A Service Perspective on Designing Learning Companions as Bonding and Mindful Time Managers in Further Education

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A SERVICE PERSPECTIVE ON DESIGNING LEARNING COMPANIONS AS BONDING AND MINDFUL TIME MANAGERS IN FURTHER EDUCATION

Research Paper

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Abstract

Further education students who work in parallel are particularly challenged by multiple loads leading to overscheduling and exhaustion. Learning Companions (LCs) in their role as virtual relationship-oriented Pedagogical Conversational Agents might facilitate the burden of learning through recurring long-term interactions. Our contribution derives design knowledge for LCs as bonding time managers from a service-oriented perspective along the three layers of the value in interaction model. By synthesizing the findings of a systematic literature review and user needs from six qualitative interviews with the target group, we derive 24 design requirements and iteratively synthesize five design principles supported by the formative evaluation of a low-fidelity prototype. We intend to contextualize a value-driven, service-oriented perspective on the design of time-managing LCs in further education.

Keywords: Learning Companion, Conversational Agent, Time Management, DSR, Value in Interaction.

1 Introduction

Technological progress and the trend toward digital learning and flexible working environments are creating new opportunities for continuous education (Rinn et al., 2022). However, this progress also increasingly blurs leisure and work and provokes overstraining and technostress (Reinelt & Benlian, 2022; Salo et al., 2022) or nudges individual choices against the long-term well-being of humans (Michalke et al., 2022). Especially when being employed or having family responsibilities in parallel, skills in mindful time management are essential for academic success (Lund & Wiese, 2021; Rinn et al., 2022). Otherwise, the double burden often results in exhaustion, mental health issues, and high dropout rates (Behr et al., 2021; Michalke et al., 2022; Nickel et al., 2018). The augmentation in remote learning since the COVID-19 pandemic (Abdullah et al., 2022), has even intensified the perceived workload, uncertainties in the course of study as well as students’ demand for assistance in coping with their learning material in line with their scarce time resources (Winde et al., 2020; Herrmann-Werner et al., 2021). A recent survey of 266 working students who are balancing multiple loads, found that the primary reason they consider dropping out of further education, regardless of their study model (face-to-face, digital, hybrid), is difficulty with mindful time management (Rinn et al., 2022).

Learning Companions (LCs) are digital (chat-)bots that communicate naturally to establish a friendship-like bond with their human learner that goes beyond pure assistance (Khosrawi-Rad, Rinn, et al., 2022; Strohmann et al., 2022). They might help (working) students improve their time management collaboratively and form sustainable learning habits (Fitzpatrick et al., 2017; Khosrawi-Rad, Rinn, et al., 2022; Luxton, 2014). LCs have in common with disruptive chatbots like ChatGPT to be constantly available, easily scalable, and highly knowledgeable, but differ in their bonding role as companions—a characteristic that is crucial for recurring, enjoyable interactions and facilitating desired behavioral changes for improving time management habits over the long term (Gubareva & Lopes, 2020; Khosrawi-Rad, Schlimbach, et al., 2022; Smutny & Schreiberova, 2020).
While the potential of using chatbots as time managers on a purely functional level has been widely recognized in scientific literature (Gubareva & Lopes, 2020; Rodriguez et al., 2019), it remains a research gap in two respects: First, there continues to be a scarcity of sound design knowledge that combines the potential for LCs to build close relationships with their human users to then jointly address mindful time management as a key challenge in learning (Khosrawi-Rad, Rinn, et al., 2022). Second, existing time-managing chatbots appear to be primarily task-driven, like focusing on scheduling services (Inie & Lungu, 2021), goal setting with an increase in user efficiency (Chen et al., 2022; Du et al., 2021) or productivity increase at the workplace (Kimani et al., 2019). Thereby, a value-oriented view on designing the artifact is missing, which considers interaction with students as a service to thus holistically build around different value layers relevant for a satisfying interaction (Geiger et al., 2020). Indeed, ignoring this service-driven perspective might lead to value co-destruction (Li & Tuunanen, 2022), since it degrades the interaction experience by undermining trust, commitment, and individual well-being (Michalke et al., 2022) in learning. We aim to contribute to this research gap by addressing the following research question:

**How to design Learning Companions for valuable interactions as a service to help students in further education better manage their time and facilitate learning?**

In section 2, we conceptualize interaction with LCs as a service and explain the individual components of *Value in Interaction* using Geiger’s (2020) model before systematically deriving design knowledge.

## 2 Applying a Service Perspective on Interactions with LCs

LCs have their origins in so-called Pedagogical Conversational Agents (PCAs), which communicate naturally as dialogue systems with their users in educational settings (Hobert & Meyer von Wolff, 2019; Winkler & Roos, 2019). The initial idea of mediating learning content via a virtual tutor dates back several decades (Atkinson, 1968; Kulik & Fletcher, 2016; Suppes & Morningstar, 1969). Since then, a variety of new PCA roles, such as organizers or time managers have emerged (Khosrawi-Rad, Rinn, et al., 2022; Weber et al., 2021; Wollny et al., 2021). Current research regards PCAs as human-like interactors (Wang et al., 2021) and recently shift more toward long-term orientation (Nißen et al., 2021; Skjuve et al., 2021). PCAs are thus increasingly promoting a companionship-like bond with their human interactors by building a trustworthy relationship with them (Grivokostopoulou et al., 2020; Strohmann et al., 2022). While previous research dealing with time-managing chatbots has focused on the functional level (Chen et al., 2022; Du et al., 2021), rarely enriched by learning theories and virtual companionship (Khosrawi-Rad, Schlimbach, et al., 2022), our focus lies on a value-driven design of a bonding time managing LC that goes beyond efficiency increase.

When we look at LCs as social actors (Nass et al., 1994) combined with the lens of service-dominant logic (SDL), reciprocal value creation between the human user and the data-driven LC through mutually advantageous resource integration takes place (Vargo & Lusch, 2004). We intend to derive design knowledge for LCs via the theoretical lens of SDL. From that viewpoint, customers (here: students as users) do more than just consume a service or product, as they also actively participate in the value-creation process while interacting (Paukstadt et al., 2019; Vargo & Lusch, 2004). In contrast to a product-dominant viewpoint, SDL regards services as the foundation for economic exchange rather than goods (Lin et al., 2015). SDL prioritizes ‘value-in-use’ (ViU) over ‘value-in-exchange’ (Azkan et al., 2020; Vargo & Lusch, 2008). That view suggests that the value of a service is defined not by its qualities (e.g., the LC’s scheduling features), but by the individually perceived value when using it (Schürzitz et al., 2019; Vargo & Lusch, 2004) – for instance, turning the burden of learning into a valuable interaction for the student, while also creating value for the LC through the fed-in data. Value co-creation, which emphasizes collaborative and reciprocal value creation between actors and entities through mutually advantageous resource integration, is an important aspect of SDL (Blaschke et al., 2019; Schürzitz et al., 2019). Blaschke et al. (2019) enhance this perspective of SDL by adding another pillar that incorporates design expertise to support the construction of digital value co-creation networks enabled by service thinking (Azkan et al., 2020) – a perspective we will build upon.
Interaction is considered an essential aspect to create value (Geiger et al., 2020). According to the value in interaction model from Geiger et al. (2020), the value in interaction (ViI) decomposes to the value in relatedness (on the relationship layer), the matching value (on the matching layer) and the value in use of the interaction itself (on the service layer) as illustrated in Figure 1.

The relationship layer is linked with the emergence, influence, and maintenance, as well as the quality of the relationship as influenced by interactions between involved stakeholders (Geiger et al., 2021). On the matching layer, actors mutually choose the proper resources and competencies for the current demands. Consequently, the matching value is the actors’ capacity to foresee the needs of other actors and match them with their own competencies. Finally, the service layer specifies how the interaction affects the actual service and whether the ViU develops immediately during the contact or throughout the concurrent activities of the players in the value co-creation (Geiger et al., 2020). Value is co-created through the reciprocal and mutually reinforcing interaction between LC and its user. For the LC, value is derived from user data input, feedback for improving its services, and the resulting scalability and reputation of its service. As we view the LC technology as a medium for improving students’ learning experience, our contribution emphasizes the value created for the student, since any service should ultimately improve people’s life (Grönroos, 2011), potentially accompanied by technology.

In the ViI model, all three levels within the interaction space and their resulting values are interconnected and impact one another. To achieve meaningful interactions and develop worthwhile valued service interactions, actors in a service system must be able to exhibit competencies at all three tiers in parallel (Geiger et al., 2021). The ViI includes, in particular, collaboration and social competencies (relationship layer), adaptation skills (matching layer), and the provision of useful services (service layer) (Geiger et al., 2020). In other words, if the LC interaction is not perceived as beneficial by its human user, it will harm value co-creation, also known as value co-destruction (Li & Tuunanen, 2022), causing service beneficiaries to be negatively affected (Fyrberg & Jüriado, 2009; Grönroos, 2011) or the chatbot to fail (Janssen et al., 2021). Following this service perspective, we derive design knowledge for LCs that co-create valuable learning interactions with a strong focus on time management support along the three mentioned layers. However, this perspective implies that aspects supposedly unrelated to time management, such as social bonding or matching the student’s individual needs in learning, must be considered to support time management at its core.

3 Methodology

For the derivation of design knowledge, we follow the DSR paradigm guided by the process model of Kuechler & Vaishnavi (2008) as an established approach to design new and innovative artifacts while ensuring practical relevance and scientific rigor (Hevner et al., 2004). Figure 2 summarizes the outputs of the design cycle phases along our DSR process.
During **Phase 1 (Problem Awareness)** we conducted a systematic literature review following Moher et al. (2010) to explore the status quo in needs, requirements, and design knowledge for time management facilitation. We queried Scopus and the ACM Digital library with a pre-defined search term to discover peer-reviewed articles up to March 2022 from the fields of information systems, computer science, business, and education that contribute relevant design knowledge:

```
((Learning OR Virtual) AND Companion OR Pedagogical Agent OR Conversational Agent OR (Virtual OR Cognitive) AND (Assistant OR Artificial Intelligence OR Chatbot OR Adaptive System OR Digital Tutor OR Intelligent Tutoring System)) AND ((Learning OR Student OR College OR University OR Education) AND Time Management)AND (Design AND (Guidelines OR Science Research OR Principle OR Theory) OR Scaffolding OR Development)
```

We systematically filtered 1591 initial hits screening titles and abstracts following the PRISMA statement (Moher et al., 2010), analyzed the full texts of 30 articles, and incorporated the resulting 15 articles matching our inclusion criteria (covering strategies or design knowledge on time management in dialogue systems) as scientifically grounded literature into the remainder of our study.

In addition, we conducted six semi-structured in-depth interviews with an average duration of 50 minutes following Gläser and Laudel (2010) with students in continuous education to better understand their perceived challenges in time management (problem space) and their desires for an LC (solution space) (vom Brocke et al., 2020). We fully transcribed and inductively coded all interviews according to Mayring (2015) using MAXQDA 2020. Among the interviewees were four men and two women aged 23-30 with different family situations, and working models, all of them enrolled in further education but covering different majors and study formats (face-to-face, hybrid, digital) as summarized in Table 1. Accordingly, we intended to integrate heterogeneous perspectives in the interviews along the semi-structured questionnaire (Gläser & Laudel, 2010) by also observing latent needs (Kuß, 2007).

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender &amp; Age</th>
<th>Major</th>
<th>Study Model</th>
<th>Working hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Male (28)</td>
<td>M. A. Digital Business Management</td>
<td>digital</td>
<td>Full-time [40h]</td>
</tr>
<tr>
<td>B2</td>
<td>Female (30)</td>
<td>Business Administration</td>
<td>face-to-face</td>
<td>Full-time [40h]</td>
</tr>
<tr>
<td>B3</td>
<td>Male (28)</td>
<td>M. Sc. Information Systems</td>
<td>hybrid</td>
<td>Part-time [20h]</td>
</tr>
<tr>
<td>B4</td>
<td>Male (27)</td>
<td>Meisterschule (Craftsmanship)</td>
<td>face-to-face</td>
<td>Sabbatical [0h]</td>
</tr>
<tr>
<td>B5</td>
<td>Male (23)</td>
<td>M. Sc. Technology-Management</td>
<td>hybrid</td>
<td>Part-time [30h]</td>
</tr>
<tr>
<td>B6</td>
<td>Female (25)</td>
<td>M. A. Business Psychology</td>
<td>face-to-face</td>
<td>Part-time [32h]</td>
</tr>
</tbody>
</table>

Table 1. Overview of the interviewed students

In **Phase 2 (Suggestion)** we explored kernel theories, extracted literature issues and user needs from the interviews, and synthesized 24 requirements. We then followed a co-creation approach (Abras et al., 2004), that actively involves students from the target group, a designer, two LC researchers, and a developer to collaboratively derive tentative design knowledge emerging from our research. That way, we aim to facilitate participatory design (Bønder & Kyng, 2018) and to counteract a potential research bias. We derived five tentative design principles as a synthesis of the clustered user requirements and literature issues in **Phase 3 (Development)**.
To test the relevance and usability (Brooke, 1996) of the artifacts, we instantiated a low-fidelity prototype as an expository instantiation with 15 smartphone wireframes (Leifer et al., 2018) by using the software Balsamiq to discuss and adapt our design knowledge at an early stage (de Sá & Carriço, 2006). In this context, we instantiated 30 design features responding to the derived requirements and mapped them visually with the wireframes on a whiteboard. We invited three students from Phase 1 to review our understanding of the problem space from a future user perspective by co-creating “Karl”, a persona representing their needs. We also recruited another three participants for integrating further expertise into the evaluation workshop: a chatbot developer, an LC researcher with prior experience in DSR, and a design student. All of them, spanning age from 24-31, contributed with their expertise to Phase 4 (Evaluation). In the evaluation workshop, we presented our tentative design knowledge for formative evaluation (Stufflebeam, 2000). The scope of this paper is not to introduce the instantiation in detail, as it just served as a medium to evaluate and further detail the DPs building the core of our contribution. We presented the five tentative DPs, explained the 24 derived requirements (p.6ff.), proposed responding features to them, discussed supportive mechanisms and further features on smartphone wireframes, and collected participants’ qualitative feedback. An embedded short survey on relevance, anticipated efficiency and effectiveness of the DP, perceived emotional attachment towards the LC and user experience measured these variables directly on a 5-point Likert scale and was complemented by open text field for qualitative feedback. Our survey validated our preliminary design knowledge ex-post, while also evaluating our expository instantiation and DPs ex-ante before actually coding an LC (Venable et al. 2016). In several iterations, the participants were split into three teams and discussed the design knowledge to then jointly capture results on a ‘feedback-grid’ covering highlights, things to change, misconceiving aspects, and further ideas. The author team finally complemented those with rigorous findings from the literature and synthesized five thoroughly elaborated design principles after several iterations of mapping in Phase 5 (Conclusion).

4 Design Knowledge for LCs as Mindful Time Managers

4.1 Towards Tentative Design Knowledge (Phases 1-3)

The literature review from Phase 1 yielded 17 foci (L#) for digital time management facilitation (TMF) touched upon in the thoroughly analyzed articles as comprised in Table 2.

<table>
<thead>
<tr>
<th>L#</th>
<th>Focus</th>
<th>Supporting Literature</th>
<th>L#</th>
<th>Focus</th>
<th>Supporting Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Goal Setting</td>
<td>(Chen et al., 2022; Du et al., 2021; Viberg et al., 2021)</td>
<td>L10</td>
<td>Strategies for TMF</td>
<td>(Tian et al., 2021)</td>
</tr>
<tr>
<td>L2</td>
<td>TMF Preferences</td>
<td>(Grover et al., 2020)</td>
<td>L11</td>
<td>Procrastination</td>
<td>(Almaki et al., 2020; Inie &amp; Lungu, 2021; Naveed et al., 2017; Pérez-Sanagustín et al., 2021; Pirke et al., 2022),</td>
</tr>
<tr>
<td>L3</td>
<td>Adaptability</td>
<td>(Tian et al., 2021)</td>
<td>L12</td>
<td>Motivation</td>
<td>(Inie &amp; Lungu, 2021)</td>
</tr>
<tr>
<td>L4</td>
<td>Adaptivity</td>
<td>(Naveed et al., 2017)</td>
<td>L13</td>
<td>Responsiveness</td>
<td>(Lund &amp; Wiese, 2021; Viberg et al., 2021)</td>
</tr>
<tr>
<td>L5</td>
<td>Task Decomposition</td>
<td>(Naveed et al., 2017; Schwabe, 2020)</td>
<td>L14</td>
<td>Social Networks</td>
<td>(Naveed et al., 2017)</td>
</tr>
<tr>
<td>L6</td>
<td>Blocking Distractors</td>
<td>(Inie &amp; Lungu, 2021)</td>
<td>L15</td>
<td>TMF User Interface Design</td>
<td>(Grover et al., 2020; Lund &amp; Wiese, 2021)</td>
</tr>
<tr>
<td>L7</td>
<td>Reminders</td>
<td>(Dalvi &amp; Siddavatam, 2019; Tian et al., 2021)</td>
<td>L16</td>
<td>Learning Companionship</td>
<td>(Khosrawi-Rad, Rinn, et al., 2022)</td>
</tr>
<tr>
<td>L8</td>
<td>Alerts</td>
<td>(Almaki et al., 2020; Dalvi &amp; Siddavatam, 2019)</td>
<td>L17</td>
<td>Monitoring Progress</td>
<td>(Naveed et al., 2017; Viberg et al., 2021)</td>
</tr>
<tr>
<td>L9</td>
<td>Relaxation + Recovery</td>
<td>(Almaki et al., 2020)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Literature Foci

We mapped these mainly functional literature issues with the learners’ needs extracted from the six interviews, formulated 24 requirements (R#) for designing an LC as a mindful time manager, and clustered them together with the 14 literature foci (L#) along the three layers of valuable interactions (cf. p. 3) according to the conceptual scheme of Gregor et al. (2020) for each layer.
4.1.1 Design Principles feeding the Relationship Layer

Interviewees require the LC to serve as “a source of mental support” (B1) and sympathy (B2), motivating students to complete their tasks on time (B1, B4, B5). In line with the literature (Khosrawi-Rad, Schlimbach, et al., 2022), B2 and B3 specifically express a desire for “a friendship-like bond” with the LC (R4) so that LC motivates and understands them, “acting more like a peer than a tutor” (B2). Humans naturally form and cherish social connections with others (Hinde, 1979; Kelley & Thibaut, 1978). Interestingly, people also exhibit social behaviors toward machines, a concept known as the Social Response Theory (Nass & Moon, 2000). However, research indicates that individuals have a stronger preference for machines with humanoid design (R2; L15), but there is a limit to this as they find overly human-like machines disconcerting, a phenomenon referred to as the “uncanny valley” (Mori, 2012). This is relevant in the context of designing an LC that teaches time management because all students value a close, social relationship with the LC (R1) and its constant availability (Vu et al., 2016) to “eventually use it for nasty tasks like time management” (B5). To ensure the LC’s adoption, it is crucial to implement a user-friendly interface (Grover et al., 2020; Lund & Wiese, 2021) consider social cues and adapt them to the learner (L16) (L. Clark et al., 2019; Doyle et al., 2019; Seeger et al., 2018). Non-visual cues, such as social integration with peers or lecturers (R3; L14), also play an important role, as students prefer to learn collaboratively (B1, B4, B5) to make in-person meetings to “something to look forward to” (B5). The social interaction that arises from collaborative learning (Naveed et al., 2017) helps improve the perceived work-life balance (B1, B5), but can also increase social pressure (B4), which may arise from the mere identifiability of results and performance evaluation by others (Lerner & Tetlock, 1999), leading to fear of failure (Schmid et al., 2015). However, transparent performance comparison has been found to prevent procrastination (L11), which is a learning stressor mentioned by four students, and positively influences their achievements (R4) (Latham & Locke, 2006).

In addition, humans have an inherent need to belong, resulting in a strong desire to develop and maintain long-term interpersonal bonding (L16) (Baumeister & Leary, 1995) that emerges from the principles of friendship (Mendelson & Aboud, 2012; Rawlins, 2017) and collaboration (Siemon et al., 2019). Social relationships are driven by rewards and costs, where costs are negative elements for the individual, such as effort put into building the relationship, whereas rewards are positive elements, such as being accepted or supported, according to the Social Exchange Theory (Homans, 1958). Perceived social isolation is a significant shortcoming of digital learning (Mirbabaie et al., 2020; Rinn et al., 2022). Some students, like B5, have independently sought out digital interaction tools to fight isolation and learn together. Social networking features (L14) integrated into the LC could empower students to interact more vividly (Coronado et al., 2018; Wang et al., 2021) and lead to better learning outcomes (Chi & Wylie, 2014), as supported by B5: “when learning with peers or even a virtual friend, I have the feeling that I am more productive, so one gets more done and makes better use of time.” Thus, social bonding with the LC and learning with peers is a prerequisite (R3) to having students recurrringly interact in learning activities. By building a close, social relationship with the LC, students are more motivated to complete tasks on time, whereby learning becomes more productive and enjoyable as synthesized in DPI in Figure 3.

Joint goals (L1) have been found to help establish common ground (H. H. Clark & Brennan, 1991) and foster companionship (Khosrawi-Rad, Schlimbach, et al., 2022) to then spend time together for learning purposes (B1; B3-B5). Goal-setting involves dedicating thought, emotion, and conduct towards achieving a desired future state and requires action towards that intention (Grant, 2012). Various goal-setting guidelines such as the SMART criteria (Du et al., 2021; Grant, 2012) or the rubicon model along consideration, planning, execution, and evaluation (Achtzheimer & Gollwitzer, 2009) might accompany the process (R7; L1). Time management is a crucial component of achieving goals, and B3 explains that it involves taking step-by-step actions (L5). It can include short-term and long-term strategies (R5), but it is easier to accomplish with buffer times within a challenging, automatically generated schedule (B2; R8). The goal-setting theory (Latham & Locke, 2006; Locke & Latham, 2006) proposes that setting specific, challenging objectives is a straightforward way to motivate individuals to perform better. B5 suggests that shared responsibility and milestones are beneficial (R6). According to the theory, difficult
and specific objectives result in much greater performance than simple, abstract, or no goals, and encourage individuals to achieve their best (Latham, 2012). Assuming goal commitment and stable abilities, higher objectives result in greater performance within a given time frame. Praise, feedback, and engagement in goal-setting decision-making impact behavior only to the extent that they contribute to the establishment and commitment to a specific challenging objective. Therefore, motivational goal-setting support is necessary for digital learning environments (Chen et al., 2022; Du et al., 2021) to facilitate self-regulated learning (Song & Kim, 2021) and better manage one’s time following the self-determination theory (Ryan & Deci, 2000). Depending on the situation, the LC should offer assistance, such as acting as a motivating friend (B2) or time managing coordinator (B5), sometimes even "lovingly kicking butt" (B6). To foster common goals between the LC and human learner, we thus derive **DP 2** shown in the lower half of Figure 3.

![Figure 3. Design Principles linked to the relationship layer](image)

The deducted DPs on the relationship layer reveal, how vital it is for positive interpersonal interactions, to find a common ground for meaningful communication (Clark & Brennan, 1991; L. Clark et al., 2019). This also results in the capacity to better comprehend and anticipate the mental state of the human interactors (Adel et al., 2017; Carruthers & Smith, 1996) as a grounding for shaping the matching layer. While seemingly unrelated to time management, all layers together are crucial in preparing students to engage repeatedly with the LC, share their challenges, and collaboratively improve their time management skills through personalized assistance in co-created, valuable interactions.

### 4.1.2 Design Principles feeding the Matching Layer

As interaction preferences are highly individual, it is crucial to provide adjustable settings for users (Oppermann & Rasher, 1997; Schlimbach et al., 2022) (L3). However, the degree of automation depends on the user’s needs (B1). While some users prefer the LC to make sensible recommendations based on data analysis (B6), others want to intervene and make decisions themselves (B2). Therefore, the LC must provide adaptive schedules (R1; L4) to variables that are challenging to articulate (like personality or cognitive ability) (Ahmad et al., 2022; Dautenhahn, 2004; Plass & Pawar, 2020) while allowing manual adaptability (L3) of time management features and communication behaviors that appeal to the user (Krümer et al., 2011; Oppermann & Rasher, 1997; Schlimbach et al., 2022). For instance, B1 claims that "also in learning, only through pressure diamonds are created", whereas B4 mentions preferred learning times that differ among his friends and B2 adds that the time to prepare for exams varies (R9; L2). Also, the students indicate very different aspects that motivate them to spend time on learning as condensed in hexad archetypes (Şenocak et al., 2021; Steinherr & Reinelt, 2022), e.g., playful elements...
(B4), social interaction (B5), or visualization of progress made (B2). Adapting communication behavior to the user (R10) and mental state (R12) “LC needs to notice when I am having a bad day” (B3) improve interaction pleasure (Hecht, 1978; Nass et al., 1995). In this process, the quantity and quality of user data and smart data processing affect the potential adaptation scenarios (Schlimbach et al., 2022). In summary, we suggest DP3 for strengthening the matching layer by purposeful adaptation to individual needs in time management as illustrated in the following Figure 4.

![Figure 4. Design Principle linked to the matching layer](image)

A strong matching value connects the other two layers and thus builds the grounding for valued time-managing services on the third layer.

### 4.1.3 Design Principles feeding the Service Layer

At the service layer, ViU is highly individual and can span multiple dimensions like social value, hedonism, or self-expression (Kleinaltenkamp & Dekanozishvili, 2019). Nonetheless, some key areas for LCs’ ViU in the context of time management stick out. For example, all interviewees see value in having the LC increase learning productivity by sending reminders (L7) and alerts (L8) for upcoming tasks (R18). In response, they cite "distraction as the main disruptive factor" (B3; R17), mentioning widespread cell phone use (B3, B4, B6) and a high level of noise in the learning environment (B6) as particularly detrimental to concentration. Thus, any distractive factors should be minimized, because selective attention improves learning (Yli-Krekola et al., 2009). Since technostress leads to severe negative consequences in the use of information systems (Salo et al., 2022), its mitigation, for instance via digital nudging becomes crucial (Bergram et al., 2022). Simultaneously, the LC should ensure a balance between learning and break times (B1, B4), because it is "important that you don’t just learn in one piece the entire time" (B4), meanwhile counteracting procrastination (R18).

Furthermore, according to self-determination theory (Ryan & Deci, 2000), developing users' individual study abilities (L10) leads to an increased ViU regarding self-confidence in their competence and motivation, along with the perception that they are responsible for their own learning achievement (Lechler et al., 2019; Ryan & Deci, 2000). Students gain self-efficacy (R19) by feeding learning guidance into the LC tailored to their individual learning challenges or by encouraging them to engage (R23) in self-directed learning (Cazan & Schiopca, 2014; Song & Kim, 2021). In this regard, B6 suggests that the LC explains "what learning methods are available and possibly apps that could help you at this stage" to prevent procrastination (L11). A motivational environment (L12) favors the emergence of flow effects (Csikszentmihalyi et al., 2005) and promotes confidence and competence, which are crucial for learning (Bandura & Schunk, 1981; Ryan & Deci, 2000). Following the Theory of Multimedia Learning (R. E. Mayer, 2014), learning material should be multimedia, albeit this increases
the danger of cognitive overload, which needs to be counteracted as well (R. Mayer & Moreno, 2003). To this end, B3 points to tools easy to use (R20) to specifically control media consumption. Besides, an intuitive user interface promotes ease of use (Davis, 1989; Wambgsans et al., 2021) and avoids frustration, since otherwise the gained ViU might be destructed through the negative experience (Li & Tuunanen, 2022). We conclude DP4 – Effective and Efficient Learning as summarized in Figure 5.

![Figure 5. Design Principle linked to the service layer](image)

Students in further education describe their programs as "quite difficult" (B1), claim "neglect of friends and partner" (B2), and admit to "really struggling" (B6) because they cannot cope with the workload in the long term and are "just glad when it's over" (B3). Learning is thus perceived as a burden by the majority, and in some cases even harmful to mental health, destroying the ViU. The statistics reflect this trend to the detriment of mental health. For instance, the number of sick leaves due to mental illness in Germany has more than doubled from 1997 to 2020 (Statista, 2022). As a necessary consequence, it is critical to incorporate learning as a fixed routine in the working students’ daily habits over time (R21; L9), without overburdening them. In this regard, B6 mentions mindfulness meditation apps and suggests that the LC could take over this function (R24), for example, by saying "here is an interesting TEDTalk on the topic, or here is a podcast, just listen to it." Chatbots enhancing positive outcomes in mental health care are emerging (Kocaballi et al., 2020), for instance, by teaching self-care and mindfulness (Luxton, 2014) or by responding to users dealing with mental health issues (Fitzpatrick et al., 2017). To foster continuous, mindful improvement and keep students motivated over a longer period, giving feedback on progress made over time (L17) helps reward them (R23) for good performance and so promotes flow effects (Csikszentmihalyi et al., 2005; Lechler et al., 2019). Just like B3 and B6, B2 believes that visualizing progress is important: "The companion should show what you have already achieved so that you can really see that (...), which would then of course also be helpful for motivation" (R22). B3 claims it is critical for the LC to "show the long-term benefits to keep you on track". Persuasive aspects like game components and digital nudging (L12) have also been proven to increase (continuous) learner engagement (Benner et al., 2022). Gamification elements should be accompanied by encouraging and pleasant communication (Strohmann et al., 2022; Wollny et al., 2021). Challenging goals result in stronger performances (Latham, 2012), but – as introduced in DP3 - need to be adapted to variables reflecting the student's cognitive abilities (Plass & Pawar, 2020). We conclude DP5 for Mindful Learning & Progress as introduced priorly in Figure 5.

### 4.2 Evaluation (Phase 4)

The evaluation revealed an overall positive attitude toward the expository instantiation, as evidenced by participants’ qualitative and quantitative feedback. On a five-point Likert scale (from poorly to
strongly), the probands attested the solution a high relevance (MV=4.5; SD=0.55) for problem-solving, and anticipated high effectiveness (MV=4.5; SD=0.52) and efficiency (MV=4.5; SD=0.82) for facilitating the target groups time management in learning when being put into practice. However, the user experience (MV=3.0; SD=1.03) and the perceived emotional engagement (MV=2.5; SD=1.21) crucial for the idea of companionship (Strohmann et al., 2022) were rated quite low. Eventually, this impression mainly link back to the low-fidelity prototype, since wireframes can only poorly mock up the true navigation of an application planned to be coded.

Figure 6 depicts two sample wireframes, details the five steps in the evaluation survey, and lists sample design features. For instance, the gamified book tower on the left rewards for accomplished tasks in time with added books (e.g., blue book for an achieved goal; green book for meeting the timetable, or red for taking a suggested break). The LC’s motivational conversation (right screen) simulates adaptive scheduling, and reminders and encourages them to learn together.

**Figure 6. Insights from the evaluation workshop**

Implicitly, the workshop group indicated concrete recommendations for improvement on each ViU layer: For strengthening the value in relatedness, participants propose to emphasize the companionship approach through a more solid LC attachment via emojis, GIFS, motivational feedback, and stronger avatar reactions to the learner’s emotions. They made clear that the bonding component and common goals are a fundamental prerequisite to interact with the LC, summarized in a participant’s quote: “there are so many time managing tools out there, but reminders, alerts, and blockers themselves are annoying, so I don’t use them. But with a bonding companion, it would be different, since we could mutually care for each other and explore ways to better manage time”.

Moreover, on the matching layer, students recommend implementing full transparency regarding the LCs’ adaptivity and prioritize transparency and accountability even higher than the adaptation features themselves. They encourage to rather query variables for adaptability than for machine adaptivity. Therefore, transparency and ethical considerations should be applied when handling user data in the LC (Luxton, 2014; Schlimbach & Khozrawi-Rad, 2022; Wambsgansß et al., 2021). Maintaining confidentiality by not disclosing data to third parties (Solove, 2004) was discussed as a key prerequisite by students to use the LC. Regarding the service layer, they suggested improving the user experience through more gamified elements like badges and competitive elements and argued for more multimedia content and links to animated external learning resources to invest more time in learning and make it “a more fun activity”. The target group was especially interested in features to counteract procrastination and establish healthy learning habits, as these appeared to be the two key areas to increase their individual ViU for collaborating with an LC. Ease of use, technical maturity, and digital responsibility are regarded as hygiene factors (in terms of value barriers to overcome) for interacting with the LC. Thus, we embed corresponding mechanisms into our proposed DPs and made them more tangible with concrete examples suggested by the workshop participants.
4.3 Finally Synthesized Design Principles (Phase 5)

Expanding on our tentative design knowledge complemented by the workshop results, we finally synthesize five conclusive DPs adding tangible mechanisms for implementation along the three value layers as illustrated in Table 3.

<table>
<thead>
<tr>
<th>Design Principle</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>DP3: Social Integration &amp; Bonding</strong></td>
<td>To create a strong value in relatedness for strong bonding and common ground (Clark &amp; Brennan, 1991) with the LC, design an anthropomorphic companion with human-like behavior and supportive attitude (e.g., by helping with problems or acting as a friend to talk to) with the uncanny valley in mind (Mori, 1970) and promote recurring interactions to co-create strategies for mindful time management on the long term. Balance social cues (Seeger et al., 2018) and enable regular usage by constant availability (Vu et al., 2016) and by respecting the principles of friendship (Mendelson &amp; Aboud, 2012; Rawlins, 2017) and collaboration (Siemon et al., 2019). Also, connect learners with their instructors and peers to foster vivid interactions and mutual learning by provoking a sense of duty to learn through positive social pressure (Lerner &amp; Tetlock, 1999). Besides, coordinate and incentivize mandatory in-person meetings to foster social interaction and prevent social isolation (Mirbarabai et al., 2020).</td>
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<td><strong>Design Requirements 1-4; L13-16</strong></td>
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<tr>
<td><strong>DP4: Effective &amp; Efficient Learning</strong></td>
<td>To facilitate the learner’s setting and achievement of common learning goals together with the LC within a given time frame, assess the individual learning goals on a short- and long-term perspective (Viberg et al., 2021) by linking cognitive abilities, prior knowledge, and personal challenges in learning with the time available (Grover et al., 2020). Formulate specific, measurable, assignable, realistic, and time-related (SMART) goals (Du et al., 2021; Grant, 2012) and teach goal-setting strategies (Dalvi &amp; Siddavatam, 2019; Du et al., 2021; Inie &amp; Lungu, 2021; Tian et al., 2021). Accompany the consideration phase by formulating intentions and tasks, support goal planning with the prioritization of tasks to be completed, facilitate the execution by monitoring and fostering the efficient and effective use of time, and evaluate the achievement of set goals (e.g., in a dashboard) (Achtziger &amp; Gollwitzer, 2009). Adjust goals and sub-tasks to the schedule with buffer time reserved for that purpose, whenever necessary.</td>
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<tr>
<td><strong>Design Requirements 5-8; L1 and L5</strong></td>
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<tr>
<td><strong>DP5: Mindful Learning &amp; Progress</strong></td>
<td>To design a high matching value between human and LC, establish common ground (Clark &amp; Brennan, 1991) and balance adaptivity to the learner’s individual needs and adaptability in the context of time management (Naveed et al., 2017). Respect individual priorities, socio-cultural preferences (such as customizable avatar embodiment, use of cultural symbols or idioms), motivational variables (e.g., adaptive to personality or motivation), affective variables (for instance by reacting with emojis and benevolence to the learner’s current mood and stress resistance) as well as cognitive variables (such as learning style or fluid intelligence) (Plass &amp; Pawar, 2020; Schlimbach et al., 2022). Collect user data to better adapt scheduled time slots for learning to individual needs, while following and observing an ethical code, make data processing transparent, and enable the user to decide on the information to be shared (Solove, 2004; Taddei &amp; Contena, 2013).</td>
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<tr>
<td><strong>Design Requirements 9-16; L2-4</strong></td>
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<tr>
<td><strong>DP5: Mindful Learning &amp; Progress</strong></td>
<td>To facilitate healthy, effective, and efficient time management in further education and to generate a positive value in use when interacting with the LC, avoid procrastination by creating an adaptive schedule that accounts for learning time preferences and ideal personal time slots to fully focus on the learning objective (Inie &amp; Lungu, 2021; Schwabe, 2020). Avoid distraction by blocking other digital resources (Inie &amp; Lungu, 2021) and redirect instead to supportive learning content. Empower students to internalize time management techniques and learning strategies. Encourage them to become self-directed learners (Cazan &amp; Schiopca, 2014) and to develop self-efficacy; for example, by reflecting on their progress over time (Almalki et al., 2020; Du et al., 2021). Monitor the time of LC’s usage (e.g., screen time) and cognitive load to avoid technostress (Salo et al., 2022) and adapt the timetable to the learner’s mental state and motivation to learn. To balance cost and reward and hence ensure regular usage (Strohmann et al., 2022), implement an intuitive user interface, responsive design, connectivity, and natural language understanding (Wambganss et al., 2021).</td>
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<tr>
<td><strong>Design Requirements 17-20; L6-8</strong></td>
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<tr>
<td><strong>DP5: Mindful Learning &amp; Progress</strong></td>
<td>To guide the students’ continuous progress in managing time and to anchor mindful learning as an integral part of their life, monitor and support mental and physical well-being to implement learning as a routine that is not perceived as a stressful burden (Luxton, 2014). Send alerts when deadlines are approaching and push-notifications for continuous learning in tasks decomposed to small nuggets (Almalki et al., 2020; Naveed et al., 2017). Teach mindfulness with the students’ mental resources (Kocaballi et al., 2020; Luxton, 2014) and proactively suggest breaks (e.g., by using the Pomodoro technique) (Almalki et al., 2020). Visualize progress made and potential negative consequences by unmet deadlines across learning groups to increase learner engagement (Benner et al., 2022). Also evaluate the learner’s time management for pre-defined periods dependent on the learning goal, highlight future areas of improvement, and provide empowering feedback (Dennis et al., 2016). Students should be challenged by adaptive, ambitious (SMART) goals to constantly improve (Latham &amp; Locke, 2006; Schwabe, 2020).</td>
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<tr>
<td><strong>Design Requirements 21-24; L9-12 and L17</strong></td>
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Table 3. Summary of the five finally synthesized DPs
Upon examination of the final five design principles (DPs), it is evident that these are not mutually exclusive but instead heavily intertwined. To illustrate, DP2 outlines the establishment of smart common goals which are dependent on the prior achievement of common ground as outlined in DP1, and must be tailored to the learner's individual characteristics, learning context, and available time as described in DP3. The implementation of time management techniques, as highlighted in DP4, is necessary for the achievement of these goals in a step-by-step manner, leading to a continuous progression in mindful learning as elucidated in DP5. Consequently, it is only by considering the interplay of all five DPs that co-created value emerges holistically, rather than focusing on individual features. In light of this, we posit that the joint implementation of all five DPs is essential for a positive Vil as a whole and for the development of LCs that support sustainable learning and mindful time management in further education in the long term.

5 Discussion and Conclusion

Taking a service-oriented perspective, we derived extensive design knowledge for virtual LCs to support working students in their time management in further education. For this purpose, we followed the DSR paradigm applying the five phases suggested by Kuechler and Vaishnavi (2008) and derived 24 design requirements along the three layers (relationship, matching, service) of valuable interactions (Geiger et al., 2021), building on 17 literature issues from a systematic literature review and user needs from six interviews with the target group. We subsequently transferred these into an expository instantiation in the form of a low-fidelity prototype to be formatively evaluated in a creative workshop with six participants representing various perspectives. We further detailed design features in co-creation with them that respond to our tentative design knowledge and synthesized five conclusive DPs for LCs as mindful time managers. These cover Social Integration & Bonding (DP1), Common Goals (DP2), Adaptation (DP3), Effective & Efficient Learning (DP4) as well as Mindful Learning & Progress (DP5), which we presented in detail along the three Value in Interaction layers as the core of our contribution.

5.1 Implications for Research and Practice

Our study contributes to research in several ways. First, we contextualize LCs as time-managing service providers in further education that need to establish strong relationships with their learning partners, adapt to their needs, and create an individual value in use as a prerequisite for valuable interactions with their human counterparts. As we increasingly search for avenues to facilitate learning via information systems, it is crucial to comprehend the value users encounter in these systems (Blaschke et al., 2019; Schüritz et al., 2019). Our unconventional approach, in terms of a value-driven service perspective on LCs, can guide more pointed research, and nuanced theories of chatbot interactions as a service, and particularly support the design of digital collaboration systems in education such as LCs that transform the burden of learning into valuable interactions. Second, we explore time management as a multifaceted impediment that is a central root cause of failure in further education (Rinn et al., 2022) and thus must be addressed by an appropriate feature set like mitigating procrastination (Almalki et al., 2020; Pinke et al., 2022) or scheduling services (Bank et al., 2012), while also generating relatedness and matching value to secure the technologies’ adoption (Sandu & Gide, 2019; van der Zandt et al., 2021). This appears to be crucial for not having the chatbot fail in practice (Janssen et al., 2021). Moreover, our interviews revealed that students’ failure in further education often links back to general overload or even a lack of interest in the training itself (Rinn et al., 2022). In this course, motivational elements (e.g., gamification) are closely linked to having students spend more time without overburdening them when learning with the LC (Khosravi-Rad, Schlimbach, et al., 2022). This implies that when it comes to the practical implementation of time managing LCs, they should always be designed with holistic user needs and their well-being in mind (Michalke et al., 2022) to turn the burden of learning into valuable interactions, rather than developing single features that only address the symptom on a functional level. However, our review of the literature revealed that IT artifacts for improving time management continue to undermine a holistic service-centered design with value co-creation (Li & Tuunanen, 2022). Finally, we contribute to research by providing prescriptive guidance.
for the design of LCs as mindful time managers, including existing design knowledge from other artifacts as well as additions derived from our study. We expand previous research on virtual LCs (e.g., Khosrawi-Rad, Schlimbach, et al., 2022) and other time-managing tools (e.g., Schwabe, 2020) in that we derived design requirements and action-oriented design principles that focus on valuable interactions with LCs as bonding time managing service providers.

This has implications for bridging IS research and practice. For instance, developers, instructors, and researchers could work together on our knowledge base to implement technically mature LCs based on the proposed design principles and investigate their impact on learning outcomes in further education, especially related to mindful time management. On a functional level, we see significant overlaps between our contribution and the field study by Kimani et al. (2019), who integrate scheduling and prioritizing tasks, provide break reminders, deal with social media distractions, and reflect on accomplished tasks in their bot for mindful time management in the workplace. We also embed common goal setting as one of our DPs also found in prior chatbots in their role as learning facilitators (Chen et al., 2022; Du et al., 2021). In this course, we expand upon these approaches through companionship, as pursued by Khosrawi-Rad et al (2022), and prioritize the value in interaction (Geiger et al., 2020). Thus, albeit some affordances implied by the design principles are already incorporated in existing tools for time management facilitation, we suggest IS designers to advance their integration with our value-driven, holistic view across running prototypes (e.g., Kimani et al., 2019; Schwabe, 2020) and further interaction systems to create awareness for all three value layers (cf. p.3). That said, some of the derived requirements and DP might also apply to purely human face-to-face interactions in educational settings or other target groups than further education students. Teachers may therefore review students’ challenges in mindfully managing their time, and proactively seek ways to counteract them in class - for example by having them reflect on their behaviors and consider potential changes such as creating strategies for self-directed learning (Cazan & Schiopca, 2014; Graesser & McNamara, 2010) more mindfully, potentially facilitated by IT tools such as LCs.

5.2 Limitations and Future Research

Our contributions are limited by the design of our study. First, our sample was restricted to young German adults pursuing further education, which may not be representative of other cultures or age groups. Therefore, the generalizability of our findings may be limited. Second, our data relied on the self-reported experiences of the participants, which may be subject to bias and variability. Although their statements overlapped significantly, more objective measures could have strengthened our conclusions. Future research should expand the investigation beyond further education of students in Germany and draw upon a quantitative approach with larger sample size. This would improve our findings' generalizability and external validity and provide more nuanced insights into time management stressors and their correlations. Additionally, we suggest developing more technically advanced IT artifacts based on the elaborated design knowledge to conduct a more comprehensive evaluation of the LCs as bonding mindful time managers. This would provide empirical evidence of their impact on facilitating learning in further education, even across different study models (i.e. hybrid vs. digital). Our results were also influenced by the disparity between the proposed implementation and the available technology maturity at the time. Implementing single features or simplifying mechanisms for feasibility reasons may reduce or even reverse the impact of the LCs. Therefore, practitioners are encouraged to apply the proposed design knowledge to coded artifacts and reflect on their experience. Researchers can then conduct further evaluations, such as (field) experiments with these artifacts, to measure the added value in interaction, thus further detailing and anchoring our service-oriented design contribution.

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Learning Companions as Bonding and Mindful Time Managers


