Enabling Good Work Habits in Software Developers through Reflective Goal-Setting

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Abstract—Software developers are generally interested in developing better habits to increase their workplace productivity and well-being, but have difficulties identifying concrete goals and actionable strategies to do so. In several areas of life, such as the physical activity and health domain, self-reflection has been shown to be successful at increasing people's awareness about a problematic behavior, motivating them to define a self-improvement goal, and fostering goal-achievement. We therefore designed a reflective goal-setting study to learn more about developers' goals and strategies to improve or maintain good habits at work. In our study, 52 professional software developers self-reflected about their work on a daily basis during two to three weeks, which resulted in a rich set of work habit goals and actionable strategies that developers pursue at work. We also found that purposeful, *continuous* self-reflection not only increases developers' awareness about productive and unproductive work habits (84.5 percent), but also leads to positive self-improvements that increase developer productivity and well-being (79.6 percent). We discuss how tools could support developers with a better trade-off between the cost and value of workplace self-reflection and increase long-term engagement.

Index Terms—Productivity, work habits, goals, self-reflection, reflective goal-setting, personal analytics, workplace awareness

1 Introduction

Software developers are motivated to develop better habits to improve their productivity and well-being at work [1], [2], [3]. It is therefore desirable to gain a better understanding of what *good* work habits and behaviors are, and how we can support developers with the identification of self-improvement opportunities to build better and maintain good habits at work. Prior research has examined developers' existing work habits, specifically the time they spend on various activities at work (e.g., [4], [5], [6], [7], [8]), their organization of work into tasks (e.g., [9]), and causes of fragmented work (e.g., [6], [10], [11], [12], [13]). Recently, researchers have also looked into the attributes and habits of *great* software developers [1], [2], [14]. They found that one key trait of successful developers is growth orientation, which means that they are constantly learning and striving to change their behavior to increase efficiency at work.

Goal-setting is one way to foster behavior change, since it allows individuals to define a target or outcome, and make progress towards their goal [15], [16]. In the context of this work, *goals* refer to desired target or outcome habits that developers set for themselves, to improve productivity and well-being at the workplace. *Strategies* refer to the system they employ to make progress towards and eventually reach their goals. However, identifying concrete and relevant goals can be challenging, which is why an active area of research is investigating how self-reflection can help individuals to get insights into positive and negative habits, and support them with the identification of meaningful goals that motivate positive behavior changes [17], [18], [19]. This includes mostly personal areas of life, such as health [20], [21], sleep quality [22], [23], students' learning behavior [24], [25], [26], and physical activity [27], [28], [29]. Research more specific to knowledge workers' work habits investigated the effects of self-reflection on task completion [30], [31], time management [32], and detachment from work [33], [34].

While developers generally want to play an active role in setting their own goals for work [35], [36], [37], we have not been able to find prior work that investigated goals developers set to improve work habits and productivity. This is why we wanted to study the goals that developers set for themselves to improve and maintain good habits at work, the strategies they pursue to achieve those goals, and the impact their goal-setting has on productivity and well-being. Even though self-reflection has previously been shown to have great potential to foster goal-identification, developers rarely reflect on or review their work in practice [14]. Hence, we further aimed to examine whether encouraging developers to self-reflect continuously on work, results in meaningful insights about work and leads to any work habit goals and -improvements. In particular, our work seeks to answer the following research questions:

RQ1: Which types of goals do developers set for themselves to improve and maintain good work habits?

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RQ2: What are strategies that help developers make progress towards, and achieve their goals?

RQ3: What is the potential impact of reflective goal-setting on developers' goal-identification, goal-achievement monitoring, and work habits?

To investigate these research questions, we combined self-reflection and goal-setting to design a reflective goal-setting study, inspired by the Personal Software Process (PSP) by Humphrey [38] and diary studies in other areas of research. Our study prompts participants on a daily basis to reflect on their work, and asks them to set concrete goals and actionable strategies for improving their work habits. 52 professional software developers completed our study and reflected for two to three work weeks.

Our reflective goal-setting study resulted in a rich set of work habit goals and strategies that we analyzed. They can be broadly categorized into improving time management, avoiding deviations from planned work, improving the impact on the team, maintaining work-life balance, and continuous learning. We found that *continuous* self-reflection can be an important step towards productive self-improvements in the workplace, since participants stated that it supports the identification of goals (80.8 percent) and actionable strategies (83.3 percent). The daily self-reflections not only increased developers' awareness about work habits, progress and achievements (84.5 percent), but also led to productive (short-term) behavior changes (79.6 percent). As a result, while initially being skeptical towards "journaling" their work, most participants (96.1 percent) stated afterwards that they could imagine to continue self-reflecting on a regular basis. Few participants, however, mentioned that constantly self-reflecting may increase pressure to always perform well and thus, could turn into a burden without tool support that would make self-reporting more convenient. Overall, we conclude that *continuous* reflective goal-setting can enable developers to improve and maintain good work habits. We discuss these results with regards to prior work on self-reflection with other types of knowledge workers, and how tools could support developers with their reflective goal-setting and how they might foster long-term self-reflection.

Our contributions are (1) a set of developers' good work habit goals and strategies to improve productivity based on a field-study, and (2) insights into the use and value of continuous reflective goal-setting, and its ability to support developers with the identification, monitoring and maintenance of good work habits that improve productivity and well-being at work.

2 Related Work and Background

Work related to our research can be broadly categorized into research that examined developers' work and productivity, what productive work habits are, and how to foster these with goal-setting and self-reflection.

2.1 Developers' Work and Productivity

Previous work on how developers spend their time at work has focused on developers' activities in the IDE, their testing and refactoring practices, and time they spend on understanding versus actually editing code [39], [40], [41], [42]. Other work has investigated developers' workdays on a more holistic level, investigating how they organize their work overall on activities and tasks (e.g., [4], [5], [6], [7], [8], [9], [43]). The results suggest that developers spend surprisingly little time working on their main coding tasks (from 9 to 61 percent) and that there is a wide variety of other activities that fragment developers' workdays. A large amount of research has focused on factors that influence developers' workdays and the effect they have on productivity (e.g., performance, efficiency, quality) and well-being (e.g., job satisfaction, stress level) [44], [45]. On productive days, developers generally manage to make a lot of progress on their tasks, are supported by their co-workers or other peers, and have a minimum amount of context switches [43], [46], [47]. Contrary, some of the biggest impediments to productive work are regular external interruptions, self-distractions and meetings, since they can make it difficult to focus on and make progress on coding tasks for an extended time (e.g., [6], [10], [11], [12], [13]). The research further showed that the impact of these factors on developers' productivity and well-being varies a lot, suggesting that the opportunities for productive behavior changes might differ amongst individuals.

2.2 Productive Developers' Work Habits

Generally, most software developers are interested in optimizing their own habits and behaviors to improve their productivity and well-being at work [1], [2], [3]. However, we have not been able to find prior work that looked into the goals developers set to improve their work habits and productivity. Previous work also suggests that it is often the managers who set goals for their developers, even though developers would like to have more involvement with setting their own goals [35], [36], [48]. Goals that managers set include usually either concrete features or development tasks, such as shipping a feature on time with minimal bugs; or growth goals, such as increasing expertise, improving team-work or working more independently.

A related area of research looked into characteristics and work habits of successful developers, some of which developers might consider relevant and important to pursue as goals. Amongst other characteristics, successful developers often share similar attributes, such as striving for productivity and efficiency, being self-aware, asking for and offering help and feedback, constantly learning and self-improving, doing data-driven decisions, and setting challenging goals [1], [2], [14], [35], [49], [50]. Successful developers also manage to find a good balance between focused work and helping or mentoring others [2], [14].

In our work, we aim to better understand developers' goals for productive work habits from the developers' perspective, and the strategies they employ to change their behaviors, and increase productivity and well-being.

2.3 Fostering Behavior Change with Goal-Setting

Behavior change is a complex and long-term process [51] that was modeled and formalized in multiple theories, such as the Transtheoretical Model of Behavior Change (TTM) [52], and more specifically to personal informatics, the Stage-Based Model of behavior change by [53] and the Lived Informatics Model by [54]. TTM models behavior change as a sequence of