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ORIGINAL PAPER



Digital Transformation of Corporate Technical Education and Training – A Case Study on Instructional Designers´ Perceptions

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Abstract

This article explores the perspective of instructional designers on the digital transformation of corporate technical education and training. It draws on "episodic narrative interviews" conducted with the learning and development department of a for-profit company in the manufacturing sector to investigate their perceptions of digital transformation. We examine the working structures of the studied company, elaborate on their perceived challenges and needs, and highlight our position on future implications for corporate technical education and training. The case study improves the quality of practice within professional education by pointing out necessary considerations about communication, the instructional design process, job descriptions, digital learning products, and the target group's attitude towards digital teaching and learning. Our results support companies, learning and development departments, and everyone related to corporate technical education and training in developing concepts for professional education programs or contributing with further best practices.

Keywords Case study design · Episodic narrative interviews · Digital transformation · Lifelong learning · Instructional design

The last decade has seen increased research on the transformation of learning environments. Since 2020, researchers have added various discussions about the impacts of the COVID-19 pandemic. Yet, most of the literature focuses on topics related

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to academia understood strictly, such as teachers' and students' perceptions and skills, or benefits, challenges, and effects of instruction in compulsory and higher education (HE) (Alenezi, 2023; Dubey & Pandey, 2020; Evans-Amalu & Claravall, 2021; Rapanta et al., 2021; Sailer et al., 2021; Scully et al., 2021). Concurrently, the corporate environment has faced a similar digital transformation of learning and development (L&D) (Nissinen et al., 2023; Sousa & Rocha, 2019; Vey et al., 2017; Virolainen et al., 2021). Training has been conducted digitally to an increasing extent, which poses challenges for L&D among technical professionals, who primarily benefit from hands-on activities (Billett, 2010). Consequently, the topicality of digitalizing corporate learning environments has gained interest (Schoop, 2023; Sousa & Rocha, 2019). In line with this evolution, research mainly contributed to evidence of implementing digital learning (Kerres & Buchner, 2022; Schoop, 2023). Nonetheless, it is rare to find literature describing the transformation processes regarding instructional design (ID) practices and how they impacted instructional designers (IDs). Hence, this article expands on the growing research interest by adding the IDs' perspectives through a case study from the corporate technical field.

This article first reports on the digital transformation and ID in corporate L&D found in relevant literature focusing on technical professions. It will then introduce the methodology used. Afterward, in the results section, the study's subjects' opinions are outlined, delineating them from the final discussion and the researchers' conclusions.

Literature Review

Digital Transformation and Instructional Design in Technical Education and Training

Besides salary, L&D is a critical driver of a company's competitiveness (Schoop, 2023). Therefore, companies broaden their training programs to serve an increasing number of learners. They either employ L&D staff or pay to outsource training. Even though learning through practice has been and still is the predominant form of re- and upskilling for occupations across the globe (Billett, 2010), companies also purchase new technologies to continue investing in virtual training (Freifeld, 2022; Nissinen et al., 2023; Schoop, 2023). On that note, a massive amount of literature in different educational contexts, though mainly related to studies based in academia, focuses on the advantages of digital learning. Among other benefits, it highlights the flexibility and on-demand access to learning material or the facilitation of the material via learning management systems (LMS) (Gegenfurtner et al., 2020; Schoop, 2023; Sousa & Rocha, 2019). Despite the benefits, during the pandemic, the digital shift forced learners into online learning, who then perceived the new way of learning negatively. Negative perceptions were mainly linked to emergency-remote teaching (ERT), not necessarily the quality of digital learning products (Rapanta et al., 2021). In corporate environments, digitally realizing training is predominantly based on economic advantages. ERT also prioritized efficiency over motivational ID, causing ongoing hesitance toward digital learning due to past negative experiences despite a

now stabilized situation (Ferri et al., 2020; Polikarpus et al., 2023). However, learnings from ERT emphasize the importance of adapting digital learning and facilitating good learning experiences rather than abandoning learning in a digital environment (Clark et al., 2022; Rapanta et al., 2021). To do proper justice economically and pedagogically, it is essential to consider ID, which aims at a context-specific didactical approach (Rapanta et al., 2021).

ID considers systematic guidelines centering on didactics in producing and facilitating training and instruction, like analyzing, planning, developing, implementing, and evaluating (Branch, 2009; Niegemann, 2020). Research demonstrates that wellplanned ID is crucial because it significantly enhances learner motivation and satisfaction, leading to a higher likelihood of future course enrollment, regardless of the ID method used; this is particularly important in diverse learning environments where tailored ID can address varied learner needs effectively (Giasiranis & Sofos, 2020).

Following up on the digital transformation, a concerning trend in technical education is the widening gap between newcomers to the workplace and experienced professionals, leaving behind essential knowledge and skills that must be preserved (Fishman, 2016; Kohlbacher, 2007). Examining countries like Japan and Israel underscores the urgency. In Japan, recognizing challenges, they respond with corporate universities and knowledge preservation (Kohlbacher, 2007). Israel addresses the issue with government decisions by the prime minister aiming to have 48% of all high-school students in technological-vocational tracks. They recognized the influence of technological-vocational education in satisfying the economy (European Training Foundation, 2018). On that note, the shortage of skilled engineers and technicians (Schoop, 2023) accounts for upskilling in technical professions across the globe. On the one hand, adaptive learning has shown positive results, including reduced failure rates and increased user satisfaction in studies of adaptive engineering mechanics tutorials (Prusty & Russell, 2011; Prusty et al., 2011). These successes suggest that adaptive learning in engineering represents an innovative advance in educational research in the future (Clark et al., 2022). Organizations such as the National Academy of Engineering and the Massachusetts Institute of Technology reinforce significant benefits for technical professions (Clark et al., 2022; Graham, 2018). On the other hand, digital learning has proven effective in accelerating the upskilling process for professionals (Koh & Daniel, 2022). Shafieek et al. (2024) found the value of incorporating digital learning content in addition to conventional learning methods in automotive technology programs. Focusing on the technical content, in this study, digital learning effectively facilitated the learning process (Shafieek et al., 2024). Regardless of whether training is conducted online or in person, ID focuses on adaptivity and learner centration, meaning that learning environments must include context- and subject-related characteristics (Poon, 2013).

Despite these benefits, digital transformation is reported to pose challenges for educators in technical education. Besides the new structures and ways of implementation accompanied by the resistance of the learners and a missing interaction, educators are confronted with new competence areas. Several studies highlight the lack of digital competence in the sense that educators are not yet well prepared for the creation of digital learning (Lyngdorf et al., 2024; Makarova et al., 2021; Mondragon-

Estrada et al., 2023). Gumaelius (2024) indeed highlights the extreme push for new competencies due to digital transformation but points out that digitizing technical education in the industry is much faster than in HE contexts.

Corporate Instructional Design Practice

ID programs in HE prepare IDs that can be understood as educators for their jobs, with syllabi traditionally focusing on teaching systematic ID models. This approach is criticized as it lacks adequate preparation for ID tasks (Brown & Green, 2018; Stefaniak & Hwang, 2021; Tracey et al., 2022). This is reinforced by IDs in the corporate context who perform tasks regardless of whether their degree is related to ID (Giacumo & Breman, 2021; Villachica et al., 2010). Working processes are shaped by individual factors and the characteristics of their environment (Villachica et al., 2010). ID tasks typically evolve around analysis, like conducting needs analyses, design, such as writing course assessment and evaluation plans, development in creating instructional materials, implementation in terms of teaching or its monitoring, and evaluation by testing the usability. Even though the literature on ID outside school and HE contexts is scarce, prior research reveals that IDs in corporate environments are involved in other tasks, and some skip various common activities mentioned in ID theory, leading to a misfit of the actual practices and the expectations of employers (Stefaniak et al., 2020; Villachica et al., 2010). Additionally, seasoned IDs with years of experience working in companies utilize the strategies they have already successfully applied rather than, in their view, abstract approaches to ID theory (Yanchar et al., 2010). Ultimately, they develop ad-hoc procedures to create training and instruction, which leads to poor ID of learning products. Despite following concrete ID processes and meeting the expectations of employers (Stefaniak et al., 2020; Villachica et al., 2010), rapidly digitizing content with limited resources brought and still brings along challenges for IDs. Rapanta and colleagues (2021) highlight with their study on post-pandemic challenges for HE that the negative experience with ERT in recent years led to learners' attitudes characterized by resistance to the use of digital learning products. While, again, literature with corporate insights is limited, the economic pressure from the employer side to realize L&D purely digitally increases stress on IDs even more. It is yet to be investigated how exactly the digital transformation of learning influences ID and the work of IDs.

Purpose and Goal of the Study

While the literature related to the digital transformation of learning, even focusing on technical professions, is massive, studies on corporate technical education and training are rare. Here, case studies presented evidence highlighting that digital learning was successfully employed in corporate contexts. Nonetheless, these cases never go beyond the presentation to the description of how learning was transformed. Thus, we could not find studies within the digital transformation of learning environments and the resulting ERT that represented the IDs' perspective on the changes in their work. Given the difficulties associated with corporate L&D practices focusing on

technical content and the heterogeneity of working structures, this study will contribute to the field with a case study.

Some scholars believe case studies are vital for research and practice (Oswald & Reigeluth, n.d.). Sharing expertise and best practices, as done in a case study, can lead to increased profit, cost reduction, and time savings (Patel et al., 2012). Therefore, real examples can support practitioners who seek to transform L&D by building on the lessons learned (Giacumo & Breman, 2021; Stefaniak et al., 2020). While case studies are rare in this field, it is essential to have researchers and practitioners collaborate to develop research by presenting insights into practice (Oswald & Reigeluth, n.d.). Given the fact that IDs in the corporate contexts are supposedly determining their own ID process, the insights will bring along specific tasks, experiences, and future considerations that can be put into practice immediately. On top of that, the results of this case study can be a starting point for developing and adapting programs for IDs to better match the requirements of corporate workplaces, starting with digitalizing technical education.

As researchers have highlighted some challenges for IDs, we strive to illustrate the perceptions of IDs contributing to corporate technical education and training (CTET) in a for-profit company and elaborate on future implications for ID development. This will include a description of the case study's working structures, answering the lack of specific cases, narratives of challenges and needs, adding to the research findings, and finally, interpretations of practical applications for future implications. To achieve this research aim, we frame the following research questions:

- 1) Which stakeholders are involved in corporate L&D projects to train technical professionals, and what are the stakeholders' responsibilities?
- 2) How do corporate IDs perceive their work in L&D projects during the digital transformation of CTET?
- 3) What future implications of CTET can be derived from the faced challenges and addressed needs of corporate IDs?

Methods

Sample Description

This case study focuses on the stakeholders of a German for-profit company's L&D projects in the manufacturing sector. The company is kept anonymous in this article. The heterogeneous sample consists of twenty-two company employees. Their work experience with digital learning ranges from three to 30 years because of different tasks and backgrounds.

Research Design and Data Collection

The case study follows a qualitative research design. Coming from a constructivist research paradigm, this approach supports the heterogeneous distribution of the participants, whose individual perspectives are the center of this research (Cobern, 1993). It additionally respects a specific period of digital transformation. Therefore, a semi-structured method of collecting individual perspectives through storytelling for a specific period was required (Mueller, 2019). To address these requirements, episodic narrative interviews were held. This research method encounters a semi-structured interview guide with questions for participants' narrative storytelling around one phenomenon, focusing on a specific period (Mueller, 2019). Table 1 demonstrates the adaptions of Mueller's (2019) approach to fit our case study. In our approach, the digital transformation of L&D was centered on. The participants were asked to describe a specific L&D project, including challenges and lessons learned. To align with the idea of interviewing, several predefined questions were only addressed if not mentioned in the storytelling or if further narration was necessary (Küsters, 2022).

Consent for data collection was obtained in written form from the company and verbal form from each participant. The interviews were facilitated online with the software Zoom due to the participants' geographical distribution, and a single researcher held them. They took place from July to September 2023, and each interview lasted between 25 and 55 min. All interviews were audio recorded. For automatic verbatim transcription, the software AmberScript was utilized. The original audio and transcripts were only seen by the interviewer, who deleted all confidential information.

Researcher Positioning

The interviewer was a prior employee who had experienced the digital transformation in the company. This background knowledge supported the access to the participants and understanding of the context. Despite the limitations associated with convenience sampling, participants familiar with the interviewer reported feeling

Table 1Comparison of episodicnarrative interview approaches	Step	Summary Mueller (2019)	Summary of own approach
	1. Select a phenomenon of interest	Identification of spe- cific phenomenon	Phenomenon: Digi- tal transformation of CTET
	2. Describe inter- view process	Outline of interview structure and process	Outline of interview structure and process
	3. Definition of phenomenon	Participants' defini- tions/descriptions of the phenomenon	Interviewer's outline of the phenomenon and participants'
	4. Request: story about an episode	Participants' stories about a specific, bounded episode	description of digital transformation in their company including timeline
	5. Request: story about the phenomenon	Participants' stories about the phenomenon within the episode	Participants' percep- tions of one project within the episode
	6. Additions or amendments	Opportunity for addi- tions or amendments to any parts of the narra- tive shared	Participants' conclu- sion of their work and further topics

comfortable answering the questions. Knowing each participant's background and pain points allowed the interviewer to enhance sensitivity.

Data Analysis

The analysis had a thematic nature and a combination of deductive and inductive coding procedures. The analysis was performed with the software MAXQDA following a semantic approach, thus coding the participant's opinions (Braun & Clarke, 2012). The coding scheme was based on the working structures of IDs and the challenges of working in CTET described in the literature review, thus aiming to answer the first two research questions. We predefined three meta-themes and created codes according to the challenges and needs mentioned in the literature review, dividing the meta-themes into distinct aspects. The meta-themes were *A: Description of the Case Study and its Working Structures, B: Perceptions of the Working Structures in the Context of CTET*, and *C: Perceptions of the Digital Transformation of CTET*. An insight into the deductive and inductive coding in meta-themes B and C can be found in Table 2.

After familiarizing with the transcripts, one researcher coded deductively, highlighting each complete statement mentioning one or more of the predefined codes. Afterwards, we used an inductive coding procedure. Here, we coded each sentence, looking for additional information not considered in the deductive procedure. Each new challenge or need was coded and grouped in one of the meta-themes, respectively. The thematic nature of the findings excludes statements of quantities and relations.

Trustworthiness of Coding and Analysis

Several analysis activities were performed to resolve concerns of subjectivity. As the coding was done mainly by one researcher, we applied intra-coder training after completing the codebook for three interviews to ensure that the coder coded the three interviews with a satisfying agreement twice. After the researcher had coded all interviews, the second coder read all transcripts and proceeded with the coding. We checked for inter-coder reliability for meta-themes B and C with 20% of the total interviews and received consent of 25%. As the agreement was not satisfying, we reconsidered the coding guidelines and checked for inter-coder reliability with another 20%. We received strong consent (K=0.81; CI 95%)(McHugh, 2012).

Illustrative anonymized quotes were selected for this article. Some quotes are revised to ensure reading flow and grammatical correctness without affecting the quotes' meaning. In the following, we will use pseudonyms for the participants. As the interview and script language were German, two researchers performed reverse translation with ChatGPT to ensure the accuracy and trustworthiness of the reported results.

Meta-theme	Theme	Coding	Description	Example
Perceptions of working structures in the context of the CTET	Perceived challenges	Understand- ing of own role (i)	Statements on the responsibili- ties of they own roles	"My role and task in this was to receive the content as a Power- Point presentation and convert it into a learning product, making it SCORM-compliant and capable of integration into an LMS, using a Learning Authoring Software."
		Expectations of other's role (d)	Statements on the expectations of other's roles	"The quality of the content is unrelated to the media produc- tion. It only involves executing the recipe, adhering to the instructional designer's guidance, and presenting the content as created by the SME."
	Addressed needs	Improve internal communica- tion (i)	Suggestions or positive experience on how to improve communicational challenges	"Exchange was key, as there were many discussions and collaborative sessions where we talked exten- sively about it."
		Keeping working structures agile (i)	Suggestions or good experi- ence of the role distribution	"Addressing the personal strengths and weaknesses of someone makes sense."
Perception of Digital Transfor- mation of CTET	Perceived challenges	Digital learning for technical professions (d)	Challenging parts or aspects of digital learning products	"When you create a digital product, you lack additional information."
	Addressed needs	Analyzing target group needs (d)	Suggestions for changes or behavior towards the target group	"I use and will use the tools that are certainly available to the target audience."
		Overcom- ing external restrictions (i)	Suggestions and implications for changing the mindset towards profitability	"Trying out things, even if one fails, is important. But then, new paths and possibilities may open, and I do not lose touch with society."

Table 2	Coding	scheme
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Notes. d=deductive coding, i=inductive coding

Findings

Ultimately, our results include a description of the working structures, divided into stakeholders and their workflow, and the participants' perceptions of these structures and the digital transformation of CTET.

Meta-Theme 1: Description of the Case Study and its Working Structures

L&D was described as mainly taking place in one department of the company. Of 22 participants, 19 were L&D department employees, and three were from other departments. The department has worked together for three years, starting in April 2020, and has joined employees with different roles and responsibilities. In their workflow,

existing training presentations or new training material was digitalized. They served two target groups: internal company employees and external customers. The department built its working structures from scratch. Additionally, the department collaborated with other companies for educational purposes, like administration, content creation, media design, and evaluation or testing. As Peter reports:

"We established three task forces. The first one focused on portfolio management, specifically strategic portfolio management. The goal was to take our range of products and tailor them to specific target groups, shifting from breadth to depth. We realized at some point that our portfolio was too broad and lacked a coherent identity or attitude. Therefore, we needed to align the portfolio with specific target groups and refine it accordingly. The second task force dealt with processes, particularly those that needed to adapt as we moved more towards a business-focused approach. The third, and arguably the most crucial task force, was market and business development, with the mission to sell. Since we did not have salespeople to do this for us, we took on the task ourselves."

Focus areas and the workflow determine the working structures of the case study. Nevertheless, the participants reported being flexible in following the workflow and sticking strictly to one focus area.

Focus Areas

Management. The management team took care of strategic and operational management. Together with the head of the department, two team leads managed personal matters of two sub-teams: technical training and media production. Three additional managers reported to the head of the department while focusing on different areas. These areas were conceptualizing and delegating the production of onboarding interventions for the company's sales and service employees, cooperating with clients, educational partners, and universities, scouting for technology, and engaging in public relations. The management team was responsible for project management, including calculating the timeframe, coordinating stakeholders, distributing tasks and material, collecting feedback, and marketing.

Media production. Seven of the 22 participants described their role as responsible for conceptualizing, designing, creating, and authoring learning products with different focuses – four focus on eLearning courses, one on video, and two on XR products like apps. The participants reported that they had determined one person's role as ID, who was not a subject of the study.

Technical training. Four participants defined their roles as technical lead trainers, providing classroom training for learners, each focusing on a different system. Additionally, they supported the media production team as SME. Two additional participants administered the LMS.

Subject-matter experts. Three employees from different departments functioned as SMEs, also called content owners, thus providing technical expertise to produce learning products.

Workflow	Order clarification	Content creation	Media production	Further steps
Involved stakeholders	Project managers, Clients	SME, Technical trainers, Media producers in video & XR, IDs	Media producers	Media producers, Training administrators, Technical trainers, Project managers, IDs

Table 3 Description of the case study's working structures

Workflow

Several focus areas worked together for each learning product (Table 3). The workflow was based on the development of these products. This product life cycle is the fundament of the workflow's description.

Order clarification. Every learning product started with a request from either external stakeholders or the management team. External requests came from the heads of other departments, the human resources (HR) department, departments implementing new processes, or customers.

Content creation. SMEs and technical trainers created content, most of the time in a PowerPoint presentation format. This could include slides with text and pictures, videos, and audio transcripts. In addition to these materials, videos were recorded, and compatible material for XR products was gathered. The ID person supported the workflow step.

Media production. Media producers, especially those responsible for eLearning, transferred the given content into an authoring tool, creating a SCORM file from the presentation. Additionally, audio files were created from a script.

Further steps. Several further steps were applied after media production was completed. There was external proofreading, testing, implementing feedback, product release, implementation, and sales. While media producers adapted the products accordingly, training administration managed the learners' access, technical trainers held training, and project management focused on coordination and releasing the product.

Meta-Theme 2: Perceptions of Working Structures in CTET

Perceived Challenges of Working Structures

Lack of exchange while working in focus groups and project teams. The participants stated that collaborating with colleagues was challenging as an exchange between groups and individuals was missing. Bruno described missing the department's expectations regarding the level of detail when he was onboarded as an SME. Nina noted that revisions she had to implement in a training program in which someone else created each module resulted only from a missing exchange.

Understanding and expectations of roles. The participants had different understandings of their roles and expectations of the roles of others. For exemplary reasons, we will compare the statements of an SME and the media producers. The SME reported:

"As a content owner, my role was to organize the information for the training program so that the department could transform it into an engaging format and create the training materials. I gathered the relevant information needed for the training to convey the knowledge effectively, initially compiling it into a rudimentary PowerPoint presentation with some images to make it understandable for the department. The department then refined and developed the content to make it more suitable for training purposes and more engaging. Essentially, I collected the information that was to be included in the training."

While the media producers aligned with the statement of the SME in terms of working together by receiving a PowerPoint presentation and transforming it into a learning product, one producer argues that when creating training, "you have to know what you are talking about; otherwise, you cannot present it, you can merely copy the PowerPoint slides."

Establishing a uniform process. Although great efforts were made to create a uniform process and many participants were involved, the participants described the lack of routine and the fact that the workflow had yet to be established. They also found it difficult to gain recognition for the process among those not involved in its creation. For example, Alex, who was not included in considerations about the workflow, added that the major problem was not the process itself; the focus was on the concepts and creating a process, not on implementing training.

Addressed Needs for the Working Structures

Increase collegial exchange. The participants emphasized the need for intensified exchange. From the participants' perspective, collegial exchange would primarily improve the work atmosphere, which would subsequently help to improve product quality. As media producer Tina describes:

"Well, you got this PowerPoint, and then it was a matter of making something out of it! I always wished that we could work more as a team, discuss how we wanted to prepare certain learning products and present them well, and whether we could perhaps make something better out of the framework we were given."

Breaking up rigid work structures. Among the participants, there was a need for a balance between structure and flexibility. While all employees should clarify and understand all responsibilities, the department needs flexibility in allocating these responsibilities. Management should not only decide but impose assignments based on strengths, weaknesses, preferences, willingness to invest time, and experience. Two media producers elaborated on their positive experience creating content for an eLearning course, although their roles were limited to media production.

Establishing an agile instructional process. In addition to the request to put the concepts into practice, requested from the participants not integrated into creating a

uniform process, there was a concrete need from those integrated to keep this process agile. Elena states: "Then you do not have to run the process so strictly, but perhaps omit certain steps or integrate others."

Increase external exchange. In addition to the needs geared toward the challenges of the working structures, there was a need to look beyond the department's boundaries. One media producer with years of experience developing, creating, and using digital learning pointed out that the management team emphasized digital transformation but focused less on didactical models for digitization. Further, the management team desired to learn how other companies work in corporate education. For this reason, an eLearning product from another company was purchased, aiming "to learn from a professional company about how they approach product development." In addition to cooperating with other companies, Udo expressed the need for university cooperation.

Meta-Theme 3: Perceptions of Digital Transformation of CTET

Perceived Challenges of CTET

Digital learning products. The digital learning product itself was a particular challenge in the transformation of CTET. Technical trainers and those closely connected to the target group reported that the scope, depth of knowledge, and learning content must be well thought out. They agreed that finding someone who can convey a message digitally, like in person, is complex. Media producers reported that the department was format-driven and mainly focused on web-based training, which came from the sense of urgency to digitize every product.

Target group attitude. Participants with regular customer contact said that the acceptance and motivation of the target group could be higher. They further pointed out the learners' preferences for classroom training over digital learning initiatives. Those learners with negative experiences were found to resist change, and as they generally suffered from little experience with digital learning, they perceived it as overwhelming. Those participants with years of experience in digital learning reported on their past observations and criticized their willingness to use digital learning, highlighting it as a challenge.

Work sector "CTET". Experienced participants described the department's work as pioneering, serving only a small target group and working against little competition. The participants sensed that education in the technical area needs to be perceived as necessary enough. The management team shared insights: "We have fallen into a time where topics like training within a company are the first to be cut." The statement was underlined by stressing that they perceived little support in sales from the company. When they tried to sell their learning products within an online store, they realized "digital learning in this industry does not sell through online stores."

Addressed Needs for the Transformation of CTET

Reconsidering digital learning products in CTET. Several needs were expressed to overcome the challenges of the learning product. Media producers highlighted that

the focus must be on the content, not the format or the tool with which something is implemented. Tina criticized: "Just because someone says we have to hop on the bandwagon of digitization and digital learning does not mean that you should not or cannot do anything in face-to-face format anymore." The need for short and adaptive learning products in the learning environment was central in many interviews. Yet, it was increasingly noted that the target group prefers face-to-face training to digital, so Alex expressed the idea of providing live support as an additional feature to live training.

Focus on target group needs and readiness. Concluding XR projects that did not reach the level of success that the participants expected, the XR project manager described: "If you do not have people who are genuinely interested or eager to change their way of working and carry that within their department, something like this will never be successful." He highlighted the need to gather a group of people who were relevant to implementing learning technologies and their willingness or readiness to try out something new.

Increase business thinking. The management team realized that to be and stay profitable in CTET, "you must keep up digital learning so as not to fall behind and become unattractive as an employer." For example, Willi, who has had over 30 years of experience creating learning products, especially in video recording and editing, suggests using more user-generated content, letting users film and use this material for learning products. Other media producers added that all products should be developed closely with the target group. External feedback should always be obtained so all products are geared towards the target group. The focus must be on quality and not quantity.

Discussion

In this final section, we first aim to reflect on research questions 1 and 2 by setting the presented findings from the literature against the participants' statements and expressing our viewpoint. Following, we reflect on the study's relevance by aligning the participants' experience and expertise with the potential impact of their statements. Finally, we will answer research question 3 by stating our position for future implications.

In contrast to available literature, this case study offers a description of how, instead of focusing on that, digital transformation had taken place. The reported working structures of this case study's company and the IDs challenges are aligned with the literature findings, yet add new aspects. In the literature, ID is associated with process steps (Branch, 2009; Niegemann, 2020). The steps of analysis, design, development, implementation, and evaluation are considered by the participants but not consistently pursued. Notably, necessary aspects of analysis, such as competitor analysis, target group analysis, need analysis, and evaluation, such as feedback, testing, and assessment (Villachica et al., 2010), are not further elaborated on in the participants' statements. The need for analysis is mentioned, and they only touch upon evaluation by highlighting the importance of learners' direct influence or involvement in their learning by suggesting user-generated content or continuously obtaining feedback.

We interpreted that one reason for the disconnection between analysis and evaluation might lie in the misfit of understanding one's role and the expectations toward others' tasks. Not only did participants not consider themselves as IDs, but they also reported having missed some necessary tasks. Noting that initial experiences with online learning often occurred within this department, they reported expecting others to conquer limited exposure to various technologies and a lack of expectation management. These tasks have been identified as a part of ID in the literature (Villachica et al., 2010). Additionally, the participants reported to have struggled with establishing and continuing with a jointly developed workflow, which, from our research perspective, could have been based on existing ID methods. The question remains as to why the methods were not applied. We conclude it is plausible that their inaction was due to a lack of familiarity with the concept of ID and an expectation that others would hold the responsibility. Additionally, they might have hesitated to engage with the theory, perceiving it as excessively theoretical and detached from practical application. This hypothesis might be confirmed by the participant's emphasis on the agility of a suitable workflow, highlighted by several researchers as outlined earlier. However, they added communication as a challenge beyond the elaboration in the literature review. Communication was focused on the exchange between focus groups and project teams. Considering the reported lack of familiarity with ID and the technical background of technical trainers and SMEs, the participants assumed there needed to be more exchange due to time reasons and non-aligned communication across focus group cultures and languages. In this context, researchers have repeatedly emphasized that collaborating across occupational boundaries is a crucial prerequisite for workplace performance and success, particularly in digital transformation (Comacchio et al., 2012; Striković & Wittmann, 2022). While the participants incomprehensively describe an instructional designer as a standalone role, we refer to them as mediators in the collaboration among individuals with different vocational and professional backgrounds (Comacchio et al., 2012). We state they should also be able to facilitate communication with other focus groups or as a corporate IDs with academia.

The participants' statements about challenges and needs align with current literature findings regarding the digital transformation of CTET. Still, while most participants stressed the target group's resistance, especially of technical professionals, and the educators' digital competence, not one participant referred to themselves when pointing out that educators needed to possess this competence. This again reflects the misperception of their role. In terms of the work sector "CTET" as a challenge stated by the participants, they have an opposing position with literature in terms of the speed of digitalization. As Gumaelius (2024) characterizes industry as a faster driver of digitizing technical education, the participants perceive implementing innovative digital technologies as rather slow.

The essence of the study lies in the fact that the knowledge gained should be used to help others bring about change (Oswald & Reigeluth, n.d.). Therefore, it is worth highlighting how the participants' experiences can be incorporated into IDs' existing work structures. As the participants' diverse backgrounds shape the meaning of the statements, a brief assessment is provided on how these should be evaluated for practical purposes. Experienced IDs bring a global perspective, substantiate their views with numerous best practices, and can predict trends. They keenly understand their target audience, other companies, and the industry. Participants with little experience offer a fresh, unbiased perspective, providing relevant feedback. With years of company experience, technical trainers maintain close contact with the target audience, understanding what resonates and is needed. Media producers generate creative ideas and make individual decisions, working closely with technical trainers. Management can make decisions by recognizing the influence of upper management on the company. To sustain employee satisfaction and balance the workload of the management team, a clear distinction is made between managerial tasks and those involved in developing a learning product. Management focuses on global strategic decisions, leaving operational decisions to the other focus groups.

Practical Implications and Future Research

Looking toward the future, it seems necessary to emphasize ID as a job description and a process. Based on the incomprehensibility of ID in this case study, we conclude that there is a need for a common understanding, which could be achieved by introducing job shadowing or rotation. Research reveals that initiatives like job rotation or shadowing are invaluable for understanding a team's diverse roles and responsibilities. It allows individuals to observe and appreciate the various professional functions by understanding how different roles contribute to collective goals. This exposure enhances collaboration and communication within the team and helps individuals recognize their occupational roles' worth and responsibility (Bakker & Akkerman, 2019; Irby et al., 2016; Striković & Wittmann, 2022). Whether the positive effect can be transferred to IDs has yet to be studied. Considering the hesitance to use theory or the fact that IDs are performing jobs regardless of formal training, in our opinion, it seems beneficial to apply methods that have been created especially for such purposes and include all necessary considerations in every activity. With increased exchange and standardized instruments, ID can still be successful. Regarding skill development, we suggest including communication skills for cross-boundary collaboration (Striković & Wittmann, 2022) and digital competence (Lyngdorf et al., 2024; Makarova et al., 2021) in formal educational programs and adding them to the lifelong education of IDs or all positions included.

Referring to the digital transformation of CTET, we want to highlight the concerning trend of knowledge preservation found in the literature and aligned with this, our participants' fear of falling behind in technical education due to the resistance of the target group and limited support from employers. Operating as a unit within a large corporation or institution often imposes constraints, as actions and decisions largely depend on directives from higher organizational levels. Therefore, we encourage the department's initial pursuit to push the digital transformation of CTET forward with pioneering work. Bates (2000) describes pioneering as the lone ranger phenomenon and highlights the essence of these lone rangers. He states that it always takes those who initiate innovation to reveal its potential (Bates, 2004). This relates to our study in two ways: on the one hand, we support the pioneering work of the company that has experimented with digital technologies, while on the other, we aim to encourage others to adopt case studies as research tools. The case study aimed to go beyond past analysis as a tool for future enhancements, and we offered a starting point for the area of CTET. With this approach, we seek to foster the discussion on the relevance of studies in this area and inspire more researchers and practitioners to align with our strategy.

Furthermore, we identified the researcher's positioning in this study as beneficial. Instead of seeing the convenience sample as a threat, we present it as a strength of this research. The familiarity with the topic, context, and individuals helped to clearly understand the individual opinions. Even though it is stated that researchers and practitioners should collaborate, we consider the feasibility and suggest familiarizing ourselves with the context in a similar depth first before researching a subsequent case study.

Limitations

Nevertheless, this study presents the perceptions of a small sample (N=22), which questions representativity. Reinforced by the participants' desire for further corporate insights, we state that there will be a need to transfer pioneering work to large-scale research (Rapanta et al., 2021). Nevertheless, larger sample sizes will help underline our findings' validity and can be transferred to other subject areas. Limitations occur as we only deal with interviews and subjective statements. We assume exploring the interactions through online platforms and the impact on work performed or applying a quantitative design could be beneficial, which is why this should be considered for future research. Still, participants commented on the behavior of other roles in the working structures. Here, not only were the statements of the individuals collected, but the understanding of others' roles also led to a description of observed behavior. This allowed for a first insight into what objectivity should be aimed at by investigating this research field further. Lastly, the experience of our participants and their target group with digital learning emerged simultaneously as ERT, equating the training experience with the experience of action taken out of an emergency. This must be looked at more closely from the learning and training side. Thus, the study provides scope for a deeper analysis of digital experiences, job descriptions, and their potential impact during the transformation to gain a more comprehensive understanding.

Conclusion

To conclude our study, we aimed to critically appraise ID practices in CTET by illustrating challenges faced in the digital transformation of L&D with a case study focusing on a manufacturing company. Our research took an additional stride toward bridging the gap between academia and the workplace. Scarce literature findings about the challenges of ID in line with digital transformation were enriched by insights gained from a practical corporate environment. We additionally elaborated on the future implications for practice and highlighted the obstacles, solutions, and our interpretations for learner and economic attitudes toward digital learning, as well as ID readiness and experience. We conclude that the future of CTET requires innovative approaches and a change in mindset to continue contributing to the devel-

opment of conceptualizations, implementations, and evaluations. Addressing the unique needs through targeted training, e.g., in lifelong learning programs for IDs or provision of templates and blueprints, can optimize work structures, diversify learning products, and deepen ID role understanding. This fosters personal development and enhances the overall quality of L&D, especially in the technical field.

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Authors Contribution Both authors conceptualized and designed the study. The first authors held the interviews and completed the first manuscript. The second author significantly revised the paper and added theoretical contributions.

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Data Availability Due to the nature of the research, interview audio files are unavailable. Interview scripts for this study are available upon request from the corresponding author. The data are not publicly available because they contain information that could compromise the privacy of research participants and the company.

Declarations

Ethics Approval and Consent to Participate All procedures performed involving human participants were in accordance with the principles that ensure research integrity, transparency, and accountability within the Technical University of Munich. Additionally, participants were asked to consent to participate in interviews and to their recordings.

Consent for Publication This study includes a table derived from another author who consented to use the table in this study in written form.

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose.

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