konferenz verschickt.
Regulating learning processes				
TK45	-	-	Q45 [ENGLISH] You will use a common survey software (e.g., Unipark, SoSci Survey) to create a test to validate the results of a learning unit. Which feature of common survey creation programmes do you use when your students are not allowed to skip a question? Q45 [GERMAN] Sie erstellen mit einem gängigen Programm zur Erstellung von Umfragen (z.B. Unipark, SoSci Survey) einen Test zur Ergebnissicherung einer Lerneinheit. Welche Funktion von gängigen Programmen zur Erstellung von Umfragen nutzen Sie, wenn Ihre Schülerinnen und Schüler keine Frage überspringen dürfen?	A45.1 [ENGLISH] **I create the test items and define each test item as a "mandatory question".** A45.1 [GERMAN] **Ich erstelle die Testaufgaben und definiere jede Testaufgabe als "Pflichtfrage"**. A45.2 [ENGLISH] I create the test items and arrange all test items on one survey page. A45.2 [GERMAN] Ich erstelle die Testaufgaben und ordne alle Testaufgaben auf einer Umfrageseite an. A45.3 [ENGLISH] I create the test items and set that the individual access code must be entered both at the beginning and at the end of the test. A45.3 [GERMAN] Ich erstelle die Testaufgaben und stelle ein, dass der individuelle Zugangscode sowohl am Anfang als auch am Ende des Tests eingegeben werden muss. A45.4 [ENGLISH] I create the test items and set up user-individual codes for each question.

				A45.4 [GERMAN] Ich erstelle die Testaufgaben und richte nutzerindividuelle Codes für jede Frage ein.
TK46	-	-	Q46 [ENGLISH] Your students have completed a survey you created (created with a common survey creation programme, e.g., Unipark, SoSci Survey) on prior knowledge. They look at the (unprocessed) results in the programme with the integrated tool for evaluating survey results. Which statement is true? Q46 [GERMAN] Ihre Schülerinnen und Schüler haben eine von Ihnen erstellte Umfrage (erstellt mit einem gängigen Programm zur Erstellung von Umfragen, z.B. Unipark, SoSci Survey) zum Vorwissen bearbeitet. Sie betrachten die (unaufbereiteten) Ergebnisse im Programm mit dem integrierten Tool zur Auswertung von Umfrageergebnissen. Welche Aussage stimmt?	A46.1 [ENGLISH] **Only numerically coded answers of the students (e.g., from a multiple-choice task) can be displayed in a diagram.** A46.1 [GERMAN] **Ausschließlich numerisch kodierte Antworten der Schülerinnen und Schüler (z.B. aus einer Multiple-Choice Aufgabe) können in einem Diagramm dargestellt werden.** A46.2 [ENGLISH] All students' answers can be listed, representations such as diagrams are not possible. A46.2 [GERMAN] Alle Antworten der Schülerinnen und Schüler können aufgelistet werden, Darstellungen wie beispielsweise Diagramme sind nicht möglich. A46.3 [ENGLISH] All students' answers, regardless of their coding, can be shown in a diagram. A46.3 [GERMAN] Alle Antworten der Schülerinnen und Schüler unabhängig deren Kodierung können in einem Diagramm dargestellt werden. A46.4 [ENGLISH] Only the students' text answers can be shown in a diagram. A46.4 [GERMAN] Ausschließlich die Textantworten der Schülerinnen und Schüler lassen sich in einem Diagramm darstellen.
TK47	TK32	-	Q47 [ENGLISH] To make your lessons more interactive, create a quiz in a common software or cloud-based audience response system (C-ARS; e.g., Mentimeter, Socrative, Kahoot!). Which statement about C-ARS is true?	A47.1 [ENGLISH] **Only the creator of the quiz can decide how many points are awarded per task.** A47.1 [GERMAN] **Nur der Ersteller des Quiz kann entscheiden, wie viele Punkte pro Aufgabe vergeben werden.**

			Q47 [GERMAN] Um Ihren Unterricht interaktiver zu gestalten, erstellen Sie ein Quiz in einem gängigen Software- beziehungsweise Cloud-basierten Audience Response System (C-ARS; z.B. Mentimeter, Socrative, Kahoot!). Welche Aussage zu C-ARS stimmt?	A47.2 [ENGLISH] The players of the quiz decide how many points are awarded per task. A47.2 [GERMAN] Die Spieler des Quiz legen fest, wie viele Punkte pro Aufgabe vergeben werden. A47.3 [ENGLISH] Points can only be awarded per task if all questions have been answered. A47.3 [GERMAN] Es können nur Punkte pro Aufgabe vergeben werden, wenn alle Fragen beantwortet wurden. A47.4 [ENGLISH] By standard, one point is awarded for each correct answer to a task. A47.4 [GERMAN] Für jede richtige Antwort zu einer Aufgabe wird standardmäßig ein Punkt vergeben.
TK48	TK33	-	Q48 [ENGLISH] You conduct a quiz with several groups of students who play against each other. You use a software or cloud-based audience response system (C-ARS; e.g., Socrative, Kahoot!). Which statement about C-ARS is correct? Q48 [GERMAN] Sie führen ein Quiz mit mehreren Schülergruppen durch, die gegeneinander spielen. Dafür nutzen Sie ein Software- beziehungsweise Cloud-basiertes Audience Response System (C-ARS; z.B. Socrative, Kahoot!). Welche Aussage zu C-ARS simmt?	A48.1 [ENGLISH] **Pictures and videos can be integrated into the questions.** A21.1 [GERMAN] **Es können Bilder und Videos in den Fragen integriert werden.** A48.2 [ENGLISH] Students must have C-ARS installed on their digital device (e.g., smartphone). A48.2 [GERMAN] Die Schülerinnen und Schüler müssen die C-ARS auf ihrem digitalen Endgerät (z.B. Smartphone) installiert haben. A48.3 [ENGLISH] Students must register with the C-ARS using their digital device (e.g., smartphone). A48.3 [GERMAN] Die Schülerinnen und Schüler müssen sich mit Ihrem digitalen Endgerät (z.B. Smartphone) bei dem C-ARS registrieren. A48.4 [ENGLISH] You can only set multiple-choice but not single-choice tasks. A48.4 [GERMAN] Sie können nur Multiple-Choice aber keine Single-Choice Aufgaben stellen.

Learning and Content Management Systems

TK49	TK34	-	Q49 [ENGLISH] Which function do you use if all your students should have the same dashboard structure on a common learning platform (Learning Management System; e.g., moodle)? Q49 [GERMAN] Welche Funktion nutzen Sie, wenn alle Ihrer Schülerinnen und Schüler bei einer gängigen Lernplattform (Learning Management System; z.B. moodle) dieselbe Struktur ihres Dashboards (dt. Armaturenbrett; Informationsmanagement) haben sollen?	A49.1 [ENGLISH] **I prohibit dashboard customisation for students using user rights and role settings.** A49.1[GERMAN] **Ich verbiete die Dashboardindividualisierung für die Schülerinnen und Schüler mithilfe der Rechte- und Rolleneinstellungen der Nutzer.** A49.2 [ENGLISH] I revoke students' write permissions. A49.2 [GERMAN] Ich entziehe den Schülerinnen und Schülern die Schreibrechte. A49.3 [ENGLISH] Nothing, as users of a common learning management system are not allowed to customise their dashboard. A49.3 [GERMAN] Nichts, da Nutzerinnen und Nutzer eines gängigen Lernmanagementsystems ihr Dashboard nicht anpassen dürfen. A49.4 [ENGLISH] Nothing, because I cannot limit the customisation options for students' dashboards. A49.4 [GERMAN] Nichts, da ich die Individualisierungsmöglichkeiten für die Dashboards der Schülerinnen und Schüler nicht beschränken kann.
TK50	TK35	TK24	Q50 [ENGLISH] You are working with a common learning platform (learning management system; e.g., moodle) in your class. Which function can you use to see which students are actively using the forum (e.g., writing three entries)? Q50 [GERMAN] Sie arbeiten in Ihrer Klasse mit einer gängigen Lernplattform (Learning Management System; z.B. moodle). Welche Funktion können Sie nutzen, damit sie Einsicht	A50.1 [ENGLISH] **I use the function to track learning progress (e.g., activity completion) and set/select criteria for active participation.** A50.1 [GERMAN] **Ich nutze die Funktion zur Verfolgung des Lernfortschritts (z.B. Aktivitätsabschluss) und setze bzw. wähle Kriterien für eine aktive Teilnahme.** A50.2 [ENGLISH] I use the function to create a portfolio (e.g., portfolio template) and set or select criteria for active participation.

			darin haben, welche Schülerinnen und Schüler das Forum aktiv nutzen (d.h. bspw. drei Einträge verfassen)?	A50.2 [GERMAN] Ich nutze die Funktion zum Anlegen eines Portfolios (z.B. Portfoliovorlage) und setze bzw. wähle Kriterien für eine aktive Teilnahme. A50.3 [ENGLISH] I use the function to create a test (e.g., test) and set or select criteria for active participation. A50.3 [GERMAN] Ich nutze die Funktion zur Erstellung eines Testes (z.B. Test) und setze bzw. wähle Kriterien für eine aktive Teilnahme. A50.4 [ENGLISH] I use the function to work on tasks (e.g., exercises) and set or select criteria for active participation. A50.4 [GERMAN] Ich nutze die Funktion zur Bearbeitung von Aufgaben (z.B. Übungen) und setze bzw. wähle Kriterien für eine aktive Teilnahme.
TK51	-	-	Q51 [ENGLISH] You work with a common learning platform (learning management system; e.g., moodle) in your lessons. You have discovered the function of adding links. Which statement about this function is true? Q51 [GERMAN] Sie arbeiten in Ihrem Unterricht mit einer gängigen Lernplattform (Learning Management System; z.B. moodle). Sie haben die Funktion entdeckt, Links zu hinterlegen. Welche Aussage zu dieser Funktion stimmt?	A51.1 [ENGLISH] **Only internal links can be created (i.e., links to elements within the learning platform).** A51.1 [GERMAN] **Es können nur interne Verlinkungen angelegt werden (d.h. Links zu Elementen innerhalb der Lernplattform).** A51.2 [ENGLISH] You can create internal and external links (i.e., links to elements inside and outside the learning platform). A51.2 [GERMAN] Es können interne und externe Verlinkungen angelegt werden (d.h. Links zu Elementen innerhalb und außerhalb der Lernplattform). A51.3 [ENGLISH] Only external links can be created (i.e., links to elements outside the learning platform). A51.3 [GERMAN] Es können nur externe Verlinkungen angelegt werden (d.h. Links zu Elementen außerhalb der Lernplattform). A51.4 [ENGLISH] Which links can be created depends on whether the learning platform was set up online or offline. A51.4 [GERMAN] Welche Verlinkungen angelegt werden können, hängt davon ab, ob die Lernplattform online oder offline aufgesetzt wurde.

TK52	TK36	TK25	Q52 [ENGLISH] You work with a common learning platform (Learning Management System; e.g., moodle) in your lessons. For uploading your newly created learning materials for your course, you are offered the "drag & drop" function. How do you proceed to use this function on your computer? Q52 [GERMAN] Sie arbeiten in Ihrem Unterricht mit einer gängigen Lernplattform (Learning Management System; z.B. moodle). Für das Hochladen Ihrer neu erstellten Lernmaterialien für Ihren Kurs wird Ihnen die "Drag & Drop" Funktion angeboten. Wie gehen Sie vor, um diese Funktion an Ihrem Computer zu nutzen?	A25.1 [ENGLISH] **I select the new learning materials with the mouse pointer (touch them), move them to the target area ("drag & drop area"), release them again and confirm the upload.** A52.1 [GERMAN] **Ich wähle die neuen Lernmaterialien mit dem Mauszeiger aus (anfassen), verschiebe diese in den Zielbereich ("Drag & Drop-Bereich"), lasse sie wieder los und bestätige das Hochladen.** A52.2 [ENGLISH] I select the new learning materials with the mouse pointer (touch), move them to the button "upload files", release them again and then click on the target area ("drag & drop area"). A52.2 [GERMAN] Ich wähle die neuen Lernmaterialien mit dem Mauszeiger aus (anfassen), verschiebe diese auf den Button "Dateien hochladen", lasse sie wieder los und klicke anschließend auf den Zielbereich ("Drag & Drop-Bereich"). A52.3 [ENGLISH] I click on the target area ("drag & drop area"), click on the button "upload files", select the new learning materials with the mouse pointer and confirm the upload. A52.3 [GERMAN] Ich klicke auf den Zielbereich ("Drag & Drop-Bereich"), klicke auf den Button "Dateien hochladen", wähle die neuen Lernmaterialien mit dem Mauszeiger aus und bestätige das Hochladen. A52.4 [ENGLISH] I click on the new learning materials with the mouse pointer, then click on the target area ("drag & drop area") and confirm the upload. A52.4 [GERMAN] Ich klicke mit dem Mauszeiger auf die neuen Lernmaterialien, klicke anschließend auf den Zielbereich ("Drag & Drop-Bereich") und bestätige das Hochladen.
TK53	TK37	TK26		A53.1 [ENGLISH] **In a learning management system, both user and teaching data (course data) are managed.**

	Q53 [ENGLISH] Which statement about common learning platforms (learning management systems; e.g., moodle) is true? Q53 [GERMAN] Welche Aussage zu gängigen Lernplattformen (Learning Management Systeme; z.B. moodle) stimmt?	A53.1 [GERMAN] **In einem Lernmanagementsystem werden sowohl Benutzer- als auch Lehrdaten (Kursdaten) verwaltet.** A53.2 [ENGLISH] All course participants must have the same roles and rights (democratic learning). A53.2 [GERMAN] Alle Kursteilnehmerinnen und Kursteilnehmer haben zwingend dieselben Rollen und Rechte (democratic learning). A53.3 [ENGLISH] In a learning management system, course content is displayed in a network-compatible browser and media is not displayed in the browser but in an external media player. A53.3 [GERMAN] Bei einem Lernmanagementsystem werden die Kursinhalte in einem netzwerkfähigen Browser und die Medien nicht im Browser sondern in einem externen Mediaplayer dargestellt. A53.4 [ENGLISH] In a learning management system, courses are also available offline, i.e., an internet connection is not absolutely necessary for use. A53.4 [GERMAN] In einem Lernmanagementsystem sind Kurse auch offline verfügbar, d.h. zur Nutzung ist eine Internetverbindung nicht zwingend notwendig.

Note. Correct responses are printed bold. Q = Question, A = Answer.

Online Supplement Material

S1. Additional Information on the Selection of 36 out of 53 Items

Table S1 provides an overview of all mean values, standard deviations, infit, and outfit values. Figure S1 shows the item characteristic curves (ICC) for all 53 items. Very easy and very difficult items are less frequent than items with a moderate difficulty. The participants' abilities were approximately normally distributed, with most persons having an ability between approximately -0.5 logits and 1.5 logits (see Wright map; Figure S2). Based on their in- and outfits, 17 items were excluded from which 7 belonged to generic technology and 10 items belonged to school-specific technology. Results of another Rasch model with the remaining 36 items revealed that infit and outfit values were in an acceptable range (between 0.7 and 1.3; Table S1), indicating that these items reflect a single underlying (unidimensional) construct. Item difficulties ranged from $\sigma_{TK5} = -1.81$ to $\sigma_{TK49} = 1.35$ (Table S1). Again, most of the items were moderate (Figure S3). The ICCs for all 36 items are shown in Figure S4.

The ICCs for all 37 items (i.e., 36 resulting items from the pilot study and one additional item, which we decided to keep for content reasons[1]) are shown in Figure S5. A visualization of the person abilities is provided in Figure S6 (Wright map). We identified another 10 items that did not fit the Rasch model well and that were thus excluded from the test. Also, another item was excluded after a renewed critical examination of the fit of the items to the content of the construct.

[1] *Content reasons* means that an item referring to functions like breakout rooms in video conferencing tools should be kept for the main study.

Table S1

Means, Standard Deviations, Item Difficulties and Infit and Outfit Statistics for the Pilot Study

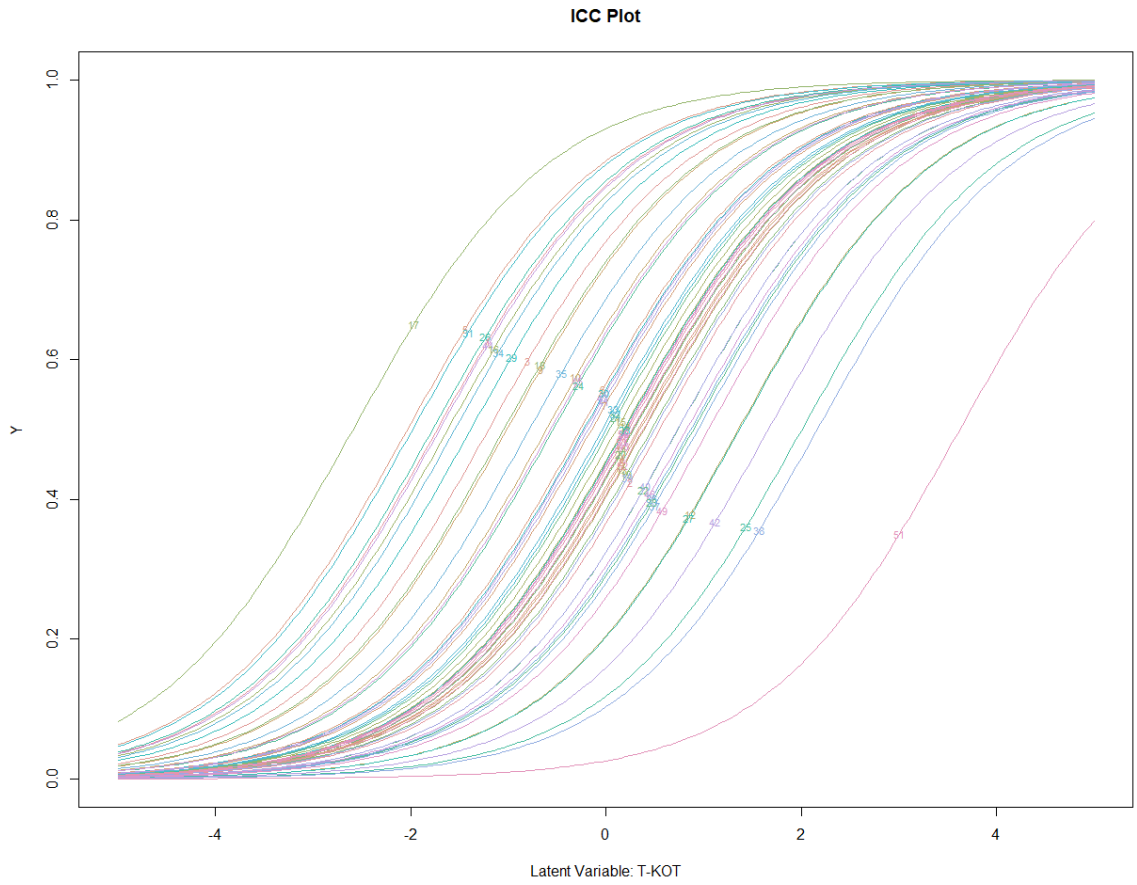
Item name	*n*	*M*	*SD*	53 items			36 items		
				σ	Infit	Outfit	σ	Infit	Outfit
TK1	268	0.90	0.30	-1.73	0.88	0.85	-1.50	0.88	0.92
TK2	268	0.54	0.50	0.55	0.99	0.98	0.82	1.01	1.03
TK3	268	0.85	0.36	-1.20	0.91	0.86	-0.97	0.90	0.83
TK4	268	0.59	0.49	0.33	1.04	1.03	0.59	1.08	1.10
TK5	268	0.92	0.27	-2.03	0.94	0.75	-1.81	0.95	0.75
TK6	232	0.71	0.45	-0.26	0.99	1.00	-0.01	1.02	1.06
TK7	232	0.69	0.46	-0.15	1.14	1.16	-	-	-
TK8	232	0.59	0.49	0.35	0.94	0.90	0.61	0.95	0.90
TK9	232	0.83	0.38	-1.02	0.93	0.83	-0.78	0.94	0.89
TK10	209	0.78	0.42	-0.61	1.06	0.96	-0.37	1.09	0.97
TK11	207	0.61	0.49	0.28	0.85	0.79	0.54	0.86	0.77
TK12	207	0.38	0.49	1.36	0.97	1.13	-	-	-
TK13	207	0.59	0.49	0.39	0.97	0.93	0.66	1.01	0.96
TK14	207	0.63	0.48	0.18	0.92	0.92	0.44	0.93	1.01
TK15	203	0.65	0.48	0.11	1.01	0.98	0.37	1.02	1.01
TK16	203	0.90	0.31	-1.62	0.85	0.76	-1.41	0.86	0.76
TK17	203	0.96	0.21	-2.59	0.75	0.27	-	-	-
TK18	203	0.84	0.37	-1.05	0.93	0.83	-0.82	0.96	0.92
TK19	203	0.58	0.50	0.47	1.00	0.98	0.74	1.05	1.04
TK20	200	0.62	0.49	0.29	1.00	0.99	0.55	1.01	0.99
TK21	200	0.66	0.47	0.04	0.91	0.88	0.29	0.95	0.99
TK22	200	0.52	0.50	0.73	0.94	0.90	1.01	0.98	0.91
TK23	200	0.48	0.50	0.90	1.17	1.19	-	-	-
TK24	193	0.77	0.42	-0.54	0.99	0.92	-0.30	1.02	0.95
TK25	193	0.26	0.44	2.01	1.02	1.16	-	-	-
TK26	193	0.91	0.28	-1.78	0.86	0.79	-1.57	0.86	0.86
TK27	193	0.39	0.49	1.37	1.11	1.26	-	-	-
TK28	190	0.64	0.48	0.19	1.04	1.10	0.46	1.10	1.21
TK29	190	0.88	0.33	-1.39	0.93	1.04	-1.17	0.93	1.03
TK30	190	0.72	0.45	-0.23	1.06	1.18	-	-	-
TK31	190	0.93	0.26	-1.98	0.88	0.80	-1.77	0.89	0.96
TK32	190	0.68	0.47	0.00	1.06	1.09	0.26	1.08	1.26

TK33	186	0.68	0.47	-0.04	1.06	1.16	-	-	-
TK34	186	0.89	0.31	-1.55	0.83	0.88	-1.33	0.85	0.98
TK35	186	0.81	0.40	-0.79	1.01	1.01	-0.55	1.02	1.14
TK36	186	0.49	0.50	0.87	1.05	1.12	-	-	-
TK37	186	0.48	0.50	0.94	1.03	1.03	1.23	1.07	1.11
TK38	186	0.24	0.43	2.17	0.98	1.16	-	-	-
TK39	178	0.57	0.50	0.50	1.01	1.03	0.78	1.07	1.09
TK40	178	0.52	0.50	0.73	1.00	0.99	1.02	1.02	1.02
TK41	178	0.71	0.46	-0.18	0.97	1.19	-	-	-
TK42	178	0.33	0.47	1.66	1.17	1.43	-	-	-
TK43	178	0.71	0.45	-0.21	1.05	1.11	-	-	-
TK44	178	0.90	0.29	-1.70	0.75	0.39	-	-	-
TK45	170	0.77	0.42	-0.57	0.77	0.69	-	-	-
TK46	170	0.50	0.50	0.83	1.13	1.20	-	-	-
TK47	170	0.63	0.48	0.21	0.93	0.91	0.48	0.94	0.89
TK48	170	0.62	0.49	0.27	0.89	0.82	0.54	0.93	0.85
TK49	166	0.45	0.50	1.05	1.07	1.10	1.35	1.11	1.19
TK50	166	0.63	0.48	0.21	1.04	1.02	0.47	1.07	1.08
TK51	166	0.07	0.26	3.63	1.18	4.66	-	-	-
TK52	166	0.60	0.49	0.38	0.85	0.82	0.65	0.86	0.90
TK53	166	0.63	0.49	0.24	0.98	0.94	0.50	1.03	0.99

Note. σ = Item Difficulty; Infit = Weighted-Mean-Square-Statistic; Outfit = Unweighted-Mean-Square-Statistic; - = Item was excluded as part of the pilot study.

Figure S1

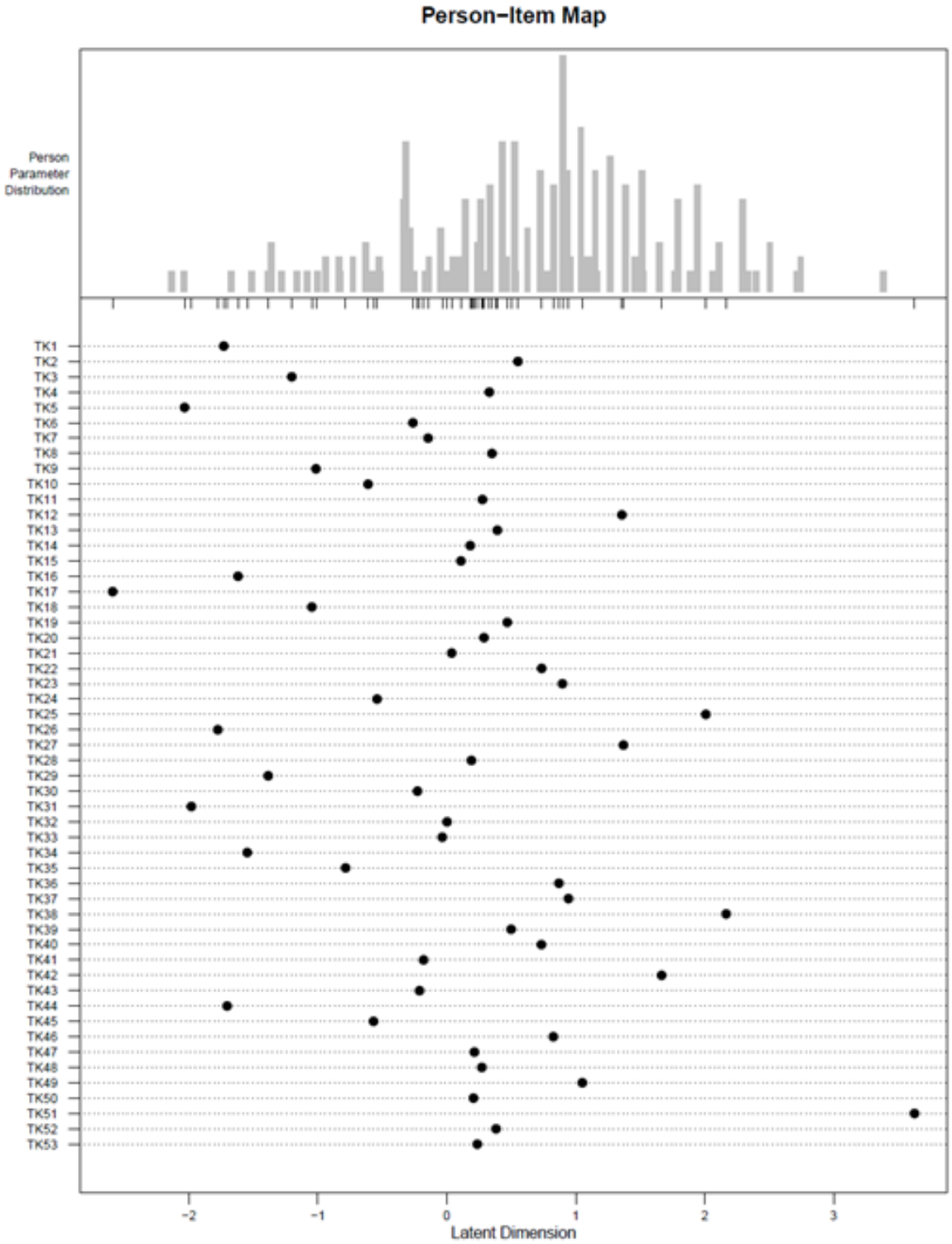
Item Characteristic Curves for the Test Version with 53 Items



Note. On the x-axis, the person's ability is mapped. On the y-axis, the probability of solving an item is depicted. The point at which the probability of solving an item correctly is 0.5 represents the item difficulty.

Figure S2

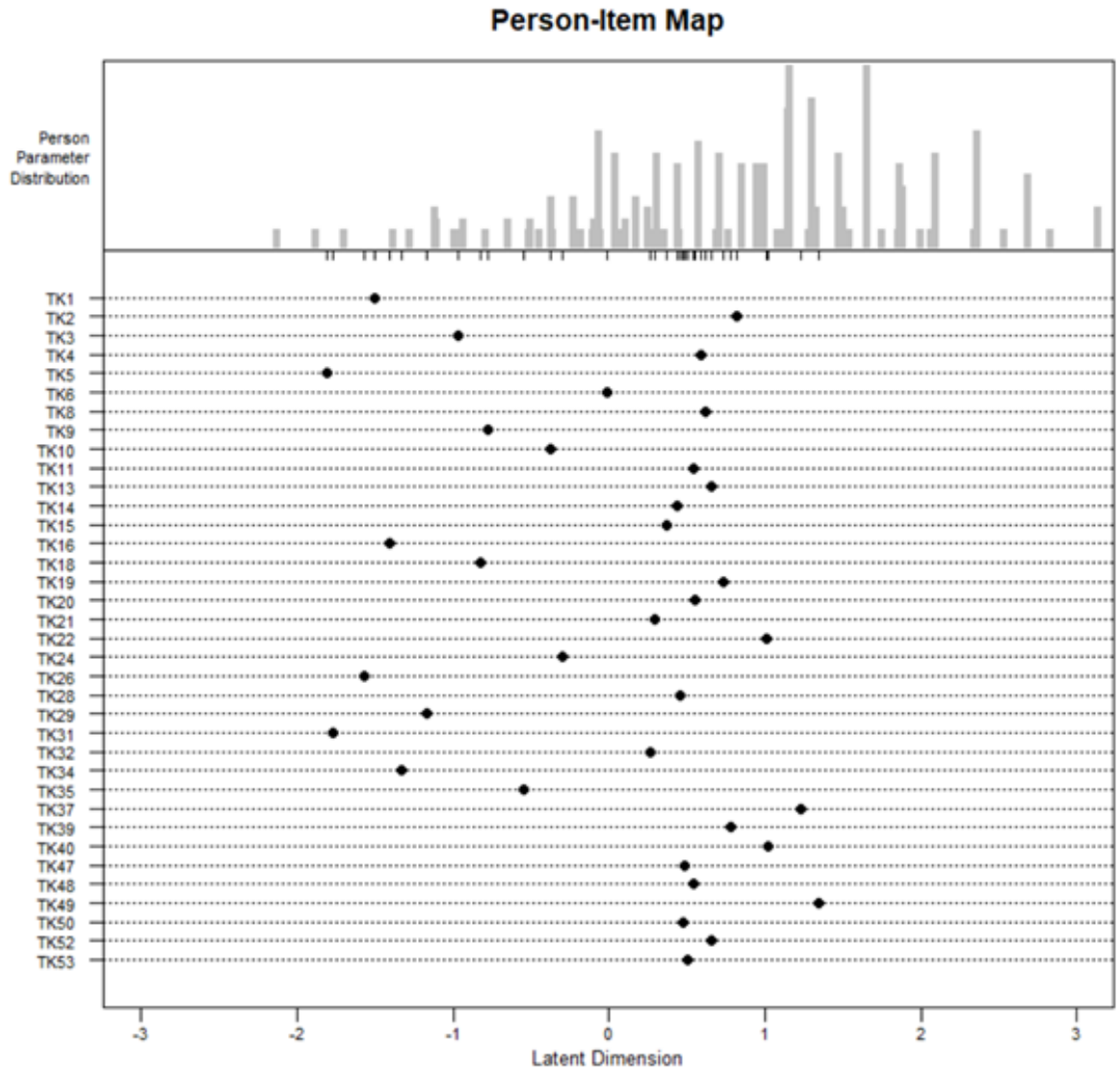
Wright Map of the Test Version with 53 Items



Note. The columns in the upper part of the figure describe the distribution of participants knowledge organized from lowest knowledge (left side) to highest knowledge (right side). The dots represent the item difficulties from most easy (left side) to most difficult (right side).

Figure S3

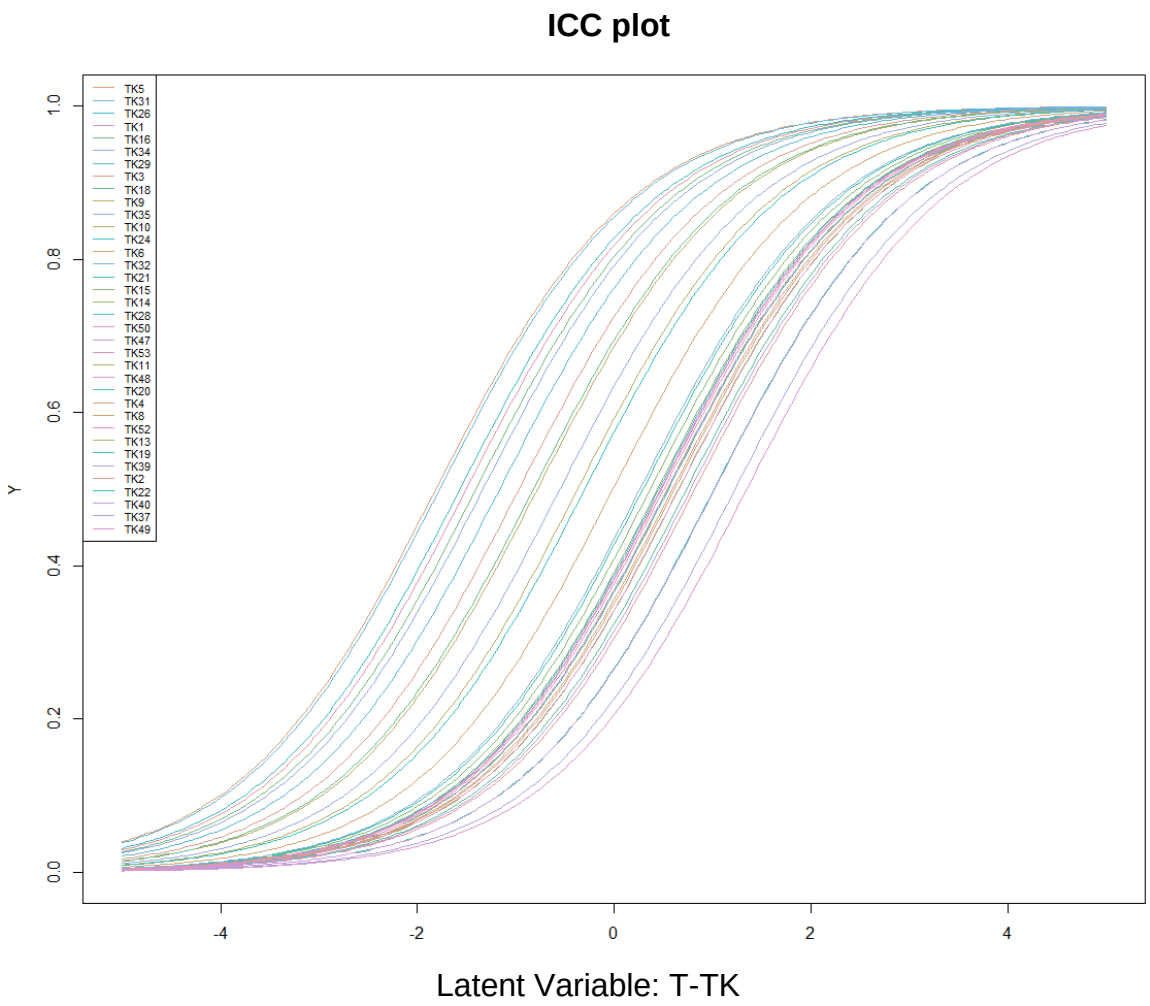
Wright Map of the Test Version with 36 Items



Note. The columns in the upper part of the figure describe the distribution of participants' knowledge organized from lowest knowledge (left side) to highest knowledge (right side). The dots represent the item difficulties from most easy (left side) to most difficult (right side).

Figure S4

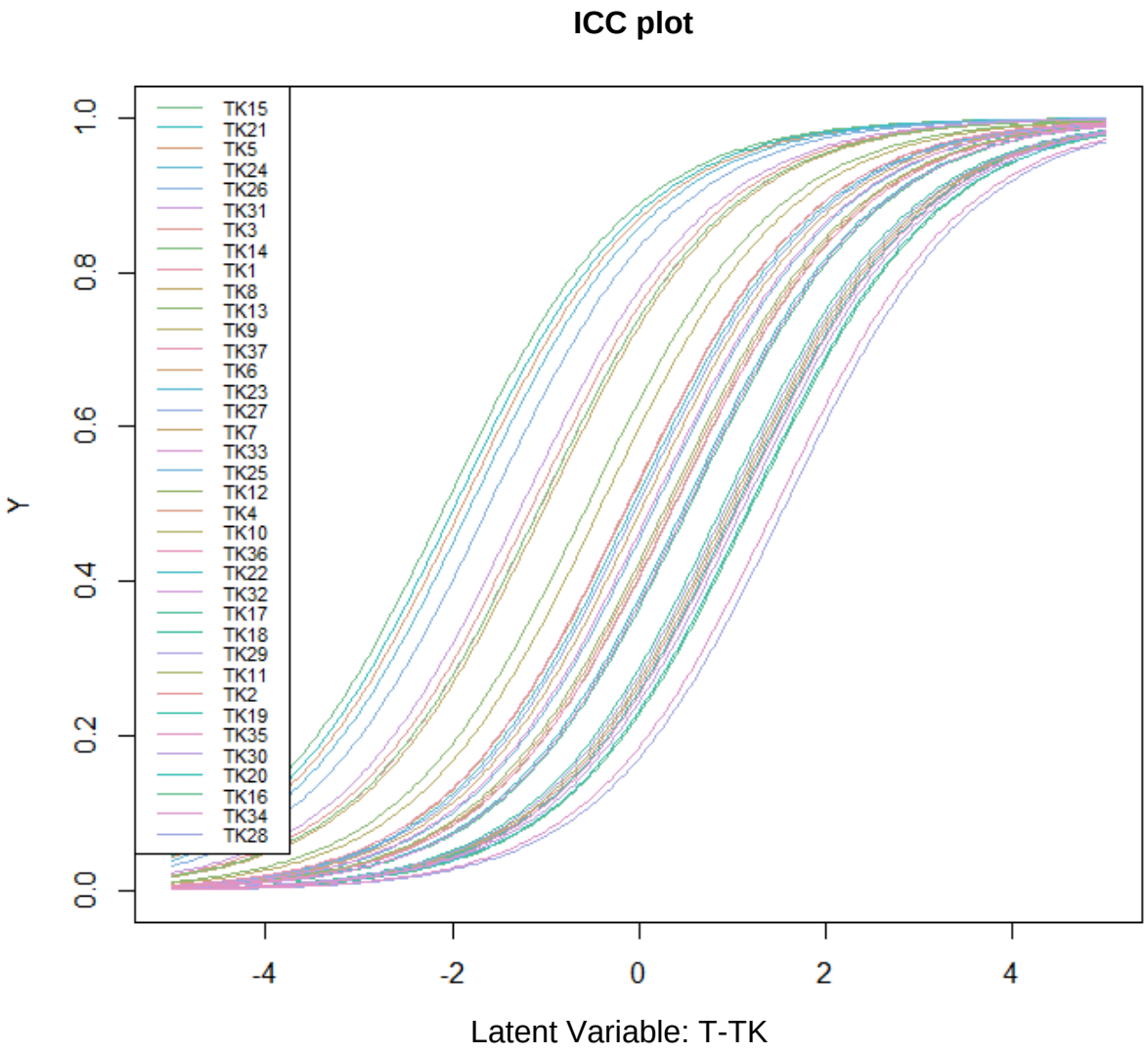
Item Characteristic Curves (ICC) for the Test Version with 36 Items



Note. On the x-axis, the person's ability is mapped. On the y-axis, the probability of solving an item is depicted. The point at which the probability of solving an item correctly is 0.5 represents the item difficulty.

Figure S5

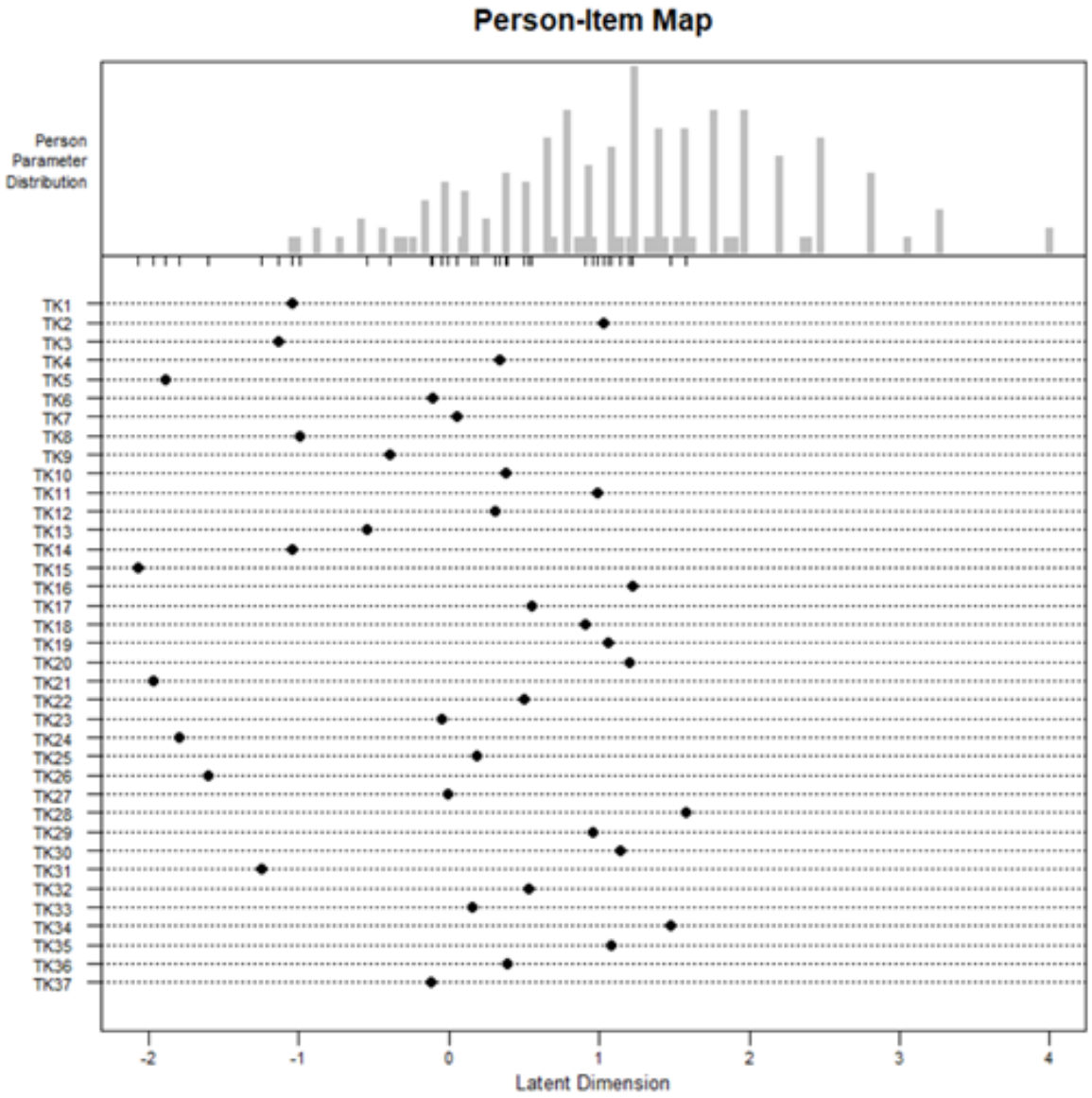
Item Characteristic Curves (ICC) for the Test Version with 37 Items



Note. On the x-axis, the person's ability is mapped. On the y-axis, the probability of solving an item is depicted. The point at which the probability of solving an item correctly is 0.5 represents the item difficulty.

Figure S6

Wright Map of the Test Version with 37 Items



Note. The columns in the upper part of the figure describe the distribution of participants knowledge organized from lowest knowledge (left side) to highest knowledge (right side). The dots represent the item difficulties from most easy (left side) to most difficult (right side).