Digital Learning Assistants in Higher Education Environments:
A Qualitative Focus Group Study

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Abstract

Digital technologies have become increasingly important for educational institutions since the Covid-19 pandemic. In this paper, we present an artificially intelligent assistant system that supports students and prospective students on different levels. In addition to an AI-based chatbot as the central communication element, the virtual guidance system includes planning, study analysis, and motivation applications. To evaluate how the assistant can best address students' needs, a qualitative focus group study with eight current students was conducted in April 2022, involving first a user testing of the chatbot prototype and second an assessment of different concept sketches for the planner and motivator applications. Results from the user testing of the chatbot suggest the importance of a vivid persona and appealing design, accurate, guided, direct answering, and optional push messaging. In the second part concerning planner and motivator, the students expressed the wish to integrate predominantly functions, which help to prepare on time for exams and ideally bundle the applications on one platform to avoid switching between different platforms. Furthermore, participants voiced privacy concerns, as well as an increase in distraction and competitive pressure through gamification. The findings were used to further develop and refine the digital assistant before launch. They give detailed insight into why and how integrated, digital assistants can be successful in educational settings and can be used for future research in the emerging research field of AI in teaching and learning.

Keywords*:* Digital Learning, Study Assistant, Educational Chatbot, AI

Introduction

Many bachelor students in Germany drop out of university before completing their degree (Autor:innengruppe Bildungsberichterstattung, 2020). Students who lack motivation have an increased risk of failing their studies (Heublein et al., 2017). With the rise of digital learning since the Covid-19 pandemic, this situation has been further aggravated, as students have fewer opportunities to interact with each other and the teaching staff (FIDL, 2021). Furthermore, digitalization results in an increasing supply of information and educational resources, often unstructured and of inconsistent quality (Schurz et al., 2021). At the same time, media and information competencies are important future skills for students. However, traditional learning formats hardly promote such skills (Mebis, 2018). By leveraging artificial intelligence (AI) technology, the DIAS project at Ansbach University of Applied Sciences aims to address these issues with a digital assistant, who steers information in a targeted manner. In addition to an AI-based chatbot as the central communication element, the virtual guidance system includes planning, study analysis, and motivation applications. DIAS offers students added value through a robust information platform and the opportunity to effectively plan and pursue their studies, while simultaneously creating more resources for individual support by relieving the burden of email traffic for the administration.

The early-stage evaluation of the project aimed to explore the assistants' feasibility and acceptability. The central question was to assess how the DIAS system can best address the student's needs and identify opportunities and risks from the student's perspective, thus enabling the research team to refine the digital assistant before launch further. A qualitative focus group discussion was chosen as a research methodology to explore answers to this question and stimulate new ideas that haven't been considered.

In the first part of this paper, the theoretical background to the DIAS system is introduced, explaining how each of the four key components is supposed to contribute to the project's objectives. The second part will detail the methodology and research procedure of the focus group. Finally, results with their respective implications and limitations are presented and discussed.

Theoretical Background

Related Work

Despite concerns about privacy issues, the relevance of digital assistants for the educational sector has increased in recent years (Alexander et al., 2019). Particularly since the Covid-19 pandemic, universities have invested more than ever in digital technologies such as AI-based assistants (Fulton et al., 2022). An intelligent assistant can take on different forms. However, in general, the term describes an artificial intelligence system that can use natural language in communicating with users (Windiatmoko et al., 2021). While most of the assistants focus on communication components in the form of chatbots, they can also include other applications such as peer support modules, content quizzes, or recommender modules (Song et al., 2019, Schurz et al., 2021). Conversational AI can provide interactive learning, ranging from knowledge tests to encouragement, learning advice, and reminder functions. A particular benefit of digital assistants in educational environments is the personalized learning experience, as they can individually adapt to the student's way and speed of learning. (Clarizia et al., 2021) Literature suggests different quality criteria for educational assistants such as humanity, affect and accessibility (Radziwill & Benton, 2017; Smutny &

Schreiberova, 2020), as well as usability, motivation, and technical correctness (Hobert & Meyer von Wolff, 2019) among other factors.

Prior, empirical research supports the successful use of conversational AI in different educational settings (Pérez et al., 2020). Thus, potential students are more likely to finish the matriculation for their chosen study program on time when using an AI-based assistant with personalized messaging. In addition, the effort of university administrative staff can be reduced considerably. (Page & Gehlbach, 2017) A quasi-experimental study revealed that teaching models using conversational AI can lead to better academic results than traditional teaching models in language courses. Students in the experimental group highlighted the easy usability and flexibility among other benefits (Vázquez-Cano et al., 2021). A study on the use of chatbots in mentoring processes suggests a positive perception of chatbots that support students with feedback and guidance in reading and writing tasks during their self-study (Neumann et al., 2021). While research on chatbots in educational institutions is growing, there are only few empirical studies on planning, analyzing and/ or motivation applications, yet with mostly positive results. Jeong et al. (2012) for example report an improvement in learning effectiveness and student satisfaction after using a study assistant for curriculum planning. In a focus group on a digital recommender tool, students found the recommendations for learning behavior based on personality tests, as well as the recommendation of academic contacts for learning exchange particularly helpful (Schurz et al, 2021). Likewise, empirical research on motivation applications shows that they can support engagement and academic performance (Pechenkina et al., 2017). To the authors' knowledge there has been no empirical research on integrated systems such as DIAS, which include all four application areas. In a first step, qualitative studies will be needed to answer why and how such integrated systems can be successful in educational settings. Similar research designs have been applied for digital assistants in other disciplines, particularly in the health sciences (Beilharz et al., 2021; Høiland et al., 2020), however, are still rare in the field of education.

DIAS Components

Informational Component

The communication/ information component of the DIAS system is represented by a conversational AI, which will be integrated on different frontends e.g., on the university's website or in messaging apps. As a 24-hour support service, chatbots can facilitate academic information flow and meet the students' needs anytime (Alexander et al., 2019). DIAS can be classified as a "service-oriented" (Pérez et al., 2020) chatbot and according to the framework of Wollny et al. (2021) assumes an assisting pedagogical role, with the objective of increasing efficiency of education through answering FAQs. Unlike teaching-oriented chatbots, service chatbots do not impart subject-specific knowledge, e.g. on language learning (Pérez et al., 2020). In the first development phase teaching and administrative staff collected quality-assured standard answers, which were integrated into the conversational AI in a rule-based approach. In the second phase, the chatbot will be trained for AI-based answer generation to deal with individual (non-standard) questions based on a self-uploading knowledge base. The chatbot's design, character traits, and conversational tone were based on a pre-developed persona, which is supposed to create a more personalized conversation experience (Braun & Alt, 2020). Apart from answering standard and individual questions from students and prospective students, the chatbot will also share unrequested information

such as exam reminders and learning advice (e.g., push messages) in the subsequent development stage and will therefore be not only responsive, yet also proactive.

Planning Component

Since the start of the Covid pandemic in 2019 and the shift to online learning, students are increasingly required to be more self-organized and self-regulated to manage their studies successfully. That includes the ability to "control, manage, and plan their learning actions" (Broadbent & Poon, 2015, p.3). Thus, a meta-analysis of different self-regulation strategies revealed that time management and consciousness of one's learning behavior, among other techniques, have a significantly positive effect on academic achievement, i.e. result in better grades (Broadbent & Poon, 2015). In a first design thinking workshop with participants from the research team, a to-do list and a calendar were identified as essential time management and self-monitoring tools. Another crucial element of self-regulation is the setting of personal goals. Academic performance can be increased if students write down specific, personal, and/or academic goals. (Schippers et al., 2020) The DIAS system will address this with a learning planner, which students can use to specify and track their academic learning goals. To-do list and calendar should be integrated with the learning planner and gamification elements in a mobile application.

Motivational Component

Motivation is a critical factor in study success and can positively influence academic performance (Kusurkar et al., 2012). One way of increasing student motivation and thus changing behavior is gamification, as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p.10). Since games and gamification promote social connections, autonomy, and mastery, they can be an essential motivational driver. Educational games can thus motivate learners and facilitate the expansion of knowledge in a subconscious way. Among the different types of game elements such as avatars, quests, and gifting, the DIAS project chose the use of badges, leader boards, (success) points, and levels since those elements are already available in the university's established learning management system Moodle and can be easily explained to students. (Success) points are supposed to be awarded for the submission of coursework or successful completion of learning games. Based on the gathered points, different levels can be reached and placements on leaderboards or rankings accordingly. Badges can be awarded for the completion of a course or also for the achievement of a certain level. (Buckley et al., 2018)

Analytical Component

The analytical function of the system leverages the educational technology of learning analytics by collecting and processing information of the learner. Thus, learning processes can be optimized, and the student is better equipped to reflect on his/her learning progress. Teachers can also use the information to support their students better and give them actionable feedback. (Galko et al., 2018) In the DIAS system, students can voluntarily choose to be shown their study progress and receive warnings if their progress does not match their plans based on the required ECTS.

Furthermore, teachers are supposed to receive anonymized reports of their course participants. Thus, they would be able to track learning status, offer further support if necessary and optimize their courses in the sense of constructive alignment. This teaching-

learning scenario design aims to better align learning outcomes, content, and assessment (Biggs & Tang, 2007). The analyzer is supposed to be implemented alongside the other functions on the learning platform with access to different databases.

Methodology

Research Instrument

The evaluation concept of the project defined several phases, for which qualitative and quantitative methods will be applied. For the initial, exploratory research phase, a qualitative focus group discussion was chosen for several reasons. First, a focus group offers more potential to generate new ideas through impulsive contributions in the group discussion compared to an individual interview. Thus, the research team expected to stimulate suggestions for improvement of the chatbot and ideas for planning and motivating functions. Furthermore, influencing factors through the interviewer/ moderator can be reduced due to the size of the group, and participants can share knowledge on which they can base their answers in return. (Schulz, 2012)

Participants

The eight participants of the study were approached through a university course and volunteered to participate in the focus group in April 2022. All students were enrolled in the "Applied Artificial Intelligence and Digital Transformation" Master's study program. Among them were four males and four females. Due to the limited research funds, there was no reimbursement for the focus group participation.

Data Collection

The research team prepared a semi-structured interview guideline to guide the focus group. Several categories were developed, based on prior literature research of similar studies in the educational field (Schurz et al., 2021), but also in other disciplines (Beilharz et al., 2021; Høiland et al., 2020). The semi-structured design of the focus group was supposed to allow for further discussions and flexible development of the conversation. The focus group was conducted online via Zoom. Since both the chatbot prototype and concept sketches of the motivator and planner functions[1] were discussed, the focus group was divided into two parts with slightly different approaches. The first part was initiated with a short brainstorming on the students' associations with artificial intelligence in general. Students were then asked to test the DIAS chatbot from the perspective of a student as well as from the perspective of a prospective student. The categories for the first part of the interview focused mainly on usability aspects such as the perception of the chatbot character or the conversational flow (see table 1). In the second part, the participants were supposed to discuss the different ideas for the planner and motivator, which were presented to them in the form of concept sketches.

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[1] The analyzer function did not allow for an inclusion in the focus group, due to its development status when the study took place. The planner and motivator applications were also still in the idea stage, however, concept sketches of the two functions could be used in the discussion.

Table 1: *Semistructured interview guideline*

Question Category	Explanation	Example Question
Part I: Chatbot prototype testing		
Chatbot character & design	Questions concerning the persona and gender of the chatbot (conversational tone, language style, etc.), as well as the visual presentation (colors, logo, etc.).	How do you perceive the use of emoticons in the chatbot text?
Content	Questions concerning the content quality (answer accuracy, answer frequency, learning tips, etc.)	How would you like it if the bot sends you unrequested messages such as learning tips?
Conversation flow	Questions dealing with aspects of navigation through the interview, links, suggestions in the form of selection buttons, but also readability through simple sentence structure and short text length, etc.	How do you feel about the navigation/ guidance through the conversation?
Overall impression	Questions that refer to the overall impression of the DIAS chatbot or chatbots in general and the associated risks & opportunities	What do you like most about the chatbot?
Part II: Planning and motivating functions		
Utility of the application	Questions concerning the utility of each of the presented application elements such as to-do list, learning planner, calendar, etc.	Why would you consider the learning planner helpful or not helpful for your studies?
Handling of Moodle (LMS)	Questions concerning the current usage of the learning platform Moodle as well as the supposed usage of applications that would be implemented on the platform	How do you currently use the learning management system Moodle?

Data Analysis

The data was analyzed based on the qualitative content analysis according to Kuckartz (2016), since this method was considered to best address the research objectives and circumstances. The evaluation was conducted in two steps as suggested by Hilpert et al. (2012). First, the research team transcribed and reviewed the video recording several times. In a second step, the data were coded and grouped into categories, again reviewed, and adapted. The coding was done in a mix of deductive and inductive approaches. Before conducting the focus group, categories were formed (see table 1) as a basis for the semi-structured interview guideline. In the content analysis with the software F4analyse, this basic framework has been further developed; new categories were added, and/or old categories were removed. To ensure objectivity, the coding system was reviewed and adapted by other team members.

Results

In the following, the results of the focus group study are presented. Table 2 lists quotes for each defined category in the first part of the discussion. Table 3 displays the results for the second part, in which concept sketches of the motivator and planner functions were discussed.

Part I: Chatbot prototype testing

During the warm-up, students mentioned different associations with chatbots, such as "fast", "intuitive" and references to chatbots in fiction. When it came to the user testing, design, use of emoticons, and the vivid conversational tone of the chatbot were largely well-received. Moreover, the majority perceived the chatbot gender neutral. Some participants wished for a more substantial visual reference to the educational context.

In terms of content, the response rate and accuracy often did not meet the expectations of students (both in their role as students and as prospective students). In particular, the wish was expressed that information, which can only be found on the website after clicking several times (e.g., opening hours), will be displayed quickly and accurately by the bot. Answers should vary; even if the question is not understood or there is no rule for it yet, there should always be a placeholder answer.

The built-in selection buttons and links were perceived positively for navigation. However, participants noted that answers should be shortened and there should be no loose ends to improve the flow of the conversation.

Push messages (e.g., study tips or reminders for deadlines, etc.) were found to be best applied if they are optional, i.e., students would ideally like to select whether they want to receive unsolicited messages from the bot at all, and if so, on which topic and with which regularity (e.g., once a week like a short newsletter). In addition, according to participants, it should be optionally adjustable whether these messages are sent with or without a pop-up sign on their smartphone.

With the current recognition rate and information basis of the chatbot, students see the risk that it conveys an overall negative impression of Ansbach University of Applied Sciences (especially since it offers degree programs in the AI field) and could discourage prospective

students from applying. However, provided that the recognition rate is further improved, students view the chatbot as an opportunity to make information quickly accessible or present it simply, which is currently not the case on the university's website. In total, the chatbot's personality, the links, as well as the selection options were best perceived and the chatbot was considered to be particularly helpful for first-year students.

Table 2: *Results from the first part of the focus group (chatbot user testing). Texts have been translated from German. Partly filler words were excluded in square brackets for better readability.*

Category	Definition	Quote (Example)
Chatbot character and design	All text passages that address aspects of the persona and gender of the chatbot (conversational tone, language style, etc.), as well as the visual presentation (colors, logo, etc.).	"I thought it was really cool that there are […] emojis built in. It just makes it a bit more personal" (Focusgroup 1.1, para. 99)
Content	All text passages that deal with aspects of content quality (answer accuracy, answer frequency, learning tips, etc.)	"I didn't think the answers were so good, because no matter what I asked about semesters abroad, really no matter what, I always got the same answer." (Focusgroup1.1, para. 127)
Conversation management	All text passages that deal with aspects of navigation through the interview, links, suggestions in the form of selection buttons, but also readability through simple sentence structure and short text length, etc.	I thought it was really cool at the beginning that […] modules were already given, so first I decide whether I am interested in studying or whether I am the student who has a question. And then the modules came automatically, where I can […] select what I want, that is, do I want to know what the application deadlines are or so. That's pretty cool to get into it that way." (Focus group1.1, para. 101)
Push messages/tips	Text passages that refer to the use of push messages in the form of learning tips, event information, or exam reminders (as a pop-up or just in the course of the conversation)	"if I am bombarded with some kind of pop-ups, then I would just delete it directly." (Focusgroup1.1, para. 75)
Risks	Text passages that refer to a negative overall impression of the DIAS chatbot or chatbots in general and the associated risks for studying and the decision phase for a study program.	"I still see a big problem there. I think if he [the chatbot] is released in its current level of development somewhere publicly on the website of Ansbach University of Applied Sciences, [and] I were […] looking for a bachelor or master, and communicated with him, then I would no longer wish to [study at] Ansbach University of Applied Sciences.

		Because I would think, wow, they're doing something with artificial intelligence and then I ask him something, get no answer, get a wrong answer, " (Focusgroup1.1, para. 168)
Opportunities	Text passages that refer to a positive overall impression of the DIAS chatbot or chatbots in general and the associated benefits for the studies and the decision phase for a study program.	"I think it just depends. If I'm a freshman and I have a really specific question, then I would definitely go to him right away because I think if he can answer it for me then it's really quick and then I don't have any more questions." (Focusgroup1.1, para. 166)

Part II: Planner and Motivator Concept Sketches

To-do lists and calendar functions were found to be helpful for study and self-organization, especially when the calendar is linked to the lecture schedule. The calendar function was also mentioned as an alternative for learning organization in the learning planner.

The suggested use of badges was seen as motivating, as long as no performance judgment is associated with them (such as grades). The learning planner was considered to have a motivating effect by showing invested learning time and learning activities.

The reminder function appears to be particularly helpful for learning support (corresponding to the push messages via a chatbot) for the students to be reminded of upcoming exams, for example, and for them to start preparing well ahead of time and thus prevent exam stress. If the learning planner is applied correctly, it was also assessed to be a helpful feature to reflect on one's learning behavior and to support particularly first-year students in their exam preparation.

Furthermore, several participants noted that the basic framework (the bot) should be in place before planning and motivator functions are included as "nice-to-have" features.

Games and pop-ups (e.g., learning tips) were partly seen as distracting instead of promoting motivation and learning. The use of games and the documentation of learning time in the learning planner were perceived by some students as an additional effort instead of a motivational or organizational aid.

Rankings and levels were almost uniformly found to be unnecessary, as they might increase competitive pressure. Participants stated that if the learning planner was course-bound or the lecturer could access the learning plans, this could also lead to an increase in competitive thinking. Most of them confirmed that they would perceive it as a control and monitoring instrument and therefore experience performance pressure. Likewise, the publication (even if only within the course) of different performance levels through rankings was considered an invasion of privacy.

Regarding the usage of the learning platform Moodle, all participants confirmed that they mainly use it for filing and downloading documents. Integration of the to-do list and the calendar including the lecture schedule in Moodle was perceived as most helpful so that students do not have to switch between different platforms to view the lecture schedule.

Table 3: *Results from the second part of the focus group reflect the feedback on concept sketches of the planner and motivator functions. Texts have been translated from German. Partly filler words were excluded in square brackets for better readability.*

Category and Subcategory	Definition	Quote (Examples)
Opportunities	Sections that show the opportunities and advantages of the planner and motivator functions.	
Organizational support	Text sections that show how the DIAS functions discussed can support study and self-organization	"I actually have a bit of a different opinion, so if the calendar really already includes the lecture schedule, then I would like that because right now we have to use two ways, so to speak, somehow Moodle for all the documents and then the, I don't even know what it's called, the lecture page to just find your lecture schedule, and even there you really have to click through every time somehow until you get to your lecture schedule." (Focusgroup1.2, para. 38)
Motivational support	Sections that show how the DIAS functions can have a motivating effect on the students	"Or now I have, that one, I think […] as a student one is actually never finished, one has always still something, that one can still do and learn. And then just to know, hey now I've invested so much time this week, now I can really take a break somehow or especially in the exam phase to know how much you actually really sit at your desk, I would actually find that really cool." (Focusgroup1.2, para. 26)
Learning aid	Sections that show how the DIAS functions can support learning and timely preparation for exams	"So, I think it could be helpful for someone who is still looking for his/her learning style. So, [someone] who is still thinking, where am I maybe wasting time or how much time am I investing in learning in the first place, it could be useful for that." (Focusgroup1.2, para. 24)
Risks	Texts sections that show the risks and disadvantages of the Motivator functions	

Distraction	Sections that show how the DIAS functions can distract from studying or from the learning process	"I see then again the danger if you are [...] somehow during the lecture [...] on Moodle and then you see, ah okay, there is a new game online and then somehow you deal with it rather than somehow dealing with the lecture. Don't know if that's really that helpful." (Focus Group1.2, para. 75)
Extra effort	Sections that show how the DIAS functions could represent an additional workload for the students	"I think it's nice to have. Whether you really want to make the effort [...], to fill it in, to set deadlines, to link that (um) that sounds somewhere also like paper whereby we really are already [going] in the direction of digitalization, already dare to take the step. I would try it, I also think it's a nice gimmick, nice to have, whether it will be used or not I don't know." (Focusgroup1.2, para. 28)
Competitive pressure	Sections that show how the DIAS functions can lead to competition and pressure to perform.	"I think studying is [...] partly already enough effort and [...] that one has a lot, so especially maybe when you start off with the Bachelor, so having this competitive thinking of, oh he/she is better, or, that person has better grades. And if you then see a ranking list on Moodle, I mean, as S3 also said earlier, some people work, they might not have the time to invest to climb higher on the ranking list and might feel rather demotivated. " (Focusgroup1.2, para. 62)
Privacy	Sections that highlight concerns about privacy and monitoring when using DIAS features	"see a little bit of a problem if one coordinates this [the learning plan] [...] with the professor then [...] this could slip into [...] monitoring." (Focusgroup1.2, para. 22)
Moodle use	Text sections that demonstrate how students use Moodle and how often they use it.	"so, I only use Moodle when I, [...] when I need content for my lectures. [...] I just go in to download it, then I leave." (Focus Group1.2, para. 4)

Discussion

The objective of this focus group was to assess how the DIAS system can best address the student's needs and to identify opportunities and risks from the student's perspective, thus enabling the research team to further refine the digital assistant before launch. Four main assessment criteria for the chatbot could be identified in the results of the discussion: character and design, content, conversation management and push messages. While character, design, and conversation management were mainly well-received, the feedback on

content and possible, future push-messaging with learning tips was more critical. The positive perception of the chatbot's vivid character and appealing design confirmed the intention to create a more personalized conversation experience using a chatbot persona (Braun & Alt, 2020). According to the participants' feedback, content should be more specific and accurate, yet still short. Any kind of unrequested messaging should be optional. In this context, the initial warm-up also showed students' high, partly fictitious expectations concerning artificial intelligence. Furthermore, students discussed the opportunities and risks of the use of a chatbot in an educational environment, which provided insight into the perception of their institution. Thus, students see the professional web presence of the university as a possible factor that can influence the decision of potential students for or against the institution. Especially with a research profile focusing on artificial intelligence, an AI-based chatbot should convey the university's expertise and act as a flagship for the university. They also illustrated the benefit of a chatbot answering routine questions, both from students and prospective students, faster and more conveniently than the study service or a search on the website. This supports the underlying assumption of the project and the perceptions evidenced in other studies on service-chatbots in educational settings (e.g. Page & Gehlbach, 2017; Pérez et al., 2020).

Several positive and negative aspects were identified in the discussion concerning motivational and planning support. Students saw opportunities in an integrated calendar, a to-do list, and reminder functions to support their self-organization and learning. The learning planner received mixed feedback. However, especially for first-year students, it could provide valuable help in finding their learning style. The functions that would remind and guide students to prepare on time for exams were seen as most helpful. In terms of motivational aspects, the students preferred the use of badges to other gamification elements, since they might also help them to identify other students who have taken the course previously and are hence able to engage in informational exchange. This supports previous findings on the positive perception of badges in educational settings (Hakulinen et al., 2015). Concern was expressed by students in terms of privacy issues when allowing teachers access to their learning plans and additional (competitive) pressure when it comes to gamification functions such as rankings and levels. These comments align with prior studies, which suggest that competition and peer pressure through games can reduce intrinsic motivation (Reeve & Deci, 1996) and result in feelings of stress and distraction (Ejsing-Duun & Skovbjerg, 2014). Lastly, students also expressed the wish to integrate the functions on one platform, to avoid switching between different systems. Since the learning management system (Moodle) is currently only used for access to lecture documents, it still has to be determined whether and how this platform can integrate the DIAS components and attract students to use them there.

Limitations

Despite the strengths of the empirical design, the study underlies some restrictions, which also offer potential for future research. Thus, a shortcoming of the design is the participant recruitment from only one course and study program, resulting in a low sample group diversity. Although a homogeneous group composition could also be seen as a positive aspect, since participants can discuss the subject matter based on similar knowledge levels (Schulz, 2012), perspectives from other study programs would have been important as well. Furthermore, the students had previously been in contact with the chatbot, which may have influenced their feedback in the focus group. As the group knew each other, social desirability could also have been an influential factor in determining their answers.

Therefore, future work in this field should consider recruiting a diverse participant base, with students from different study programs and possibly even different educational institutions.

Implications

Key insights from the focus group will be integrated into the further development of the DIAS project. To address the risk of keeping potential students from applying to the university, when faced with a prototype of the chatbot, the welcome message will include a statement on its research status and explain potential misunderstandings or lack of answers at this development stage. The focus group also highlighted the importance of training the chatbot for AI-based answer generation to deal with individual (non-standard) questions in the second development phase. This will also improve content quality, and recognition rate and allow for more diverse question-answering scenarios. In addition, the student feedback will be integrated into the design of the push messages or unrequested messaging, considering the wish for optionally selecting topics and frequency. Regarding the planner and motivator applications, the focus group showed the need to carefully assess which functions benefit students, and which might even have adverse effects on the student's motivation. Therefore, the research team decided to focus on fewer applications than initially planned, with a better adaptation to the student's most pressing needs, such as exam reminders and support in identifying and tracking their individual learning style.

Furthermore, the study also contributed to the practice of chatbot design, learning assistants, gamification and motivation in general. Two themes could be identified in this respect. First of all, there is a high need to educate on and clarify the benefits and limits of artificial intelligence, since, despite the participant's knowledge of the current development stage, expectations were higher than reality can currently provide, partly even fictitious. The second aspect relates to the student's concerns regarding privacy issues and (competitive) pressure. Particularly in educational settings, it is essential that students trust the provider of the digital assistant and are assured that the stored information e.g., on their course performance, cannot influence their assessment by teachers. Apart from that, the aspect of competitive pressure should be considered when designing gamification applications, especially, since there is still only little empirical evidence on the benefits of gamified learning (Antonaci et al., 2019; Hakulinen et al. 2015). Based on the findings and their consideration in the implementation, future quantitative research could aim to find evidence for positive effects on motivation, information transparency, and planning skills when applying an integrated system such as DIAS.

Conclusion

The study findings provide detailed insights into the students' preferences, such as their support of the assistants' vivid persona, an optional push messaging, and functions to help them prepare on time for exams. While many aspects of the system were received positively by participants, there were, however, also some risks and concerns mentioned, such as the need for privacy and avoidance of competitive pressure when designing a digital assistant. The focus group results were able to answer the initial question of how students' needs can be best addressed, and the participant's feedback could be used to further refine the system before launch.

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