From a Conversational Agent for Time Management towards a Mentor for (Study) Life Priorities: A Vision

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Abstract. Time management is at the same time a challenge, and a factor that contributes to the academic success of university students. In this paper, a vision is developed for how intelligent mentoring about life priorities could look like for university students, based on existing work on 1) time management, especially also of university students, 2) conversational agents for time management studied in the context of researchers and software developers, and 3) own past work on reflection prompts and conversational reflection guidance. We argue, that such a conversational agent should be able to lead reflective conversations both on operative, short- and midterm time management (suggested: in the context of students: the current week, and the current semester); and on long-term time management in the sense of wider goals, values, and ensuing priorities in allocating time. Technically, such a conversational agent ideally would have APIs towards the plethora of usual tools that are typically used for operative time management, such as digital calendars and TODO lists; in order to be able to lead reflective conversations with students in relation to such artefacts. While this vision is developed within the context of higher education, it is argued, that such a mentoring technology that leads reflection on time management and life priorities would also be helpful for people in other life situations.

Keywords: time management, reflective learning, conversational agent.

1 Introduction

Time management is known to be a challenge, both for students in higher education, as well of course as for a wide range of professionals (cp. Claessens et al., 2007). By time management, we here understand all activities and behaviours that surround people's allocation of time to their own activities (in line with Claessens et al., 2007). For students in higher education, it has been found that time management, such as reporting short-term and long-term planning, and attitudes towards time as in Britton & Tesser (1991), positively impacts academic performance, with especially clear evidence for the positive impact of short-term planning (Claessens et al., 2007). Further positive impacts of time management are on psychosomatic wellbeing (ibid).

In this paper we develop a vision of intelligent mentoring technology based on the principle of conversational reflection guidance. This vision is founded most narrowly on the background of conversational agents for time management, as have been stud-

ied with researchers and developers; and on the wider background of computer-mediated reflection prompts and reflection guidance.

2 Background

2.1 Conversational Agents for Time Management

Conversational agents have been shown to be capable mediators of learning in educational settings, and for different types of learning (e.g., Adamson et al., 2014, Graesser et al., 2001; Graesser et al., 2005; Ruan et al., 2019), but have only rarely been used as partners in reflection; and typically not in repeated and long-term interactions. There are scarce exceptions: With respect to being partners in reflection, Kocielnik, Avrahami et al., 2018 have studied as proof of concept an conversational agent for reflecting on time management, albeit with a focus on comparing written to speech-based interaction, in a field study within a research lab. Wöls (2020) has studied as proof of concept a conversational agent for reflecting on time management in a field study with software developers, with a focus on exploring next steps of making conversational agents effective in long-term, operative time management. Maybe not surprisingly, integration with study participants' (digital) work environment such as existing calendars was identified as both technically challenging, and relevant in order to increase usability and value of the conversational agent. With respect to long-term interaction, in addition to the above two studies, Lee et al. (2019) have carried out a two-week study with a conversational agent as support for learning self-compassion. Long-term studies in the context of existing studies with conversational agents means approximately two weeks. Throughout these studies, user acceptance of conversational technology was high; and the intended positive effects (meaningful reflective conversations about time management, learning about being self-compassionate) were observed.

2.2 Computer-mediated Reflection Prompts and Conversational Reflection Guidance

Technology for reflection can support both reflection-in-action, and reflection-on-action; and prompts or other means of structure and support can facilitate reflection within computational tools (cp. Fessl et al., 2017). Researched computer tools for reflection ranges from artistic interventions (e.g., Lindley et al., 2009's tool Shoddy-Pop, discussed in the context of reflection by Baumer, 2015); to displaying relevant data with no to little guidance as in literature on self-tracking (e.g., Li et al., 2011); to reflection prompts with variations in adaptivity and domain-independence (e.g., Renner et al. 2016 - no in-built adaptivity, domain-independent; Fessl et al., 2017; McCall et al., 1990 - adaptive, context-specific; Kocielnik, Avrahami et al., 2018; Kocielnik, Xiao et al., 2018 - adaptive, domain-dependent). Substantial research in computer-mediated reflection focuses on reflection prompts (e.g., Shin et al., 2018; Renner et al., 2016) rather than on adaptivity or long-term interaction. Most narrowly relevant for the present discussion, Pammer & Bratic (2013) and Pammer et al. (2015) have

studied activity log data with simple reflection prompts as basis for reflection; and interpreted the overall positive results, that one next step in order to increase the value of the reflection environment would be to go beyond data towards actionable insights (Pammer & Bratic, 2013), and to explicate plans and commit towards a reflection partner own plans for changing time management (Pammer et al., 2015). Consistently, throughout these studies, support for reflection has been effective – although of course the mechanisms and approach to guiding reflection was extremely different in all these studies.

Furthermore, more broadly speaking, reflection is an effective strategy to learn in a self-directed manner from past experience (cp. Boud et al., 1989); albeit one that requires sufficient knowledge about the domain one is reflecting (Kirschner et al., 2006). Especially in the case of time management, which is a horizontal activity for students in comparison to the single subjects they study, such knowledge and guidance would typically be given by mentors.

3 Discussion and Vision

In summary, we see that

- time management is relevant for students
- there is a plethora of tools for operative time management (e.g., calendars, task list tools)
- there is extremely scarce work on conversational agents that support reflecting on own time management – especially in relationship to the plethora of tools for operative time management; (in parallel by the way to the scarce evidence beyond planning and goal-setting on concrete time management practices, cp. Claessens et al. 2007)
- there is a broad body of literature both on reflection prompts, and a range of complementary computer-mediated environments that structure and guide reflection

We therefore see that students have the tools available for time management, but not necessarily the knowledge to reflect on their own about their time management – and hence to fill the tools with reasonable plans; hence mentoring in terms of time management is expected to be interesting to students. Given that knowledge workers in principle are known to also be challenged by time management (Claessens et al., 2007), even if the concrete time management challenges are maybe different, we can expect that such mentoring would also be interesting to a broader range of target users.

In own past work (in particular Pammer et al., 2015), we have seen that while reflection in a self-directed manner worked, self-awareness of plans for change, and experimentation with different time management setting changed in a study with a coach, but didn't change in a study with only computational support for reflection.

This would of course simply argue for establishing a broad mentoring structure at university. This doesn't scale. As a step of intermediate quality (effective, maybe worse than a good human mentor, but better than no mentoring at all, and hence

not only effective but also efficient), there would be intelligent mentoring technology. Such technology would, beyond what is currently explored in existing literature and commercial products, need to

- Have knowledge both on how to lead reflective conversations, and on time management, and at the same time develop an understanding of each user in terms of strengths and weaknesses with respect to both reflection and time management. So far, I argue that intelligent mentoring technology is somehow similar to intelligent tutoring systems – however, the domain we are talking about here (time management) is substantially less structured and less evidence-based, than typical domains of intelligent mentoring systems – hence, open-ended reflective dialogues as means for support.
- Be conversational in order to act as a reflection partner towards whom to make explicit own reasoning in reflection; and towards whom to commit with respect to plans. It is of course uncertain, whether commitment to a software agent will be as high as towards a human reflection partner, but as study participants were found to develop something akin to attachment to an agent in two weeks (Lee et al., 2019), it seems reasonable to expect that commitment will still be achieved.
- Integrate with the existing digital environment for time management of users, in order to be able to refer to operative time management in reflective conversations.

Finally, beyond short-term planning as seen as positively impacting academic performance in time management literature (Claessens et al., 2017), goal achievement literature in addition points to the positive effects of setting specific, ambitious goals that are under the control of the user (Locke & Latham, 2002). However, people are in general reluctant to refine higher-level goals, and typically tend to start by refining lower-level goals (Cropanzano et al., 1995). In parallel, there are indications about the positive impact of reflective goal-setting (Travers et al., 2015). Hence, I argue that intelligent mentoring technology for students' time management should not only consider operative time management, in the sense of putting up daily, weekly, or semester-plans up for reflection; but should also consider higher-level goals as objects of reflection.

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