

# Development and Test of a Semi-structured Explorative Survey Methodology to Analyze Appropriate Learning Methods for Technology-related Training across the Phases of Technology Use

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**Abstract.** Training is regarded as an indicator for organizations' performance. To analyze appropriate learning methods for technology-related training across the phases of technology use we develop a semi-structured, explorative survey methodology. The methodology is tested with a sample of 53 healthcare professionals from China, France and the USA. Based on that, lessons learnt are concluded that confirm the usefulness of the methodology for research and practice. In addition, further improvements and enlargements of the methodology are illustrated in this paper as basis for further research.

**Keywords:** blended learning, training needs analysis, healthcare, technology, technology use

## 1 Introduction

“*Extremely powerful*” and “*cost-effective-investment*” [1, p. 147] – these two quotes relate to the characteristics of training. In the context of corporate education, training is regarded as an indicator for increasing the organization's performance [1-2]. Thus, studies focused on the investigation of pre-training, training and post-training activities [3]. From a general training research perspective, we know that the training processes start with the analysis of training needs followed by the design and delivery of trainings and ends with the evaluation and transfer of it [4]. The starting process is often referred to a training needs analysis (TNA) and concentrates on the assessment and analysis of data to determine training needs for an organization [5]. Necessary skills and knowledge that need to be acquired by the workforce are analyzed to ensure the organization's performance [2].

The appropriateness of learning methods for the delivery of knowledge and skills is not analyzed in the current practice of TNA. This confirms the request for research of Santhanam et al. [3] regarding how to match appropriate learning methods with characteristics of the trainee to ensure positive learning outcomes. The achievement of this match represents a challenge especially for blended learning concepts. These

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concepts are characterized through the combination of traditional learning methods such as classroom training and online learning methods such as web-based trainings [6]. During the last years, blended learning is increasingly used in organizations for training delivery [7] and requires a decision whether rather online or offline learning methods for the delivery of knowledge and skills should be used.

Furthermore, when a new technology is implemented the knowledge and skills which need to be trained are defined by the project management or general management [8]. The analyzed training needs are often short-term and task-oriented; however, the use of technology covers multiple years and is long-term oriented. Therefore, several phases of technology use are differentiated [9], which indicate that across all phases of technology use training needs arise and trainings are delivered; however, the respective needs for each phase are different [10].

Next to the skills and knowledge needed to be trained, the environment of the learner as well as his/her motivation is important to result in a good performance [11]. Therefore, we can assume that if the individual feels the training method as appropriate, his/her motivation increases and leads in conclusion to a better performance. Technology-related training should address the training needs of the individual for the relevant phase of technology use with regards to relevant knowledge and skills but also consider the appropriateness of learning methods based on the characteristics of the individual trainee such as working environment, training time, etc.

This aspect is not covered in the current state of TNA such that no methodological approach exists that focuses on the analysis of appropriate learning methods for technology-related training across different phases of technology use. Especially the appropriateness of blended learning for technology-related training and thus the appropriate interplay of traditional learning and online learning methods over a longer timeframe and in particular across the different phases of technology use remain unknown. Therefore, we address this gap and focus on the following research question:

*How to analyze appropriate blended learning methods for technology-related training across the phases of technology use?*

To answer this research question, we develop a semi-structured, explorative survey methodology based on TNA research. We applied this methodology within a study in the healthcare sector and interviewed 53 subjects from ten institutions located in China, USA and France. Within our paper we will introduce the semi-structured, explorative survey methodology in detail and discuss the lessons learnt from its initial use with 53 employees. Therefore, we follow the schema of Gregor and Hevner [12] but focus on the design of the artifact and its first application in practice within this paper. The conducted evaluation investigates the usefulness and comprehensibility of the methodology for practical application, as it is important in a first step to develop a methodology that is accepted by learners [11]. It is shown that the positive evaluation of a learning method by the learner him/herself leads to a positive increase of his/her learning outcome [13]. In a second step, the designed artifact needs further be evaluated according to design science guidelines [12], [14], [15] to demonstrate that by using the suggested methodology to select an appropriate mix of learning methods

for technology-related training across the phases of technology use will improve the learning outcomes. However, this part of the evaluation is not part of this paper.

We structure the paper as followed. We focus in the theoretical background on TNA and provide an overview about the state-of-the art. In addition, we explain the concept blended learning and the different phases of technology use. Then the development and evaluation of the methodology follow. Based on our first application, we will present our lessons learnt and how we adjusted the methodology. Implications for theory and practice will be provided in the discussion followed by future research and the limitations of the paper.

## 2 Research background

We introduce the TNA as start point of training processes in the following. In addition, an overview about current research of TNA is illustrated. Afterwards, blended learning and the phases of technology use are explained.

### 2.1 Training needs analysis

In general, a training need analysis is defined as “*process of gathering, assessing and analyzing data to determine the training needs for an organization*” [5, pp. 393-394]. The goal of the TNA is the identification of training needs as well as the design and development of ways and resources to address and satisfy the needs by the most possible cost-effective and efficient manner. Based on an organization’s current and desired performance levels, data will be collected and interpreted by using methodical investigations and analyses [1-2]. The TNA consists of the organizational analysis, the task and knowledge, skill, and ability analysis and the person analysis. The organizational analysis focuses on the short- and long-term goals of the organization as well as on the trends that might affect these goals. The task and knowledge, skill, and ability (KSA) analysis concentrates on the analysis of the job that needs to be performed by the trainees upon completion of the training program. The third part of the TNA, the person analysis, investigates how a specific employee is carrying out the tasks of his/her job [16]. The data collection of the TNA can be done through different methods such as surveys/questionnaires, interviews, observations etc. [8]. The collected data will be interpreted and provide the basis for further activities such as training delivery.

The results of our literature analysis<sup>1</sup> indicate that only the task and KSA analysis are conducted within TNA reported in the literature [17-19]. Moreover, apart from Waldman et al. [20] who use interviews and survey in their studies, the other identified research studies mainly use surveys as method for performing the TNA.

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<sup>1</sup> To get an overview about past research we screened the databases of the IS senior basket of eight and relevant journals of human resources and the organizational context (journal rated A+ and A) as well as general economics (A+). We used the vhb-journal ranking (<http://vhbonline.org/VHB4you/jourqual/vhb-jourqual-3/>) as orientation. We used “training needs”, “training needs analysis” and “training needs assessment” as search terms.

The literature review of Moore and Dutton [21] states that the implementation of TNA is not done in the way as it is suggested by training theorists. Although the literature review is long time ago, less research focuses on TNA in the following years such that their conclusion is still valid. Ford and Noe [18] identify in their study high impact of the position of managers in the organization and small impact of individual characteristics such as the attitude towards the utility of training on the self-assessment of training needs by managers. Phang et al. [19] develop a TNA module to support employees in their selection of the right training modules based on their analysis of training needs. The current state of the TNA research indicates that TNA covers a small part in the research field of training processes [4]. The analysis of training needs concentrates on skills and tasks of jobs and in conclusion, on relevant training content. In addition, the analysis has no temporal focus such as milestones or phases of use. Hence, we can conclude from prior research that there is a gap in the literature that focuses on how to analyze the appropriateness of learning methods and especially the mix of online and traditional methods across the different phases of technology use. Therefore, we will focus on this gap in this paper by proposing a TNA method with a focus on blended learning methods such that we introduce in the following blended learning and the phases of technology use.

## **2.2 Blended learning**

In general, learning methods can be classified in traditional learning methods and online learning or electronic training methods [11]. Both methods are characterized through their benefits and drawbacks. Traditional learning methods have a high degree of interactivity which in contrary is often related to high costs. The benefits for the employees of being out of their daily working routine e.g. for a classroom training and having the instructor directly available for comments and questions are connected to missing working time and possible costs for traveling [7]. Online learning methods that are also known as e-learning offer the employees flexibility regarding the aspect when and where to learn and how much to learn. The instruction is often asynchronous as online learning methods are delivered by a CD-ROM, the internet or the intranet. Instruction can also take place synchronous e.g. in form of a virtual classroom training or remote training [22]. The use of a learning management system (LMS) enables to provide learning material without time and place-restrictions. LMS integrate features such as online discussion forums for the exchange of the learners or further tools such as simulation which can be used for training issues [23]. Moreover, it enables the organization to track the learning outcomes and progress of its employees [7], [22]. This aspect is often related to negative aspects of online learning such as the high front-up costs for the organization. In addition, employees often complain about the lack of interaction that might result in demotivation and feel isolated from the other learners [7]. The implementation of blended learning – which reflects the approach of combining traditional and online learning methods – tries to avoid the negative aspects and benefit from the positive aspects of both learning methods [6-7].

The results of studies indicate that the blended learning approach leads to better learning outcomes compared to only traditional learning [24] or online learning [25]. Learning outcomes can be differentiated into affective, cognitive and skill-based outcomes [26]. Previous research shows that blended learning has a positive influence on affective outcomes such as the satisfaction of the learner or cognitive outcomes such as the effective knowledge transfer [24]. In addition, past studies in the blended learning context mainly focus on comparisons between blended learning and traditional learning concepts or online learning concepts. Potential predictors for course outcomes are examined [27]. In the healthcare IS research contextual factors which have impact on the relationship between blended learning and positive learning outcomes are investigated. The studies of Buyl and Nyssen [28] and Lopez-Campos et al. [29] examine that based on the user group different blended learning concepts are necessary to ensure positive learning outcomes. In addition, culture as contextual factor is examined by the Sánchez-Mendiola et al. [30]. They confirmed that the concept of blended learning is especially successful in developing countries. In conclusion, there is no research which uses blended learning concretely in the context of technology-related training. In addition, no research focuses on the contextual factor time such that designing blended learning concepts over a longer timeframe. We use the examined contextual factors as basis for the development of appropriate blended learning concepts as they are important in the context of technology use [10] as it will be discussed in the following and hence, also for designing a blended learning concept for technology-related training.

### **2.3 The different phases of technology use**

In general, the phases of technology use cover six phases of a technology in connection to its diffusion within the user groups [31]. The first phase, *pre-implementation*, can be defined as the period before the new technology is available for use in an organization [31]. This phase includes the process of defining, creating, and obtaining the tools, documentation, procedures, facilities, and any other physical and informational resources which are done before the implementation of the technology takes place [32]. From a training perspective the focus of the first phase is especially on making the users ready for the implementation phase. In the *implementation* phase, which is the period when the new technology has been implemented and employees are starting to use it to the point when the technology is routinely used in the daily working [33], employees get in touch with the new technology and start using it. Therefore, users need to be supported in using the technology during the implementation phase. Follow-up challenges need to be addressed in the following *follow-up* phase. Finally, in the post-implementation period, which is the period when the technology is becoming or has become part of the organization and employees use it in a routine way [34], the use of the technology itself or of specific features need to be refreshed, new employees need to be trained in using the technology or new features need to be introduced and learned when small changes or updates of the technology are implemented [32]. As a result, we differentiate between three further phases *refresh*, *new hire* and *new feature*. In

summary, there are six phases of technology use which can be distinguished as illustrated by Figure 1 (left side). All the phases result in different training requirements. We will use these six different phases as a basis to reveal the appropriateness of traditional and online training methods in each phase.

### **3 Development of methodology**

Summarizing the findings of our research background we conclude that there is no methodology covering the analysis of the appropriateness of learning methods in general and for blended learning in particular. In addition, we found no methodology that analyzes appropriate methods for technology-related training across the phases of technology use. To develop the required methodology, we use a design science research approach and followed the guidelines of Hevner et al. [14] and Gregor and Hevner [12] to design our methodology artifact.

The need for the design of an artifact results from a business problem located in the healthcare sector. The company produces healthcare technology and related services such as training in order to use the technology effectively and efficiently in the daily working routine. The job group of healthcare professionals is characterized through a high specialization in their job and a wide array of tasks performed by the group each working day [35]. The tasks are related to different skills and knowledge, expertise and former education implicates differences with regards to the use of for example healthcare information systems by nurses and physicians. The high responsibility related to the job of healthcare professionals results in a high training priority of the healthcare workforce to ensure the appropriateness of treatments and, in conclusion, the patients' health. Therefore, the use of technology is crucial in the healthcare context. As the job responsibilities and tasks vary between nurses, physicians, technicians etc., healthcare information systems are customized to cover the specialized need of the different user groups [36]. Conversely, this means that the customization of training to meet the training needs of different groups can be assumed. As a result technology-related training is of high importance for the healthcare technology company. To solve the business problem and to be able to work out concrete planning of training delivery over a longer period as well as possible investments for tools and infrastructure, the management requires a methodology for analyzing technology-related training needs which focuses on how to deliver technology-related training. The content delivered by the trainings (with regards to tasks and related knowledge and skills which need to be learned by the healthcare professionals) is well-defined. As the knowledge base of IS research [14] includes currently no methodologies facing this business need (see section 2), the development of an artifact is necessary. To get the full picture of the IS research framework we supplement the analysis of the knowledge base by the investigation of the environment in which the designed artifact should be applied. With the help of the analysis we want to get an overview about the current state-of-the art and to draw conclusions for the design of the artifact. Therefore, we analyze in the first step all relevant information from customers of the healthcare technology company with

regards to methods used to analyze training needs. This provides us a first overview about the current methods used for technology-related training, issues and improvements. In the second step, we examine internally which training methods are currently used or in planning for technology-related training by conducting a survey with product managers who are responsible for the creation and implementation of training strategies. In the third step, we analyze the training offerings of further healthcare technology companies. Based on the three-step-analysis, we conclude that often the management of healthcare professionals is asked about training needs and related issues and not the end user of the technology. The feedback indicates that training needs exists also after the implementation of the technology for refreshing knowledge, extending expertise or the training of new employees. For training delivery, product managers mainly decide to use traditional learning methods such as on-site training, which takes place directly at the institution of healthcare professionals when the implementation of the technology takes place. On-site training is sometimes combined with web-based training or delivered by CD/DVD dependent of the infrastructure of the institutions. The training delivery focuses on the phases *implementation* and *follow-up*. Besides, healthcare professionals feel “over surveyed”, as they commented to be too much contacted for surveys for all different cases and they indicated that they only want to participate in surveys they evaluate as positively for themselves.

Hence, based on this analysis, we designed a methodology that enables to analyze appropriate learning methods for technology-related training across the phases of technology use. A first evaluation of the artifact will be done. The evaluation focuses on the acceptance of the new methodology by learners as our analysis indicates that healthcare professionals feel “over surveyed” and that they only want to participate in surveys they evaluate as positively for themselves.

#### **4 Semi-structured, explorative survey methodology**

To assess the appropriate mix of traditional and online learning methods that addresses the training needs of individuals for the relevant phase of technology use we design a new methodology artifact. The proposed semi-structured, explorative survey methodology consists of two parts.

The first part focuses on general information with regards to the job, training and product experience of the interviewees. The interviewees are asked how they would classify their user role (*regular user* who uses the basics of the technology, *expert users* who are key users and have deep knowledge, and *head* users who are in a management role and often formerly worked as expert user). This enables the interviewer to get a first profile of the healthcare professional.

The second part focuses on the appropriateness of different training methods across the different phases of technology use. Therefore, we provided a list of different training methods and tools that can be used in the learning process (see Figure 1). We differentiated between traditional and online training methods and described each method in detail. This classification is based on Blanchard et al. [11]. In addition, we

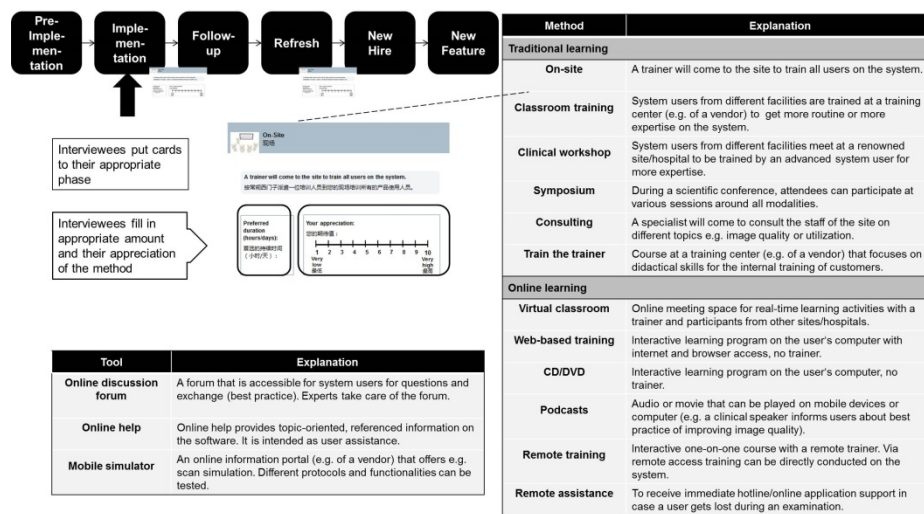
introduce the six phases of technology use as described in section 2. The data collection focuses on evaluating the appropriateness of different learning methods and on the amount and appreciation of the learning method. We regard the appropriateness of a training method or tool as suitable and compatible for individual subject to solve his/her issue of training needs for the phase of technology use [17]. The amount of the training method is simply the amount of time that the individual likes to spend with the training method or tool such as hours or days and is important for the planning of training [3], [17]. The appreciation considers “*a meaningful response associated with mixed emotion*” [37, p. 398] of the subject with regards to the training method or tool. Therefore, the relative value of the method or tool for the individual is in focus which covers also an important affective measure in training research [3], [17].

To **collect the data**, we suggest using a Din A1 poster and cards as additional guideline. The poster shows an overview about the six phases of technology use (see Figure 1). With the help of the cards the different learning methods are shortly explained (see the overview in Figure 1) and the amount of the training method or tool can be filled in as well as the appreciation of the individual regarding the training method or tool can be specified. For additional suggestions of training methods by interviewees empty cards are provided which can be filled out by the interviewees as well. The procedure of the data collection is suggested as follows: (1) The interviewer explains the different phases of technology use to the interviewee; (2) the interviewer explains the cards to the interviewee; (3) the interviewee chooses his/her appropriate learning methods and tools for each of the phases of technology use and put the cards to the relevant phase, (4) the interviewee filled out the cards and specified the amount of training as well as the appreciation of the training method on a scale from 1 (very low) up to 10 (very high) in detail, (5) each interviewee is asked for a justification, why s/he has laid down the learning method to one of the phases of technology use, why the specified amount of the learning method is needed and why the learning method is more or less appreciated. We suggest to record the survey and that the interviewer should take notes. Figure 1 illustrates the procedure of this interactive part.

For **analyzing the data** we suggest that on the one hand one should evaluate the notes taken by the interviewer. For better comparison, the notes are structured according to comments to the phases of technology use, training methods, amount or appreciation and further comments. In addition, for clarifying or analyzing some aspects in detail, the recorded tapes can be used. On the other hand, the cards chosen by the subjects are evaluated. Thus, one regards the appropriateness of learning methods in relation to the phases of technology use in general. Therefore, one examines the overall number of cards laid down by each interviewee to all phases of technology use. In addition, one counts the cards put down to each phase of technology use. This provides a first overview about the interviewees' appropriateness of some training methods for different phases. Moreover, it shows the extent of training needs for each phase. If the interviewees wrote down additional notes on cards one can listen again to the tape to have a full understanding as the interviewee often provide more information regarding his/her notes by explaining it to



the interviewer and/or translator. Furthermore, one can analyze descriptive data by the percentage of traditional learning and online learning methods in general and in detail for each of the six phases. In addition, one can investigate the percentage of tools chosen for supporting the traditional and online learning methods. The amount of training methods can be evaluated by one in the first step per hour; in the second step one can calculate the mean of each training method for each of the six phases of technology use. The appreciation of the training methods can be evaluated in general by analyzing the mean of the training method independent of the phases of technology use and in addition separated for each phase of technology use.



**Figure 1.** Proceeding of interactive part and overview about learning methods and tools for supporting

Hence, the proposed methodology is characterized as interactive. The interviewee is involved directly by a task of selecting appropriate traditional and online learning methods. The interviewer can provide guidance to the interviewee if s/he has questions. In addition, the interviewer can directly ask the interviewee why s/he has selected this learning method and why this amount is needed as well as why the method is more or less appreciated by the interviewee. This results in the detailed explanation of the appropriateness of training methods across the phases of technology use. To test the appropriateness of the methodology we evaluated it in a study in the healthcare context as it will be described next.

## 5 Evaluation of semi-structured, explorative survey methodology

To evaluate the usefulness, the practicality and comprehensibility of the designed methodology we conduct a study. The objective of the evaluation is the first

presentation of the methodology and its practical application. A full evaluation of the design artifact has to be done according to the guidelines of design science research in future research to concretely demonstrate the utility, validity, quality and efficacy of the artifact [12], [14], [15]. The study includes three large Chinese hospitals, three large French hospitals and one large diagnostic imaging center in France as well as three large hospitals in the USA. The contact to the institutions was established by the healthcare technology company that highlighted the need for developing a new methodology for assessing the appropriateness of training methods.

In total, 53 Healthcare professionals were interviewed using the newly developed methodology and welcomed to provide feedback to the methodology. The average age of interviewees is 38.5 years (seven subjects provide no data about their age). 24 were female and 29 were male interviewees. An overview about our sample is illustrated in Table 1. The interviews took between 45-60 minutes. We select our interview partners in dependency of the technology they use. We ensure that that all interview partners work in radiography departments such that they use technology systems like angiography or x-ray (AX), low complexity of technology, computed tomography (CT), medium complexity, and magnetic resonance imaging (MRI), high complexity. Moreover, we select our interview partners according to three user roles: regular user, expert user and head.

**Table 1.** Overview of interviewees

		User role		
		Regular	Expert	Head
Tech- nology	AX	CN (2); FR (0); USA (0)	CN (2); FR (3); USA (0)	CN (2); FR (1); USA (0)
	CT	CN (1); FR (1); USA (5)	CN (2); FR (6); USA (5)	CN (1); FR (1); USA (5)
	MRI	CN (1); FR (0); USA (1)	CN (2); FR (0); USA (0)	CN (2); FR (1); USA (1)
CN: China; FR: France; brackets cover number of interviewees				

For collecting our data we interviewed each professional first using the proposed method and afterwards we asked them about their evaluation of the interview conducted. For the second part, we asked questions such as “*What is your opinion about the methodology?*” “*How would you rate the usefulness of the method?*” “*Would you use the methodology in the future?*”

In addition, we observed the subjects while conducting the method. We analyzed their reactions regarding the proceeding, their tasks and if the method and its proceeding and outcome were understandable. We made additional notes if the interviewees asked questions regarding the method. We classified the notes taken by the interviewees according to questions about the proceeding in general, the comprehensibility of the method, improvements for the method and further notes.

We coded the feedback based on the transcripts of the second part of the interview and we coded the emotions of the interviewees by conducting the methodology as well as the reaction of the interviewees for providing feedback. We classified the emotions in positive (e.g. excited, satisfied), negative (e.g. bored, distracted) and neutral. Hence, we identified incidents that the interviewed healthcare professionals

rather evaluate positively or negatively. Furthermore, we presented our methodology and the results of the first application to the management of the healthcare technology company. Based on the feedback and the analysis of the interviews we deduced lessons learnt from the first application for further adjustments of the methodology which will be explained in the next section.

## 6 Lessons learnt from first application

As a result of the demonstration and first evaluation of our designed artifact [14] we conclude four lessons learnt addressing the practical applicability of the methodology:

**Lesson learnt 1: Interactivity takes time but it is worth.** We estimated for conducting the survey - including all parts - 30 to 40 minutes. Whereas the first part about questions regarding the experience of interviewees was done efficiently, the second part took time because of the explanation of the additional material such as the poster and the different cards. In China and France where the interviewers were accompanied by a translator, it takes more time for translations even when the interviewees clarified for example their understanding of the training methods or tools to ensure the correctness of their selected cards. In some cases, the interviewees did not finish the survey despite lack of time.

In general, the feedback of the interviewees to the semi-structured, explorative survey methodology was positive. The interviewees felt satisfied as the methodology enables them to plan their ideal blended learning concept for learning a new technology. One American interviewee said: *“We had some time ago the implementation of a new technology. So I could reflect about the training we had and if something was missing and could be improved the next time.”* (male, 41, expert user CT). In contrary to the French and U.S. interviewees, the reactions of Chinese interviewees were more characterized through shyness and restraint. Therefore, more guidance from the interviewer and the translator was necessary. The feedback to the survey was also positive. As a result, the methodology is in general well applicable for practical use but should be adjusted regarding the aspect planning. Enough time for the performance should be calculated and also communicated to the interviewees in advance to ensure that the interviewees have enough time to complete the survey.

**Lessons learnt 2: Adaption of the different phases of technology use and the methods based on the context of technology.** We applied the survey methodology in the healthcare context. Therefore, other training methods can be more appropriate in other business contexts. In addition, the phases of technology use can be different based on the characteristics and use of the technology. In our study, 52 of the interviewees agreed with the six phases of technology use. Only one Chinese interviewee provided feedback that she would add another phase named “improve clinical experience” after the sixth phase. This phase is *“for improving the clinical expertise of the user and to extent the clinical knowledge”* she explained (female, 39, MRI expert user). With regards to the training methods, additional methods to the cards provided were suggested by the interviewees. Four interviewees from France proposed for example the “visit of another institution” as another training method to

the *pre-implementation* phase. We can summarize that independent of the technology the interviewees are using; further methods and tools may be appropriated additional to the setting of our methodology. Therefore, the possibility for additional proposals by the interviewees should be included in the survey methodology.

**Lessons learnt 3: Estimation of training amount as challenge.** In the methodology we ask the interviewees also for the appropriate amount of the selected method/tool. Based on our first experience in using the survey methodology, we can conclude that this aspect is difficult to specify for the interviewees especially the amount for spending time with the tools. Therefore, we focus on guiding the interviewees to conclude what works best and how our methodology might be improved. As a result, the interviewees took additional notes to the appropriate amount they like to spend with the tool or method. The American MRI head user selected the tool mobile simulator for the pre-implementation phase of technology use but added “*it would be good to have the mobile simulator around three months in the pre- and post-install phase available to support internal training*” (male, 41). The additional information provided by the interviewees facilitates on the one hand the planning of training and the possibility to customize training according to special needs. On the other hand, comparisons between countries, for example, are difficult.

**Lessons learnt 4: Expanding the horizon – for business and research.** The semi-structured, explorative survey methodology and a summary about important results were also presented to the management of the healthcare technology company. With regards to the survey methodology the feedback of the management was positive to solve the business problem and for practical application. One manager commented “*A really interesting and especially innovative approach. [...] This enables us to work on the customization of training needs [...] and enlarge our training offerings after the installation of the systems*” (female, mid 30s). The current training strategy of the healthcare provider concentrates on the phases *pre-implementation, implementation and follow-up*. To cover all six phases of technology use for analyzing appropriate training methods of the healthcare professionals provides new insights for the management. In addition, the extent of data collection is desirable such that further factors are included in the methodology. Thus, the management asked to consider the willingness-to-pay in the survey. A manager said “*So we can see if this factor [willingness-to-pay] impacts the training and the appreciation*” (male, mid 40s). As the methodological approach appears as appropriate for the practical use, it can be adjusted and extended by further factors.

## 7 Discussion

By following the guidelines for design science research [14], a semi-structured, explorative survey methodology is designed. The designed methodology artifact provides an answer to the research question of how to analyze appropriate blended learning methods for technology-related training across the phases of technology use. We test the designed methodology for its practical application and evaluate the usefulness, comprehensibility and practicability. The resulting lessons learnt based on

the first evaluation confirm the usefulness of the designed methodology for practice. The six phases of technology use are well accepted by the interviewees and provide guidance for the appropriateness of blended learning methods over a longer timeframe as well as the identification of technology-related training needs.

As the methodology concentrates on the analysis of how to deliver training and the appropriateness of online and traditional learning methods we contribute to TNA research. The findings of our literature review (see section 2.1) shows that the focus of TNA is mainly on what training to deliver such as knowledge and skills. In addition, the planning is often short-term oriented. Also in technology implementation research the training of new technology is mainly concentrating on the implementation phase. Therefore, we enlarge TNA research as well as technology implementation research by integrating further aspects such as the long-term orientation of training needs and the appropriateness of traditional and online learning methods across the phases of technology use. The concept of TNA provides the basis for analyzing training needs with regards to the appropriateness of learning methods. In addition, the six phases of technology use were integrated into the semi-structured, explorative survey methodology. The designed methodology addresses the research request of Santhanam et al. [3] regarding the match of training methods with individual needs and characteristics. Consequently, the results provide implications for the training design such that the appropriate amount of training is considered within the conceptualization of a training method. Further contextual factors such as characteristics of the target group (e.g. user groups, culture) [28-30] can be addressed in the training design to ensure positive learning outcomes. Thus, future research can apply the methodology to develop and validate theoretical models about the appropriateness of learning methods in different contexts. In summary, we contribute with our semi-structured explorative survey methodology as a basis for further investigations of factors influencing the relation between learning methods especially of blended learning and learning outcomes.

Next to the theoretical implications, the application of the semi-structured, explorative survey methodology results in implications for practice. The interactive methodology is easy to implement for practical use. Based on the positive feedback gathered by the interviewees from different countries as well as from the management of the healthcare technology company, the methodology facilitates to reflect about past training methods used for the implementation of new technology.

As the semi-structured, explorative survey methodology is applied for the first time within the study, there are limitations regarding the validity and reliability. In addition, a complete evaluation following the requirements of design science research is necessary in future research as within this paper only a first application of the designed method was done that focused on the acceptance of the methodology by learners. For approving these factors further studies are necessary. Additional impact factors such as the working environment can be examined in-depth. Furthermore, the usefulness of the methodology itself for other contexts should be investigated. This enables in addition, the comparison of the appropriateness of blended learning contexts based on different contexts, technologies and users. Therefore, in future research, the methodology should be applied by conducting further studies. Based on

the lessons learnt and resulting adjustments the methodology should be investigated in other countries or healthcare technologies to ensure further validation. In addition, the methodology can be extended by further factors such as willingness-to-pay.

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