Design Characteristics of Virtual Learning Environments: An Expert Study

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Abstract. *Virtual Learning Environments (VLE) constitute the current Information Systems (IS) category for electronically supported corporate training and development. Frequently supposed advantages of using VLE refer, for instance, to the efficiency, individuality, ubiquity, timeliness, and task orientation of learning. However, a crucial precondition of realizing such advantages is an appropriate systems design. Hence, the question which specific design characteristics actually characterize successful VLE is of specific interest for training and development practice. The current paper therefore addresses design characteristics by conducting an expert study which is based on a general theory of IS success and previous insights of the literature. As a result, a set of relevant, well-defined design characteristics is presented and discussed while implications for research and practice are derived.*

Keywords: Virtual Learning Environments, Design Characteristics, Expert Study.

1 Introduction

For decades, electronic learning systems constitute the basic enablers of corporate e-learning. Though designations as categorizations of such learning systems are rather heterogeneous and also change over time, current systems can be pooled under the rubric of Virtual Learning Environments (VLE), which can be understood as electronic Information Systems (IS) for the administrative and didactical support of learning processes in vocational settings by systematically providing corporate learners adequate learning materials as well as corresponding collaboration facilities so as to develop intended qualifications [e.g. 8, 42, 49]. The usage of such systems in corporate training and development is commonly justified based on diverse advantages such as efficiency, individuality, ubiquity, convenience, timeliness, cost efficiency and task orientation of VLE-based learning [e.g. 15, 20, 41]. Such advantages may also explain the ever increasing adoption of VLE in corporate training and development [e.g. 15, 19, 48]. However, the actual realization of such advantages crucially depends on several preconditions, while the specific characteristics of the used VLE constitute a prominent

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aspect. It is evident that only adequately designed VLE will offer the promising potential for success, while ill designed systems may even cause harmful disadvantages. This directly focuses on design characteristics of VLE as a crucial aspect of learning success. Technically [e.g. 18] as managerially oriented literature [e.g.6, 7, 45] congruently understands design characteristics as the set of those inherent information system properties, which determine IS success (while IS success is differently conceptualized as net benefits, user acceptance, or actual usage, among others). Though termed "design" characteristics, such properties critical to the success of VLE gain practical importance for the entire process of developing or else procuring, implementing and applying VLE in organizations. It is not surprising that design characteristics firstly are relevant for developing new VLE. Here design characteristics offer a framework of requirements which mandatorily must be met by the future system to assure its quality. Given that corporate VLE are getting purchased more and more from external vendors, design characteristic also are relevant for the systems procurement, since they offer a valuable set of selection criteria. Beyond development and procurement, design characteristics may also instruct the technical implementation process by defining technical implementation goals. Finally, design criteria offer suitable evaluation criteria for already applied VLE, and hence support the inspection and improvement of existing systems. Given the wide-spread and still increasing usage of VLE, design characteristics of VLE hence are of relevance for a broader group of technical and managerial decision makers in corporate training and development.

The current paper therefore aims at elaborating general VLE design characteristics. An expert study is conducted for this purpose. As a general foundation for the study theoretical bases are discussed first. In order to contribute to cumulative research and to integrate the expert study with previous findings subsequently a review of previous research is conducted. Based on this, the method of the expert study is exposed and the results are presented and discussed. Finally, implications for practice and research are derived.

2 Expert Study

2.1 Foundation

As a clear explorative empirical method, expert studies usually are employed to gain insights in topical domains which are theoretically not or at least not well developed and hence, are not open to confirmative research. In certain respects, this applies also to research into design characteristics of VLE. At least, there is no completely developed theory of VLE design which would allow for a direct elicitation of the desired design characteristics. However, alternative foundations may be found in more general theories of – given the subject of the study – in the area of general IS design or general IS success. In the recently flourishing area of IS design the necessity of a general theory of IS design is well recognized [e.g. 14]. However, so far rather procedural models of design research have been offered [e.g. 14, 35], while an explicit theory of IS design, which directly unfolds design characteristics or at least allows to derivate design characteristics, is missing at present. Conversely, in the area of general IS success there are some recognized theories [e.g. 7, 45]. Since explaining success of IS such theories mandatorily present a set of success predictors. As long as such success predictors constitute or at least refer to IS characteristics, these theories can also be used to found design characteristic research. In view of this possibility, in particular the IS success model (ISSM) [6, 7, 40] presents general success relevant IS characteristics and,

additionally, is repeatedly validated. Basically, ISSM offers three groups of success predictors, namely, systems quality, information quality and service quality [6, 7]. Visibly, systems quality understood as a set of features which refers to the system as such, and information quality, understood as a set of features which refers to the content of the system, constitute system-related characteristics and hence, are appropriate for design characteristics research. Service quality, however, understood as a set of features which refers to the user support, does visibly not constitute a characteristic of the system itself, and hence is not appropriable. Transferred to VLE design characteristic, the ISSM hence clarifies that system-related (features of the VLE as such) and information-related (learning content of the VLE) constitute essential groups of design characteristics. Being a general theory, ISSM however is not able to provide more detailed information about VLE design characteristics. It is hence the task of the expert study to ascertain systems as information-related design characteristics of VLE empirically.

2.2 Review

In order to add to cumulative research and integrate the expert study with previous findings a comprehensive review of previous research in design characteristics of VLE was conducted. The review considered studies which directly deal with design characteristic of VLE in an empirical or conceptual way. Extensive searches of electronic databases (EBSCO, ScienceDirect, and Scopus) as well as of selected journals and conference websites were carried out to identify appropriate studies. However, in order to assure the quality of results only outlets with double blind peer-review were taken into account. To map existing studies comprehensively, a time frame of 20 years (1989-2009) was analyzed. Based on this procedure 25 relevant studies could be identified (these studies are marked with an asterisk in the references section and are summarized in Appendix 1). The analysis of VLE design characteristics identified within these studies yielded several interesting results.

Firstly and unexpectedly, a plethora of over thirty different design characteristics could be identified (for details see Appendix 1). Though this may be judged as ample results of previous research, this abundance also represents a certain problem like an increasing number of design characteristics detracted from there applicability and usefulness. Hence, future research should strive for a limited set of major design characteristics rather than amassing a maximum of design characteristics. Secondly, as predicted by the ISSM, all identified design characteristics could by classified as either system-related or information-related, while quite frequently systems quality and information quality were presented as design characteristics. Whereas this constitutes a consent concerning the general design characteristics, there is dissent concerning more concrete design characteristics within these groups. This heterogeneity adds to the problem of the mere number, since it is still unclear which concrete design characteristics actually are relevant for success. Hence, it is necessary to validate design characteristics to attain a set of resilient characteristics. Thirdly, the design characteristics found are of rather different granularities, understood as the grade of operativeness and detailedness of design characteristics. Basically, very general, coarse-granular characteristics such as the mentioned "systems quality" or "information quality" and rather medium-granular characteristics such as "personalization" or "clear terminology" can be differentiated, while fine-granular, detailed, i.e. very specific design characteristics could not be detected. Granularity of design characteristics evidently is of major importance since expressiveness and usability increase with granularity (for instance, “develop/select/use

personalized VLE" constitutes a more expressive and usable statement than "develop/select/use VLE with good systems quality"). In view of this, at first glance one may claim maximal granularity from the expert study, however increased specificity commonly is aligned with a decreasing range of validity. Hence, to warrant general validity the expert study may have to get by with a medium granularity. Fourthly, there is a prevalent lack of explicit definitions of design characteristics (while there are some exceptions). Since the design characteristic presented, such as "perceived flexibility", represent rather complex constructs which can be understood in quite different ways, the lack of definition aggravates the understanding of design characteristics as well as their further usage. It also complicates the detection of possible redundancies of characteristics found in different studies such as "personalization" and "user adaptation". Hence, the expert study mandatorily has to elaborate thorough and explicit definitions of design characteristics.

In summary, previous research suggests a set of design characteristics which is copious, of limited congruence, of different granularity, and frequently unclear in meaning. This clearly justifies the necessity of the expert study. However, instead of just adding a further unconnected study, the current state of knowledge is to be used as a base to contrast but also enrich the expert study and thereby integrate it with previous work.

2.3 Method

To ascertain success relevant system- as well as information-related characteristics of VLE with an expert study systematically, the Delphi method was considered as promising approach [e.g. 11, 12, 13, 22]. Besides supporting practical forecasting and practical decisions, the Delphi method is also appropriate for systematically analyzing complex and multifaceted scientific topics that are not directly and easily accessible via quantitative research approaches [e.g. 11]. To ascertain relevant design characteristics systematically, a two-phased approach was performed.

Phase I was aimed at a general inquiry and categorization of generally imaginable design characteristics. As a starting point of phase I, a group of appropriate experts was to be appointed. Participants were selected based on different criteria, while it was intended to arrange an international group of experts with extensive knowledge in the design of VLE which is of diverse disciplinary provenience (computer science, management, pedagogy, and psychology), and diverse institutional affiliation (universities and private companies). The resulting group consisted of 13 international experts with different affiliation and backgrounds (see Appendix). Subsequently, an online-questionnaire was developed. Beside the provision of a general introduction into the questionnaire, relevant terms such as VLE or design characteristic were thoroughly defined in order to assure a consistent understanding of constructs and questions. In so doing, the questions referred to the creation of a comprehensive list of design characteristics in general, and to subsequently match this list to a categorization of system- and information-related design characteristics of VLE. Balancing the trade-off between specificity and validity it was asked for characteristics which were specific, but generally valid. To avoid mere adjective lists with undefined and hence unclear constructs, experts were explicitly encouraged to explain the stated design characteristics in detail. The questionnaire was pre-tested and slightly modified based on in-depth interviews with two experts. The online survey was carried out in autumn 2009, while all 13 experts participated.

A monitoring team of five independent researchers individually evaluated the results obtained in phase I. In particular, based on the construct explanations synonymous

design characteristics were identified and adjusted, the adjusted set of design characteristics was summarized respectively aggregated according to the principles of "summarizing content analysis" [31], and finally, general definitions for the summarized design characteristics were derived from the expert explanations. In a subsequent group discussion, individual results of the monitoring team members were mutually adjusted, while there was an initial high degree of inter-coder reliability [31] within the monitoring team anyway.

During the preparation of phase II the result list of design characteristics of phase I was compared with the results of the review of previous work. As there was substantial agreement concerning several design characteristics, the result list from phase I missed some of the design characteristics that proved to be significant for success. To be more concrete, experts did not mention "multimodal" [30, 36, 38], "accessible" [30], "appealing" [3, 4, 16, 27, 38], "reliable" [27, 30, 47], "secure" [30] and "structured" [3, 36]. To test also the relevance of these characteristics, they were added to the results of phase I. The resulting list of adjusted, aggregated, enriched, categorized and defined design characteristics constituted the base of the second online-questionnaire. The 13 experts this time were asked to rank the presented system- and information-related design characteristics of VLE from highest (rank 1) to lowest (rank n) priority for success. The resulting priority lists were summarized by calculating means and standard deviations of the respective rank positions.

2.4 Results

Interim results of phase I firstly revealed an unadjusted list of 55 design characteristics (31 system-related, 24 information-related). This list was successively reduced by adjustment of synonyms to 31 design characteristic (13 system-related, 16 information-related) and the summarizing of design characteristics to 16 design characteristics (10 system-related, 6 information-related).

VLE Design Characteristic	
A. System-Related	
Reliable	**A1. 3.08 (1.44)**
Secure	**A2. 4.38 (3.52)**
Learning-Process-Supportive	**A3. 4.46 (3.13)**
Interactive	**A4. 4.77 (3.11)**
Appealing	**A5. 5.08 (2.25)**
Transparent	**A6. 5.15 (2.79)**
Structured	**A7. 5.92 (2.22)**

Standard-Supportive	**A8. 6.46 (2.79)**
Accessible	**A9. 6.85 (2.15)**
Platform-Independent	**A10. 7.62 (2.90)**
B. Information-Related	
Understandable	**B1. 2.23 (1.48)**
Consistent	**B2. 2.92 (1.66)**
Credible	**B3. 3.23 (1.30)**
Challenging	**B4. 3.54 (1.51)**
Multimodal	**B5. 4.00 (1.78)**
Enjoyable	**B6. 4.58 (1.44)**

Table 1: Means and Standard Deviations of VLE Design Characteristics Ranks.

As depicted this list was enriched with 7 literature-based characteristics (6 system-related, 1 information-related).

Final results are rendered in Table 1 and 2. Table 1 firstly depicts the results of the prioritization process in phase II by presenting the mean values and the standard deviations (in brackets).

The derived definitions of these characteristics are presented in Table 2, while each definition is illustrated with selected statements of the literature review and/or experts to make their origin more transparent.

Design Characteristic	Definition	Source	Exemplary Statement
A. System-Related			
Reliable	VLE are *reliable*, if their end-users/learners can apply it without technology owed disturbances.	literature review	"Whenever I use the e-learning tool, it always works correctly." [30]

Secure	VLE are *secure*, if the system itself as well as unauthorized users cannot modify or delete the learners' personal profile data, respectively their learning history, progress (i.e. learning outcomes), and corresponding resources.	literature review	"I trust the system security." [30]
Learning-Process-Supportive	VLE are *learning-process-supportive* if they support the provision of (further) learning activities and/or materials with their inherent information (e.g. activity description and/or instruction, etc.) according to the learners' current status in the unit of learning, and help the learners to coordinate audit dates, group meetings, etc.	expert study	"Workflow-management component"
Interactive	VLE are *interactive* if they allow for learner-system- (e.g. taking self-tests, uploading assignments, etc.), learner-learner-, and/or learner-teacher-communication and/or collaboration (e.g. via	literature review	"[…] key to the learning process are the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions." [34, 36]

	audio/video conference, blackboard, chat, forum, etc.).	expert study	"The core of learning remains a relationship between a learner and a tutor. VLE must keep this crucial factor in the loop."
Appealing	VLE are *appealing*, if their graphical user interface has a pleasant appearance.	literature review	"Screen design is the way information is presented on the screen." [16, 23, 28]
Transparent	VLE are *transparent*, if they allow the learners to keep an eye on their own and/or other learners' learning history (i.e. completed and/or passed learning activities of a unit of learning) and current status in the learning process.	literature review	"The e-learning system allows the user to control his/her improvement." [30]
		expert study	"The system enables users to trace why and how certain recommendations are made, how much personal data one allows the system to data mine implicitly/explicitly to produce a user profile."
Structured	VLE are *structured*, if learners can quickly detect the allocated information (e.g. learning resources such as learning materials, collaboration services, assessment items, system-generated information such as user guidance, feedback, etc.) in, respectively can easily navigate the graphical user interface.	literature review	"[…] the ease with which users can move around the system." [23]

Standard-Supportive	VLE are *standard-supportive*, if they facilitate learning materials which are compiled based on approved eLearning standards such as IMS Learning Design [17], or SCORM [1] as these eLearning standards enable learning materials to be widely shared across VLE which also support these standards.	expert study	"Interoperability and standards compliance"
Accessible	VLE are *accessible*, if learners can access it according to their own possibilities.	literature review	"The e-learning tool is accessible according to my own possibilities." [30]
Platform-Independent	VLE are *platform-independent*, if they run on a wide range of operating systems.	expert study	"VLE should be Web-based, not standalone."
B. Information-Related			
Understandable	The information provided by VLE is *understandable*, if the words, sentences, and abbreviations applied within the learning materials are clear in meaning (e.g. by use of definitions), easy to comprehend and easy to read.	literature review	"Terminology refers to the words, sentences, and abbreviations used by a system." [23, 28]
		expert study	"Understandability vs. complexity."

Consistent	The information provided by VLE is *consistent*, if the learning materials themselves are without contradictions, coherent and presented in a logical order.	literature review	"The use of terms throughout the (E-library) is consistent." [16]
		expert study	"Sequencing of learning objects, tasks, and assessments."
Credible	The information provided by VLE is *credible*, if they originate from a trustworthy source (e.g. teacher, certified and/or reputable organizations, etc.).	expert study	"[…] how much one trust the credibility of the material (i.e. it does not convey wrong concepts)"
Challenging	The information provided by VLE is *challenging*, if the learning materials contain difficult but interesting tasks which stimulate learners' curiosity to solve them.	expert study	"For ambitious learners, focusing on learning objectives."
Multimodal	The information provided by VLE is *multimodal*, if the learning materials are presented in different media formats such as text, audio, and video.	literature review	"The Web-based learning system offers multimedia (audio, video, and text) types of (course) content." [36]
Enjoyable	The information provided by VLE is *enjoyable*, if the learning materials provided do so in their own right aside from their	expert study	"Positive user experience, associated with pleasure, fun, playability, and enjoyment."

	textual value, and consequently make the learning experience more pleasant.		

Table 2: Definitions, Sources and Exemplary Statements of VLE Design Characteristics.

2.5 Discussion

The present expert study provides a systematic set of well-defined, specific but generally valid system- and information-related design characteristics based on the ISSM and compatible to previous research results. Hence, the general objective of the expert study could be satisfactorily achieved.

Findings concerning the system-related design characteristics show that "reliable" was unambiguously rated as the most important system-related design characteristic, followed by "secure", "learning-process-supportive", "interactive", "appealing", "transparent", "structured", "standard-supportive", "accessible", and "platform-independent". It should be noted, "interactive", "appealing", and "transparent" show almost the same mean values, that may be a consequence of the prioritization procedure within phase II as study participants were "forced" to rank the given design characteristics even though they may have preferred similar priorities of different design characteristics. However, the salient disagreement amongst study participants concerning the relative importance of "secure" (SD: 3.52) as the second important system-related design characteristic of VLE in particular might be engendered by its diverse understanding ("[…] the system itself as well as unauthorized users cannot modify or delete the learners' personal profile data […]", etc.). The same may count for "learning-process-supportive" (SD: 3.13), "interactive" (SD: 3.11) as well as "transparent" (SD: 2.79) and "standard-supportive" (SD: 2.79). Once again, this result may originate in the way the prioritization procedure was conducted. It is noticeable, amongst the five system-related design characteristics considered to be the most important ones, rank number one ("reliable"), two ("secure"), and five ("appealing") are design characteristics from the literature review which were added subsequently. This shows that even though study participants did not even mention these system-related design characteristics within the first survey wave, they considered them as highly-relevant system-related design characteristics of VLE. Thus, the prioritization of preceding expert statements and theoretical-founded design characteristics proved to be a feasible and promising approach. Hence, the set of system-related design characteristics presented should always be under consideration when designing, and evaluating VLE.

Regarding information-related design characteristics, findings show that "understandable", is considered to be the most important design characteristic, followed by "consistent", "credible", "challenging", multimodal as well as "enjoyable". It should be pointed out that not similar to their system-related counterparts, all information-related design characteristics show high levels of agreement amongst study participants regarding their relevance for VLE (SD spectrum: 1.30 - 1.78). Hence, when designing and evaluating VLE one should consider the set of information-related design characteristics presented.

To conclude, the results of the expert study presents a comprehensive set of VLE specific information- and system-related design characteristics, which should be considered when developing, purchasing, implementing or evaluating VLE.

3 Implications

The above-mentioned results should generally provide a basic starting point for future research as design endeavors, while there are some implications for research as well as practice.

Concerning research implications, firstly, some further theoretical deliberations may improve future research. The used ISSM is able to roughly categorize relevant design characteristics, but however does not allow to deduce directly specific design characteristics. This likely applies to further imaginable theoretical foundations, in particular to the prominent TAM-approach, what could be proved within the frame of the literature review (see e.g. the TAM-based studies of [3, 38]). Again, the basic TAM does rarely directly propose concrete design characteristics. In order to overcome this theoretical gap, more recent theoretical developments that are orientated towards design and intervention (e.g. the TAM 3 offered by [45]) may offer deeper foundations. In addition, also amalgamations of such approaches with the ISSM may be worth of a trial (see the example in [32]). Furthermore, given that expressiveness and usability of design characteristics increase with growing specificity, future research should aim at increasing specificity of design characteristics, however without losing general validity. One imaginable way is to work out different facets of the design characteristics by constituting sub-characteristics. For instance, based on the definitions elaborated certain sub-characteristics of "flexible", "learning-process-supportive" or "transparent" could be established. As an important aspect considered by one previous study [30] and confirmed in the expert study, possible interdependencies of design characteristics should be taken into account. Basically, design characteristics may not be arbitrarily combinable for logical and/or technical reasons [10], hence, future research should also strive for (in-)compabilities of design characteristics found. This also entails a question that has not been tackled till now, whether different system- and information-related design characteristics contribute rather individually and independently to VLE success, or whether whole bundles or entire configurations of design characteristic are triggering success. Moreover, given the benefits of an experimental design, such as controlling relevant while excluding confounding variables, ensuring direct relevant experiences of respondents, and, particularly enabling the manipulation of specific design characteristics [21], experimental designs seem to be a promising approach to ascertain and evaluate relevant design characteristics empirically (cf. the pioneering work of [36] who conducted an offline experiment to determine relevant design characteristics). Finally, given the costs and duration of developing prototypes, and, all the more, full versions of a VLE, it would be highly beneficial if relevant design characteristics could be ascertained as early as possible, in order to avoid misconceptions and failure [5]. Hence, the usage of simple prototypical models (paper prototypes, video mockups, etc.) of the system planned may allow ascertaining relevant characteristics in very early phases of the corresponding software development process [32].

Additionally, the results of the study yield some implications for practice. Managerial and technical decision-makers in the process of developing new, selecting pre-packaged VLE-software, or evaluating and improving already adopted VLE are offered a valuable general (check-)list of criteria relevant for success. Beyond, with a particular view to information-related design characteristics, learning designers and teaching staff may

profit from their application while preparing their learning materials. Hereby, information-related design characteristics could also be understood as a checklist in how far their learning materials fulfill the proposed requirements (e.g. understandable, consistent, and credible learning materials).

Refining and customizing this (check-)list towards individual corporate settings and subsequently considering the list may lead to practical VLE design- and selection-processes which minimize learner resistance, increase learner satisfaction, and support overall learning success.

4 Conclusions

Within this paper a comprehensive literature review and an initial expert study were carried out yielding a systematic list of well-defined system- and information-related design characteristics of VLE. This hopefully will stimulate future research, especially quantitative studies which evaluate and deepen the insights offered, but may also instruct future practical development, selection and evaluation projects, while both streams may finally contribute to improved VLE which support better corporate training and development endeavors.

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Appendices:

1) Literature Review – Results Overview

Study	Theory			Design Characteristic	Construct Definition	Method
	TAM	ISSM	…	System-Related / Information-Related		
1. [26]	X	X		System Quality / -		Offline Survey
2. [4]			X	Perceived Usability, Perceived System Quality) / Information Quality	X	Survey with Application
3. [25]	X	X		System Quality / -		Offline Survey
4. [38]	X	X	X	System Quality / Information Quality	X	Online Survey with Application
5. [24]	X			- / Perceived Content Quality, Course Attributes		Online Survey with Application
6. [15]		X		System Quality / Information Quality		Survey with Prototype and Application
7. [27]		X		System Quality / Information Quality	X	Offline Survey with Application
8. [50]	X	X	X	System Quality / Information Quality		Offline Survey with Application
9. [48]				System Quality / Information Quality		Evaluation of an Applicatoin
10. [37]	X	X		System Quality / Information Quality	X	Offline Survey with Application
11. [3]	X		X	Perceived System Quality / -		Survey with Application
12. [32]	X	X		System Quality / Information Quality		Conceptual

13. [46]	X	X		System Quality Information Quality	X	Online Survey
14. [44]	X			System Adaptability -	X	Offline Experiment with Application
15. [2]	X			Perceived Course Interaction, Perceived Flexibility (time, location, methods)		Offline and Online Survey with Application
16. [16]	X			Screen Design Relevance, Terminology	X	Online Interview with Application
17. [47]		X		Learner Interface Learning Community Personalization Content		Interview and Survey with Application
18. [29]	X		X	- eLearning Materials Presentation Types: 1. Text-Audio, 2. Audio-Video, 3. Text-Audio-Video		Survey with Application
19. [23]	X			Screen Design, Navigation Terminology	X	Evaluation of an Application
20. [36]	X			System Functionality, System Interactivity, System Response -	x	Offline Experiment with Application
21. [9]	X			Functionality, Interface Design -		Online Survey with Application
22. [43]	X		X	e-Learning Course Flexibility (time, location, methods) Course Quality	X	Online Survey with Application

23. [30]	X			Accessibility, Communicativeness, Feedback, Interactivity and Control, Reliability, User adaptation, User tools		Survey with Application
				Format		
24. [39]	X			Flexibility		Online Survey with Application
				-		
25. [33]	X			Screen Design		Offline Survey with Application
				Relevance		

2) Expert List

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Anh Vu, N.-N.	University of Leicester, UK	Computer Scientist
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Susanne, N.	University of Vienna, Austria	Pedagogue
Volker, Z.	IMC, Germany	Management, and Business Informatics Specialist