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Digital Measures to Decrease Thesis ProCrastination in Distance Education

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Abstract

Thesis procrastination arises besides other factors from task aversion, anxiety, and a lack of task structure. Social integration, including emotional support from peers and supervisors, is crucial for overcoming these challenges. Nevertheless, social integration is challenging in distance educational settings that have increased during and after the pandemic. This study investigates how to design digital support measures to address thesis procrastination in distance education at a fully digital University of Applied Sciences in Germany. The research follows a design science research approach, incorporating three design cycles and five evaluations. The results indicate that a fair-like measure in a virtual world, introducing a mentoring program and covering organizational topics and scientific writing, is effective. Design principles and design features are validated, so that implications for researchers, practitioners, and virtual world developers can be derived and discussed.

Keywords: Virtual World, Higher Education, Thesis Blocking, Procrastination, Social Integration.

Introduction

According to the latest educational report in Germany, the duration of study, i.e., the time needed to finish a study program, increases constantly for years (Autor:innengruppe Bildungsberichterstattung, 2022). Furthermore, drop-out rates stagnate at a high level

(Heublein et al., 2022). Procrastination, the needless delay of a task, is one symptom that causes an increased duration of study or even drop-out (Engberding et al., 2017). Task aversion or even anxiety, and a lack of structure of the task promote procrastination. Therefore, bachelor and master thesis procrastination gains special attention in research, because the task is at first unstructured, and unknown and can even cause writing anxiety (e.g., Pravita & Kuswandono, 2022; Sari & Kusumaningrum, 2022; Tuasikal & Patria, 2019). Social integration in the form of emotional support from peers and faculty members is a decisive success factor for overcoming these challenges (Rennie & Brewer, 1987; Tuasikal & Patria, 2019). Peers can positively influence each other's motivation by simply being present (Kindermann, 2015). Nevertheless, social integration is a problem in distance education, which spread to all universities in the cause of the pandemic (Lörz et al., 2020). Since a complete shift back to the classroom is unlikely per a current study (Luebcke et al., 2022), distance learning alternatives have to be established to foster social integration targeted at completing the thesis. Virtual worlds are a promising approach to solving this problem because they encourage social presence, i.e., the feeling of being together (Edirisingha et al., 2009). Rinn et al. (2023) identified a research gap in prescriptive design knowledge for social interaction and social integration purposes in the context of higher and further education.

Against this background, we address the following research question (RQ) to be studied at a fully digital German distance education University of Applied Sciences where students may never meet in person:

> *RQ: How to design a networking event in a virtual world to promote the social integration of students and thesis writing in distance education?*

To answer the research question, we describe the relevant theoretical background leading to the idea of applying a virtual world due to its social presence, detail the methodology based on the design science research paradigm, and present the results from three design cycles and five evaluations. We discuss the results and derive implications for researchers, practitioners, and virtual world developers, and conclude with a summary and limitations for this study.

Theoretical Background

Academic study programs require self-determination, self-control, and planning skills for gaining and applying knowledge (Engberding et al., 2017). These requirements are even increased for thesis writing (Pravita & Kuswandono, 2022). Social integration, e.g., through peer presence or emotional support can be supportive for finishing the thesis and can lower the risk of thesis procrastination (Kindermann, 2015; Rennie & Brewer, 1987; Tuasikal & Patria, 2019). Nevertheless, social integration is challenging in distance education, with the result of

missing social control and support so the probability of thesis procrastination rises (Sari & Kusumaningrum, 2022). Procrastination in general refers to "the voluntary delay of an intended and necessary and/or [personally] important activity, despite expecting potential negative consequences that outweigh the positive consequences of the delay." (Klingsieck, 2013, p. 26) In the Rubicon model of action phases, procrastination occurs at the "critical point [...] of action initiation" (Engberding et al., 2017, p. 419), i.e., the core of procrastination is an intention-action gap (Steel, 2007). The virtual event to be designed should address and bridge exactly this gap. The lack of social control due to insufficient social integration can be overcome by synchronous digital measures with social presence. Social presence is the extent to which digital communication is close to physical communication (Rice, 1992; Short et al., 1976). Originally a communication theory, social presence theory has entered educational research, especially in combination with virtual worlds (Edirisingha et al., 2009). Due to their high social presence, virtual worlds are widely spread in education covering different disciplines (Rinn, Khosrawi-Rad, et al., 2023). Social presence is influenced by the identification with the avatar representing oneself (Nadolny & Childs, 2014). Designing a course in a virtual world requires knowledge of technology, pedagogy, and content, and especially the intersections of those areas of knowledge in accordance with the *Technology Pedagogy Content Knowledge* (TPCK) framework (Mishra & Koehler, 2006) and should be made sure to be present when designing the measure collaboratively (Stahl, 2004).

Mentoring is a learning relationship between the mentor, an expert who can provide guidance and support, and the mentee, whose support areas are academic, professional, or personal (Etzkorn & Braddock, 2020). Mentoring can be formal, e.g., in so-called mentoring programs (Burlew, 1991) or informal (Etzkorn & Braddock, 2020). It was initially defined in an institutional context when an executive made a career happen. Later the mentee was made responsible for the outcome (Burlew, 1991). In the late 1990s mentoring reached higher education research (Alonso-Muñoz et al., 2023). Current research trends in higher education are on mentoring for minorities (Alonso-Muñoz et al., 2023). Furthermore, studies reveal that mentoring can positively influence academic performance (e.g., Fox et al., 2010) and students' retention (e.g., Bettinger & Baker, 2011), but also decrease stress and enable self-efficiency (Alonso-Muñoz et al., 2023), problem areas of procrastinators.

Methodology

To answer the RQ we designed a measure following the Design Science Research (DSR) approach (Hevner, 2007). DSR ensures scientific rigor in designing artifacts and generates abstract design knowledge. The workflow and structure of the steps performed are based on

Vaishnavi & Kuechler (2007). Within the five evaluations across three design cycles, we followed the *Human Risk and Effectiveness* strategy (Venable et al., 2016). In general, we planned to follow the rule to have 8 to 12 evaluation participants based on Hwang & Salvendy (2010). The following table reveals the course of action performed in May and June 2023.

Table 1: Steps performed within the design cycles

	Design Cycle 1	**Design Cycle 2**	**Design Cycle 3**
Awareness of the problem	Covered in introduction and theoretical background based on literature	Written interviews on students' demands	Unchanged since prior cycles
Suggestion	Preliminary mapping diagram with design principles	Extended mapping diagram and design features	Confirmed design principles and design features
Development	Minimum Viable Product 1 (MVP1)	Minimum Viable Product 2 (MVP2)	Prototype roll-out to real students
Evaluation	Focused expert group interview with MVP1 as object	Focused expert group interview with MVP2 as object	Group interview & quantitative evaluation with participants
Conclusion	Revision of mapping diagram and design features	Confirmation of design principles and design features	Confirmation of design principles & design features Effectiveness of measure

After we had narrowed down the problem space via literature research, we developed a first suggestion in the form of a mapping diagram as proposed by Möller et al. (2020). From a priorly conducted systematic literature review (Rinn, Khosrawi-Rad, et al., 2023) we identified relevant theoretical foundations and derived meta-requirements and from them elicited design principles (Gregor et al., 2020; Möller et al., 2020). The resulting preliminary design principles from our reflective development strategy were the basement for developing the design features (Möller et al., 2020). To evaluate these design features and principles we organized a focused interview with experts from the domain. A focused interview is targeted at gaining insights on an object (in our case the MVP) which is presented during the interview (Döring & Bortz, 2016; Ries, 2011). The selection of the virtual world for the MVP was based on the market experience duration and the availability of an in-world editor for easy adjustments and adaptations. *Design Cycle 1* was finished with a revision of the mapping diagram and the corresponding design features. To gain further insights into our target group in *Design Cycle 2*, we asked students about their needs and expectations for the announced course in terms of the upcoming thesis in a written interview as proposed by Schiek (2014). This kind of interview was chosen because a synchronous interview with mainly students in a full-time occupation (Alonso et al., 2017) was judged to be unrealistic. Another focused expert group interview was conducted based on the revised MVP. The focused interview as well as the students' interview results led to a

revised mapping diagram and design features for *Design Cycle 3*. Two group interviews were conducted synchronously at the end of the measure in accordance with Flick (2007). The interview guide reflected the design principles and their effectiveness. The interview recordings made with *Microsoft XBOX Game Bar* were automatically transcribed with *Microsoft Word* and coded with *MAXQDA*. The code system was deducted from the interview guide and subcategories were complemented exploratively. In addition to the qualitative evaluation, we conducted a quantitative survey hosted at *umfrageonline.com.* The validated constructs we included were facilitating conditions, social presence related to the virtual world, technology experience, and computer self-efficiency following Brown et al. (2010). Furthermore, we added social presence related to the course communication following Arbaugh et al. (2008) and avatar identification following Van Looy et al. (2012). Behavioral intention to use the mentoring program, start the thesis, contact a potential supervisor, and contact peers from the course were asked with two items each following Venkatesh et al. (2003) to capture intention and (planned) action. Therewith, we can identify potential gaps relevant to procrastination. To rate the different support measures, we invented our questions on the importance of a support contact, manual, offline tutorial, introductory video, and synchronous introduction. In addition, we asked for demographic information. So, the quantitative evaluation is complementary to the qualitative one which has a focus on gaining further insights into the target group and the overall effectiveness of the measure towards the goal of making students start their bachelor's thesis.

Results

To answer the RQ, we followed the pattern proposed by Vaishnavi & Kuechler (2007). In the following chapter, we describe the evolvement of the final design over three design cycles for suggestion, development, and evaluation.

1.1 Suggestion

We reanalyzed the MAXQDA file of a priorly conducted systematic literature review (Rinn, Khosrawi-Rad, et al., 2023) to identify common theoretical foundations for virtual world application in the educational domain. We systematically filtered them for relevant theories contributing to our research question. We identified the *Constructivist Learning Theory* (Jonassen, 1994), the *Social Presence Theory* going back to Short et al. (1976), and the *Technology Acceptance Model* (Davis, 1989), which we substituted with the newer and more detailed *Unified Theory of Acceptance and Use of Technology* (UTAUT) by Venkatesh et al. (2003). Furthermore, we added *Identity and Control*, and *Strong / Weak Ties* as relevant for virtual worlds in distance educational settings with the aim of social networking (Rinn, Necker, et al., 2023). In terms of bachelor thesis procrastination, we found the *Theory of Thesis*

Blocking (Rennie & Brewer, 1987) and the so-called *Rubicon Model* (often referred to in the context of procrastination) that explains the human decision-making process (Heckhausen & Gollwitzer, 1987). From the theoretical foundation, we derived meta-requirements and in a later step design principles (DPs). In *Design Cycle 2* we added user stories (USs) from the students' interviews on their expectations before the actual course. One US led to a new user requirement and an additional DP. After *Design Cycle 2*, no revision or addition to the DPs was made. The mapping diagram depicts the derivation process along the three design cycles.

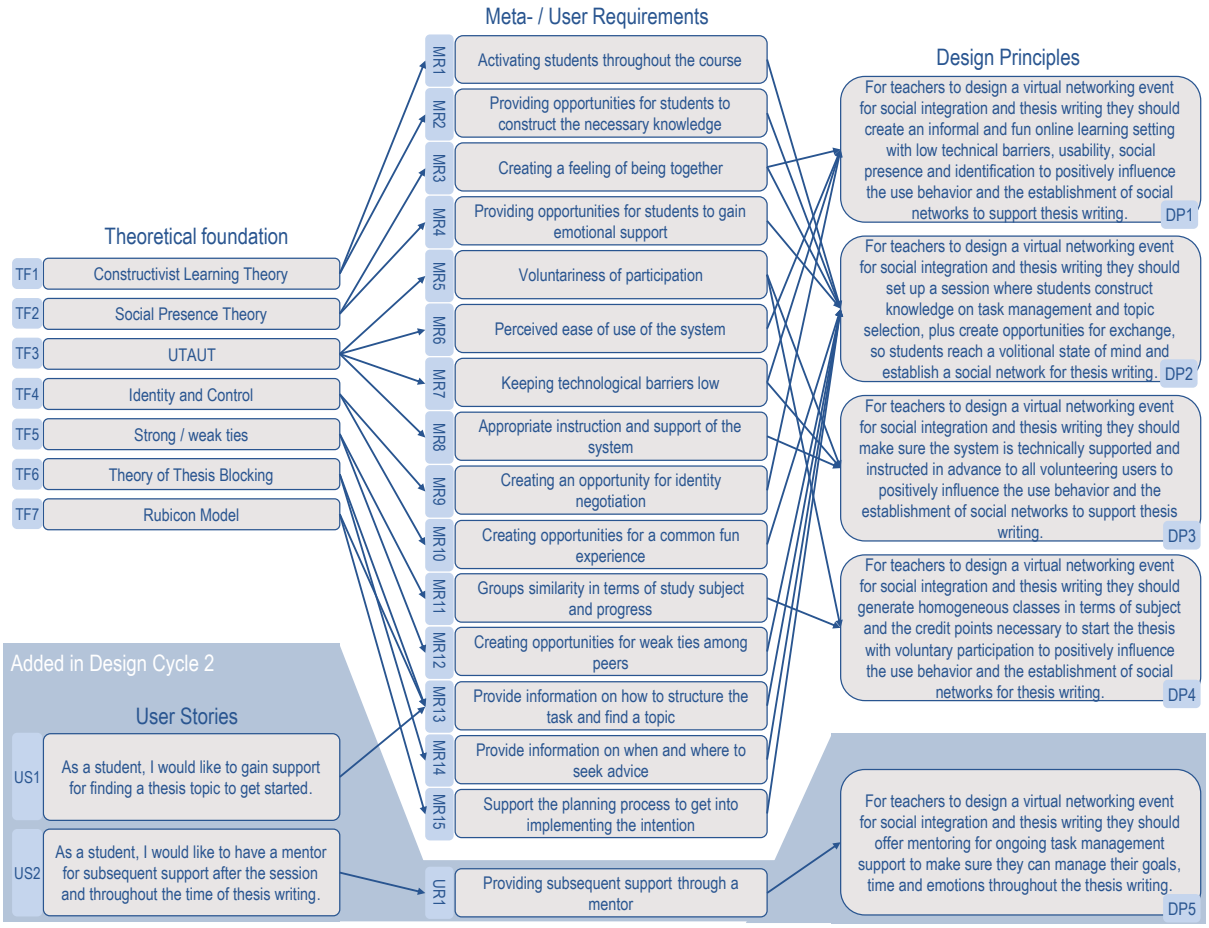

Figure 1: Mapping diagram (in accordance with Möller et al., 2020)

1.2 Development

The development process brought up design features (DFs) that were iteratively revised and refined in the three design cycles. The following DFs described reveal the final version.

DP1 (online learning setting) was translated into three DFs. DF1.1 is to keep technical barriers low with the solution selected to not exclude potential participants from joining. The solution selected has low hardware and bandwidth requirements according to its manual and is available for Windows and MacOS. DF1.2 is closely related to DF1.1 and marks the selection of the tool from a functional perspective. We chose a professional multi-user virtual world

(TriCAT spaces) that supports spatial audio, a selection of avatars to choose from, lip sync, and automatic gestures. The avatars and the environment look realistic, and the navigation is optimized for mouse and keyboard. This is an advantage over e.g., *Engage*, another commercial and realistic solution optimized for head-mounted displays. TriCAT spaces come with a room scenario (called *Coaching*) with a large park area and a patio outside a small building with three rooms. This realistic and informal environment should create social presence and a videogame-like and fun learning setting for a positive attitude. The learning setting was presentations on one hand and a gallery with posters and referents next to them for a fair experience on the other hand. DF 1.3 represents the scenario editor included that enables non-technical staff like teachers to adapt the scenario by adding e.g., pillars with self-made content, virtual notebooks with screen-sharing functionalities, and other objects or furniture.

DP2 (course design) was set up by five DFs. We combined technical introduction and peer exchange (partner interview on a topic free to choose) to an informal warm-up when participants joined consecutively in the first 10 minutes (DF2.1). In the subsequent introductory presentation of 20 minutes, we explained the structure and the process of writing a thesis. Furthermore, the Rubicon model was introduced to make participants aware of human decision making and we advertised the mentoring program from DP5 (DF2.2). For students' activation and for supporting the construction of knowledge we subsequently had students walk freely through the fair area in the virtual park for 45 minutes. We supported students' orientation with numbers on the posters and arrows for a round course on the floor. Each booth contained a poster and was accompanied by a referent who explained the presented content but also answered additional or general questions. The topics covered were literature search, statistics search, workflow on filtering search results (tool-based), and citation. Due to the spatial audio avatars who stand further apart hear each other fainter or not at all. When too many participants were talking too close to each other an audio area could be added spontaneously as visible in Figure 3 on page 10. Students could also have bilateral chats on informal topics while walking through the park (DF2.3). For the consequent presentation, students were summoned with the *Open Voice Channel* function that transmits the voice independently from the distance to the other participants. The presentation aimed to help students find and formulate a topic and the corresponding potential supervisor by explaining methods and revealing where additional information can be found (DF2.4). At the other end of the park, a cinema area was set up with an automatically playing video on formulating a research question and the corresponding topic relevance (DF2.5).

DP3 (technical support) is represented in another four DFs. At the very beginning of the project, we provided technical instruction to all employees involved, namely professors, referents, and supporters to make sure the course design can be developed collaboratively along the TPCK framework. Employees only marginally involved in the project, namely class management and student support services, were informed in advance so they could react accordingly in case they got questions from students (DF3.1). We sent a pre-announcement of the course with a contact person named (equal to the sender) for any type of questions. The same contact was named in the registration e-mail two weeks in advance (DF3.2). In the registration e-mail, we included a small step-by-step instruction and a link to a Zoom session that started 30 minutes before the actual course, so that those who needed help could gain support for installation and login voluntarily (DF3.3). The technical introduction to the virtual world at the beginning of the course was performed by two referents taking the support role as an additional one. Having two supporters available makes sure participants with problems gain immediate help. In general, the introduction was informal and playful and combined with the partner interview from DF2.1 (DF3.4).

DP4 (curriculum integration) is found in two DFs. The course participation was voluntary (DF4.1). The students invited directly via e-mail were selected by the following criteria. All students were business bachelor students with 140 to 170 credits. This potential target group consisted of 102 students, 70 of whom had started their study program in 2017 or earlier and are likely to procrastinate (DF4.2).

DP5 (post-course mentoring) is revealed in two DFs. The mentoring program added in the *Design*

Cycle 2 is offered by the referents participants get to know during the fair visit. This fact ensures a lower hurdle to contacting a mentor compared to naming persons on a list. Furthermore, students can choose a person who is sympathetic and trustworthy, especially students with a procrastination history, who might feel embarrassed (DF5.1). Contentwise the mentoring concentrates on task structuring, time management, and emotional support (DF5.2).

1.3 Evaluation

Evaluations were made along the complete design process and included the perspectives of professors, technical experts, and students. The following graph reveals the evaluation method, target group, sample size, and corresponding design cycle following the evaluation framework of Venable et al. (2016).

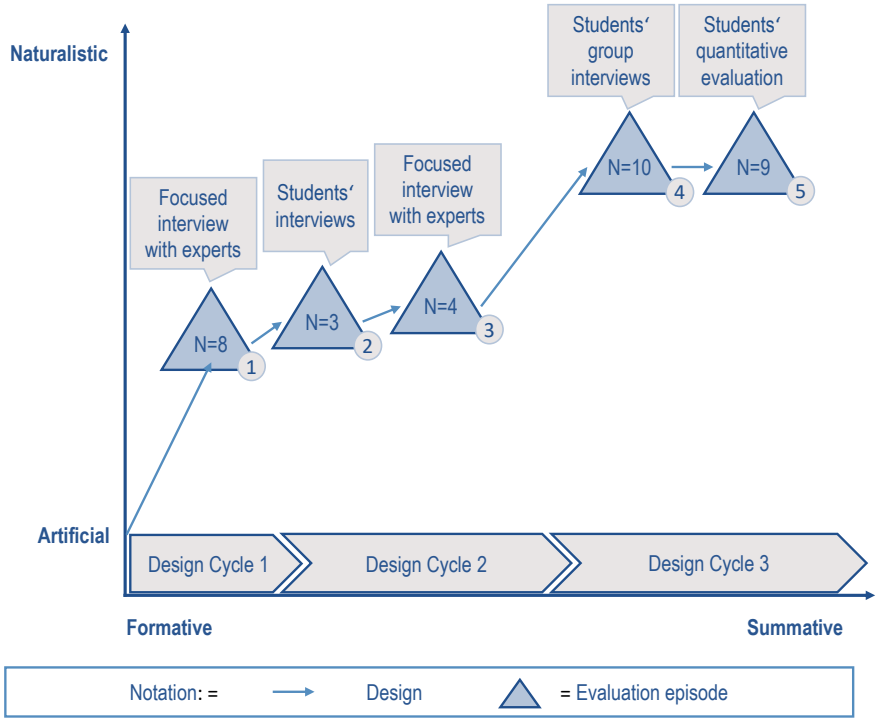

Figure 2: Evaluation strategy (in accordance with Venable et al., 2016)

In the following section, the evaluation results are described chronologically as indicated in Figure 2.

The **focused interview with experts** was conducted within TriCAT spaces, with the adaptations that have been made with the included scene editor in advance in *Design Cycles 1 & 2*. The interviewees consisted of three professors, one of them vice-rector, and five experts on virtual worlds for educational purposes. The focused object, which is the central part of a focused interview, is the derived design features from DP1 to DP4. Therefore, the interview was taking place in the virtual world. The results of the interview as well as the actions taken for *Design Cycle 2* can be summarized as follows: All design features of DP3 and DP4 were confirmed. DF1.3, the fair-like presentation, was generally accepted but detailed with the posters being put on a cuboid to be visible from four sides to extend the number of students to view the posters at the same time. Furthermore, the poster content was adapted to better fit the target group of bachelor students. DF2.2 and DF2.5 were added.

The **students' interviews** were announced within the identified target group of 102 students. Only three students participated and added the user requirement for an accompanying mentoring program (named twice and backed by literature), plus a confirmation of two already existing meta-requirements. This addition in *Design Cycle 2* is reflected in *Figure 1*, on page 6.

The second **focused interview** with experts in *Design Cycle 2* was held with a subset of interviewees of the first one (two professors, and two virtual world experts). All DFs and DPs

revised in *Design Cycle 1* were confirmed, accepted, and approved to be rolled out with students shown in the following figure.

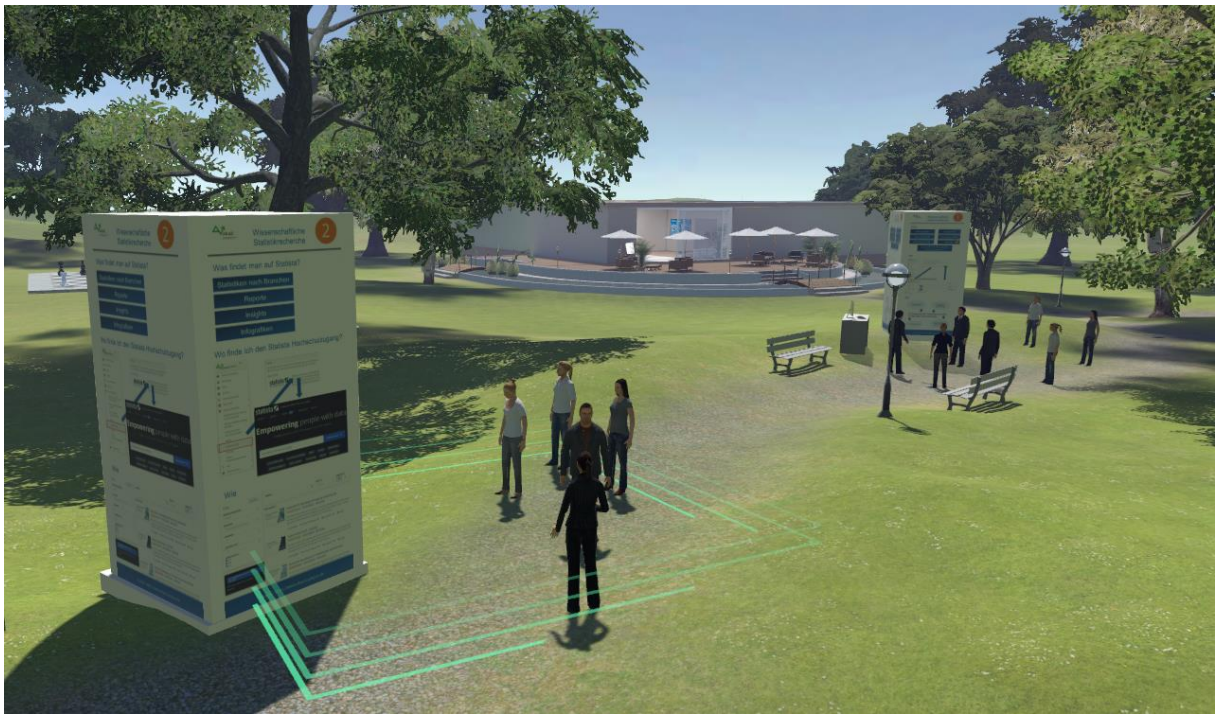

Figure 3: Fair-like, informal design of the learning setting

12 of the 16 registered students participated in the course in *Design Cycle 3*. 11 students were enrolled in business administration targeting a bachelor's degree, and one student was still in a diploma program. The digital affinity is high for students at the distance learning university since it is completely remote and digital (Blumentritt et al., 2020). Four of the 12 students started their studies in 2017 or earlier, so one-third of the participants are potential procrastinators. Compared to the rate among those contacted initially (67% procrastinators), procrastinators are underrepresented in the course. Two of the participants made use of the voluntary virtual world installation and login support. Three participants extended the course duration of three hours voluntarily by another 30 minutes to watch the video and ask additional questions.

Toward the end of the course, we held two **group interviews** with 10 of the 12 participating students (three and seven). In terms of DP1 (online learning setting) and its corresponding design features, the advantages named by the students (12 nominations) outperform the disadvantages (4). Advantages named were e.g., the social interaction (3 persons), the format virtual world itself (3), and the option for bilateral conversations (2) as well as the game-like character (1). Disadvantages mainly targeted the technical hurdles: Installation (2), the additional time needed (1), and the headset that is a prerequisite for the spatial audio to not produce an echo (1). In terms of DP2 (course design) the main positive aspects (9) named

were e.g., learning about literature search options in the learning management system (2), meeting the own supervisor (1) or learning where to find topic areas for those who do not have an idea for a topic yet (1). The disadvantages were partly heterogeneous, e.g., in terms of the duration, while one regarded the three hours as too long, the other would have preferred to have slightly more time. The same for the fair setting: Two would have preferred a presentation over a fair, while three explicitly praised the fair-like setting. Two mentioned that they wished to have had such a session at the very beginning of their study program. While DP3 (support and training) was rated positive in general (5), the criticisms all point in the direction of the login process. Two students admitted that they had not read the invitation e-mail containing the installation link because they had expected a process comparable to teleconferencing tools. Another student thought the registration link was a login link and had obviously not read the invitation thoroughly as well. Only two students had an improvement idea addressing training: the instruction at the beginning should ideally be separated from the course and available asynchronously. DP4 (curriculum integration) was rated positive in terms of voluntariness (1), participant composition based on similarity concerning study subject and progression (1), and well-positioned before the thesis to decrease anxieties (1). One student described a procrastination situation of four years of postponing the thesis and felt bad in the company of students finishing within the standard period of study. Rating the achievement level of the goals set with the course, three students have noted down one or more names of potential mentors, one of them had the plan to contact a certain mentor. Four explicitly said they wanted to start the thesis soon. Four already had a supervisor before the course, one found the supervisor in one of the two presenting professors. Four students mentioned to have a more detailed view of their potential topic, one would have preferred to have concrete topic proposals presented in the course. The networking aspect was rated positive twice but with one remark, that social networks are especially important during the initial phase of the study program.

The day after the course in *Design Cycle 3* the participating 12 students were provided with the documentation and the link to the survey for **quantitative evaluation**. Nine students participated in the survey. The age ranged from 25 to 56 with an average of 34 and a median of 27 years. All items are measured with a 7-point Likert (agreement) scale with no inversion (1=strongly disagree; 7=strongly agree). The following table reveals the summarized results.

Table 2: Quantitative evaluation results

Construct name	**Cronbach's Alpha**	**No. of items**	**Mean**	**Standard Deviation (SD)**
Facilitating conditions	0.774	3	5.82	1.57
Support measures	**0.723**	6	5.22	1.49

Social presence related to the virtual world	0.745	3	5.59	1.17
Social presence related to the course communication	0.924	9	5.18	1.28
Technology Experience	**0.704**	3	4.11	1.83
Computer Self-efficiency	0.925	3	6.15	1.08
Avatar identification	0.922	4	2.22	1.38
Behavioral intention	**0.813**	8	4.45	1.77

Facilitating conditions (resources, knowledge, support) are rated rather high (mean 5.82) with a moderate standard deviation (SD 1.57), comparable to the slightly and in general higher rated *computer self-efficiency* (mean 6.15, SD 1.08). Nevertheless, *technology experience* is technology-dependent and individually differing. While *technology experience* in videoconferencing is well established among participants (mean 6.00, SD 1.12), video-gaming is less distributed and individually different (mean 3.89, SD 2.57), and professional virtual world experience is little in general (mean 2.44, SD 1.81). *Social presence related to the course communication* is good in general (mean 5.18, SD 1.28). The *social presence related to the virtual world* on average is even higher (mean 5.59, SD 1.17), but there is one item value that is out of line (*I was able to form distinct impressions of some course participants*, mean 4.11; SD 1.62). Removing that item increases the average to 5.32. Since the *avatar identification* is generally very low (mean 2.22; SD 1.38), this might be the reason for the low impression of peers. We could neither confirm nor disprove the age-relatedness of this identification issue due to the small sample size. Another item below average (construct: *social presence related to the course communication*) is *the virtual world is an excellent medium for social interaction* with a mean 4.67 and an SD 1.23. The rating of the support measures is revealed in the following diagram. Besides the introductory video, all other measures were already in place for the course prototype, but in the case of the offline tutorial not explicitly communicated.

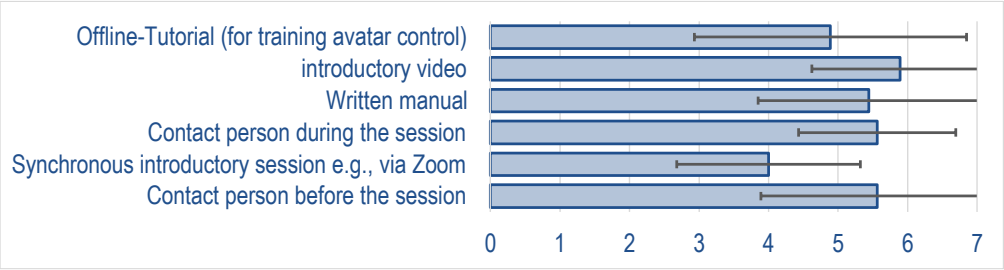

Figure 4: Evaluation results for support measures

The behavioral intention can be seen as a general effectiveness evaluation of the measure and is depicted in the following figure.

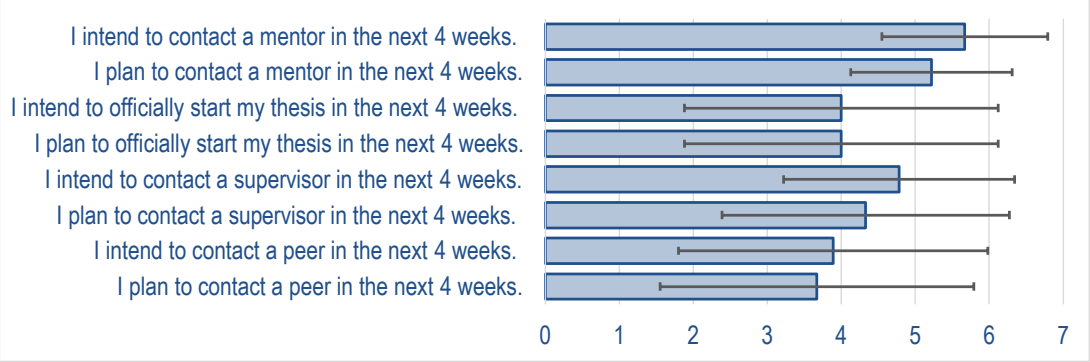

Figure 5: Evaluation results of behavioral intention

In the 7-point Likert scale used, the value *4* would be neutral, higher would indicate a more probable action, and lower a less probable action. In the Rubicon model by Heckhausen & Gollwitzer (1987), the *plan* to act is closer to the real action than the *intention*. A high gap between an intention value and an action value indicates that people have not made up their minds yet to act. Comparing the action plan values (*I plan to…*), peer contact is the least probable action for participants (mean 3.67, SD 2.12), followed by officially starting the thesis (mean 4.00, SD 2.12). The high SD indicates high individual differences. Contacting the supervisor is slightly positive (mean 4.33, SD 1.94), and contacting a mentor is the most probable action to be taken by all participants (mean 5.22, SD 1.09). The gaps between intention and action are generally low (mentor 0.45, thesis 0.0, supervisor 0.45, peer 0.22). Two participants contacted a mentor within the four weeks (both procrastinators), the other actions are not transparent to us. The mean for all plan values is 4.31 and slightly higher than neutral. Due to the low duration of four weeks during the holiday season and the fact that one-third were most probably procrastinators (started in 2017 or earlier), the measure itself can still be interpreted as effective.

Discussion

Five evaluations were made during the three design cycles, three evaluations were rather formative, and two were summative. In this discussion, we concentrate on the summative feedback, i.e., the students' group interview at the end of the course and the quantitative evaluation after the course. We argue that the summative evaluations already include the feedback from the previously made formative evaluations.

Although we have evaluated our prototype course with non-technical related students, quantitative results reveal a very high computer self-efficiency. We assume this is a consequence of the digital study model of the distance education institution, that these students have consciously selected. Nevertheless, students name technical hurdles like an

installation as the main disadvantages of the online learning setting and criticize the additional time effort. We conclude that the technical hurdles are negative due to time efforts rather than the lack of technical knowledge or self-confidence. The online learning setting in the virtual world was praised for its social presence and the suitability for social interaction in the interviews but social interactions scored below the average with a low SD in the survey. Our interpretation is, that the low avatar identification could have caused that. Problems with avatar identifications, when the selection is very limited (around 20 per gender), have also been uncovered in a prior study (Rinn, Necker, et al., 2023), our quantitative survey results add insights into the extent of this deficit.

Qualitative results indicate that individual solutions or options are necessary to prevent resistance and meet individual demands, e.g., in terms of a more flexible course duration by offering asynchronous content like videos. This is due to individual differences in the perception of the course duration and design (presentation vs. fair). This result highlights the urge for autonomy as indicated in the technical foundation *identity and control*. Although two students had preferred asynchronous virtual world technical training, the need for an offline tutorial was rated rather low with a high variance. We conclude that one should address individual preferences again in terms of introduction and communicate the options explicitly. The statement that social networks to peers are especially important during the starting phase of the study program is in line with another study in the context (Rinn, Necker, et al., 2023). Before starting the thesis, contacting faculty members is more important to students in distance education than contacting peers.

Implications for research are on how to increase the participation rate of only 12 out of 102. Especially the rate of procrastinators should be increased with two-thirds being among the identified target group and only one-third being among the actual participants. Advertising via marketing, the publication of success stories, and direct contact via phone could be evaluated for effectiveness and add additional design features for *curriculum integration*. Furthermore, a long-term study with a larger focus group for measuring actual success in terms of e.g., thesis grade compared to those not participating in the measure would gain additional insights into the effectiveness. Teaching method variances could refine or diversify design features and potentially design principles. Researchers should include further perspectives like marketing, class management, and student support services to inform practitioners on how to perpetuate the solution. Since mentoring was the lowest hurdle for participants to get started with the thesis, a standalone mentoring program could be developed in another design science project. For higher scalability, solutions with artificial intelligence-based conversational agents should be designed (Khosrawi-Rad et al., 2022).

Implications for practitioners are the fact that an introductory video would be of help for future courses as an additional option. This result aligns with qualitative results that e-mails are not read carefully and the login process is expected to be comparable to videoconferencing solutions. The synchronous session for login support that was voluntary in advance of the course was given a rather low priority and we conclude it should not be made mandatory. A direct contact person during and before the sessions is important. Although not read by everyone, a written manual is still seen as a helpful tool for the introduction. A procrastination hotline could help to increase the participation rate among procrastinators and de-taboo the problem. Separate courses for long-term and regular students should be offered to decrease embarrassment for procrastination and ideally increase their participation rate.

Implications for developers of virtual worlds either for research or commercial purposes are to adapt the login process to well-known videoconferencing solutions since this is the expectation of full-time working students for efficiency. The availability of a web application would make the installation optional. For better identification with the avatar, the choice and individualization options must be increased from today's mostly preconfigured 20 avatars per gender. Also, diversity aspects must be considered to foster inclusion. Successful business models like the free-to-play *FORTNITE* have proven, that customers are willing to pay for avatars, which underlines the importance (Schöber & Stadtmann, 2020).

Conclusion

Following the design science research approach, this study contained three design cycles and five evaluations. While the first three evaluations were rather formative and exclusively qualitative, the evaluation of the last design cycle and the naturalistic prototype with real students was both qualitative and quantitative. The formative evaluation results went into the naturalistic summative evaluations in design cycle three. Therefore, the results focused on the final two evaluations. These results reveal that a fair-like measure in a virtual world introducing a mentoring program and covering organizational topics as well as methods and tools fostering thesis writing is efficient. The validated and final design principles for the design of the intervention are the online learning setting in a virtual world, the course design to activate students, technical support before and during the course, curriculum integration for a homogenous target group, and post-course mentoring for continuation. These result in various implications for researchers, and the numerous design features developed reveal implications for practitioners and virtual world developers. The main contribution is a scientific rigorously developed blueprint including the perspective of multiple stakeholders that can be easily

applied to other educational institutions. Due to the high digital affinity of the business-related target group, the blueprint is transferable to more technical students in information systems education.

In the study we assumed that the duration of being in the study program is the only predictor for procrastinators. This is a simplification in the absence of qualitative data. There might be other factors like financial burden or lack of time that caused the extension of the duration of study. Furthermore, we initially planned to follow the rule to have eight to 12 evaluation participants based on Hwang & Salvendy (2010) but failed in two cases. With the high number of evaluations (five) in three design cycles this limitation is negligible. Furthermore, the interview groups were unequal (seven and three) because we let them choose the group. An equal distribution would have been ideal. Since all evaluations took place in the same educational institution the results are context-bound to a certain degree.

For productive usage, scalability, and cost-effectiveness new technologies should be monitored for applicability and value-add. Promising technologies could be artificial intelligence for technical support or even post-course mentoring. Furthermore, head-mounted displays mirroring mimics to the virtual self or controllers transmitting gestures would increase the number of nonverbal cues and thus social presence. The options for methods to be transferred from face-to-face to online would increase as well. For a productive operation, the stakeholders identified in this study are students, professors or teachers, rector, IT support staff, class management, student care services, virtual world developers, mentors, and marketing staff.

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