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# Introducing a Gamification Element in Enterprise Collaboration Platforms: Only a Flash in the Pan or a Lasting Effect?

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**Abstract.** Enterprise collaboration platforms are expected to facilitate effective information exchange by supporting employee sociability, i.e., finding communication partners and building common ground. However, they often suffer from low user engagement, requiring the implementation of additional design elements to encourage user participation. Though previous research found evidence for the effectiveness of introducing new features, particularly gamification elements, to such platforms, the question remains whether it represents more than a flash in the pan and creates some sustainable effects over time. Therefore, the current longitudinal quasi-experimental field study investigates the effectiveness of introducing one exemplary gamification element, a progress bar to encourage profile completion, as a new feature within a digital collaboration platform in a large public sector organization across time. We collected data before (t1 – t3) and after (t4 – t6) implementation of the progress bar. We analyzed the data using linear mixed-effects models, enabling the assessment of time effects and interaction effects of time and progress bar implementation. Profile completion rates increased over time, and introducing a progress bar significantly impacted users' profile completion behavior. More importantly, we found both short-term effects and, after an interim decline, a sustainable change in user behavior after the progress bar implementation over time. Thus, this study presents quantitative evidence of the long-term effectiveness of introducing a gamification element in enterprise collaboration platforms over time.

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## Introduction

Enterprise collaboration platforms support communication and knowledge exchange within organizations. User profiles are an essential basis of such platforms. They enable connections and sociability within the knowledge exchange process (Nonaka and Takeuchi, 1995; Nonaka et al., 1996) as users can more easily identify persons with the knowledge they want to connect with (Schubert and Glitsch, 2016). But, given that enterprise collaboration platforms are organization-driven, the profiles often lack completeness probably because users are only formally required to use the platform due to institutional obligations, e.g., a profile is created when they enter the organization by default, the internal management communication is handled via the platform, they have to use the platform to complete some mandatory training (for example on data privacy or IT security), etc. In contrast to other social platforms that are used privately, such as LinkedIn for job search and career networking, employees may not accept the full potential of the enterprise collaboration platform and lack intrinsic motivation for using it; consequently, filling out the profile is not prioritized (Trier et al., 2017; Nielsen and Razmerita, 2014; Greeven and Williams, 2017). To tackle this problem, one promising approach is to use a gamification element, such as a progress bar, to enhance users' motivation to complete their profiles and increase user engagement with these platforms. Though we have some evidence of the effectiveness of such changes, data is often based on case study approaches or experimental designs with a limited scope. This is a problem because we cannot rule out that new features get some interest, but their effects are quickly in vain. Whether an intervention may help to change user engagement, for example, by increasing profile completion and changing user behavior on a platform in the long run, is an open issue and a question we want to investigate within one specific enterprise collaboration platform.

Before diving into the details of the platform, we analyzed and described our research objective. We reviewed related work on understanding a progress bar as a gamification element on enterprise collaboration platforms.

## Related Work

An enterprise collaboration platform can be understood as “[...] complex, large-scale information infrastructures comprising an ecosystem of highly integrated tools and functionality to support collaborative work and information sharing in organizations” (Schubert and Williams, 2022). It is a system with “A purposefully developed selection of applications/tools that are fully integrated and provided to the user in a workspace under a uniform interface.” (Williams et al., 2020)

The following characteristics are common for such platforms (Nitschke, 2021, p.23-25):

- *Users*: Users are part of an organization but do not necessarily participate voluntarily on the platform. Consequently, the extent of usage is a matter of discretion for individuals. Some research shows that increasing the number of users may increase platform value and adoption (Herzog and Richter, 2016; Herzog and Steinhuser, 2016) and that user profiles are essential for finding an expert and networking (Schubert and Glitsch, 2016).
- *Access and ownership*: Enterprise collaboration platforms are internal, used within the organization and only accessible by authorized employees (Schubert and Williams, 2013; Schwade and Schubert, 2017).
- *Integration and socio-technical relations*: Often, enterprise collaboration platforms are large-scale heterogeneous platforms (De Reuver et al., 2018) that are geographically distributed across various contexts, cultures, and time zones.
- *Structure*: Each organization adjusts and builds its enterprise collaboration platform for its specific context and needs. Generally, Williams and Schubert (2018) found three levels of structure for such platforms: Platform level, community level, and content level.
- *Functionalities*: Gewehr et al. (2017) state that a platform's flexibility in integrating new functionalities will be more relevant in the future and requires involving users of the platform to address their needs.

Enterprise social media is a closely related category. It can be defined as follows: "Web-based platforms that allow workers to (1) communicate messages with specific coworkers or broadcast messages to everyone in the organization; (2) explicitly indicate or implicitly reveal particular coworkers as communication partners; (3) post, edit, and sort text and files linked to themselves or others; and (4) view the messages, connections, text, and files communicated, posted, edited and sorted by anyone else in the organization at any time of their choosing." (Leonardi et al., 2013) Research about enterprise social media investigates ways to increase user participation on such platforms (Chin et al., 2020; Meske et al., 2019; Hacker et al., 2017; Schiller and Meiren, 2018). For example, Van Osch et al. (2015) report in their study that the functionalities' uniqueness and relevance to the employee's daily work and clearly describing the system's benefits and purpose are required to increase its adoption and use, whereas Schwade and Schubert (2019) defines various user types that differ in motivations for participating in such systems.

While the previously mentioned research considered individual differences in user participation in enterprise collaboration platforms, the more intriguing problem is that many platforms suffer from low user participation in general. One answer has been to ask why certain features are not well accepted. For example, the problem of profile completion has been studied in different contexts and from various perspectives: How can we predict missing profile information using a feature-oriented analysis? (Haghir Chehrehgani, 2017) What are the appropriate methods to analyze and investigate user profiles on online social networks? (Hazimeh et al., 2019) Another and probably even more promising approach is to

introduce gamification elements to enhance user experience in general and motivate users to contribute to the platform in particular. Gamification is defined as "[...] the use of game design elements in non-game contexts" (Deterding et al., 2011). A detailed discussion of gamification elements is provided by Sailer et al. (2013) and Reeves and Read (2009). One example of such an element is progress bars. Note that in gamification, a progress bar used is not one showing the progress of a loading program or system interaction (Windows updates, file transfer,...) but an achievement-based feature, for example, profile completion with elements to motivate users to fill in their profiles (Werbach and Hunter, 2012). As noted by Mazarakis and Bräuer (2020); Mazarakis and Bräuer (2023), progress bars are rarely investigated gamification elements and thus require further investigations in various contexts, especially as studies also show a positive influence on task performance. One example is Mekler et al. (2017), who conducted a study using a progress bar to increase intrinsic motivation and performance within a specific task, levels in this case, reporting promising results on its influence on task performance.

Gamification elements and profiles have also been studied in various papers on social media like Facebook or LinkedIn (van Dijck, 2013; Daniels et al., 2021). However, these research findings cannot be applied to an enterprise context, as the individuals' motivations differ (Yousaf et al., 2022; Laitinen and Sivunen, 2021). Research findings regarding gamification within enterprise systems show the importance of analyzing such approaches within this specific context (Suh and Wagner, 2017; Meske et al., 2016, 2017). Schubert et al. (2014) and Greeven and Williams (2017) specifically mention progress bars as a gamification element for enterprise systems but do not show whether and how they are effective in the long run.

In summary, enterprise collaboration platforms aim to connect people and foster knowledge exchange. Thus, users have to share information about themselves. However, usage intensity is often low, which might be tackled by introducing gamification elements, such as a progress bar for completing the user profile.

Evaluating the effects of gamification elements often happens in controlled laboratory settings, such as in the work of Mekler et al. (2017) and Mazarakis and Bräuer (2020). This kind of setting allows us to investigate the specific potentials of the elements. Still, it fails to evaluate the effectiveness of gamification elements in the long term and in real-field settings where we can observe whether they have a lasting influence on user behavior. So, field studies may have a lack of control but enable the observation of user behavior changes over a longer time period, which also takes into account the novelty effect, which can blur the actual efficiency of changes to the user interface.

# Research Questions and Exploratory Hypothetical Model

Our study aims to understand and examine user behavior change in the context of enterprise collaboration platforms by analyzing the change of user profile completions within the platform over a certain period, considering one gamification element, a progress bar. Therefore, we specify our research questions as follows:

- RQ1 What is the effectiveness of implementing a progress bar on users' profile completion behavior on enterprise collaboration platforms?
- RQ2 How does users' profile completion behavior develop over time, particularly after a progress bar has been implemented?

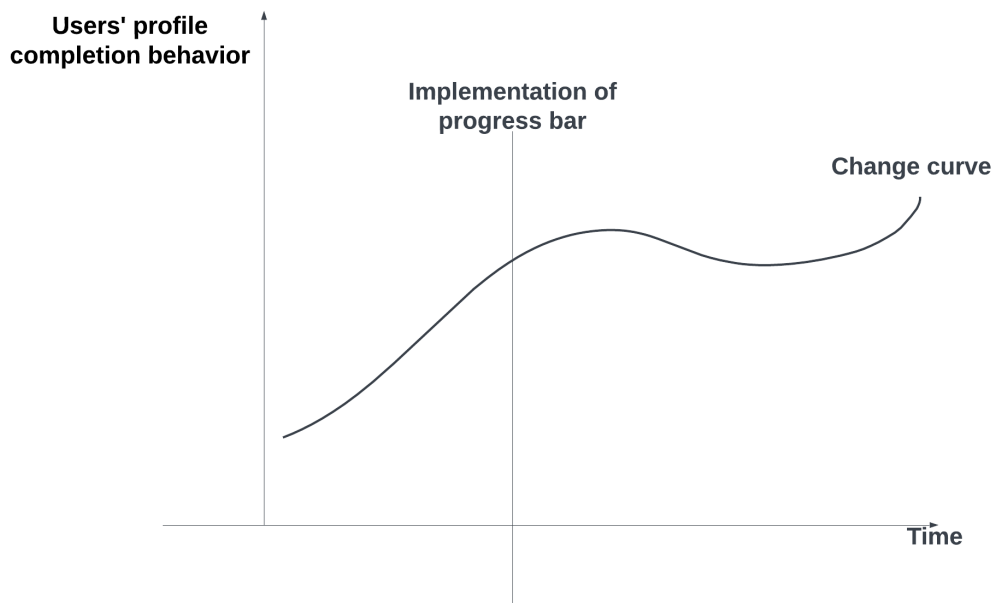


Figure 1. Exploratory hypothetical model of the users' profile completion behavior change across time by implementing a progress bar based on the technology change curve and organizational performance change curve.

Figure 1 shows our exploratory hypothetical model based on the technology change curve (Foster, 1986; Nikula et al., 2010) and the organizational performance change curve (Schneider and Goldwasser, 1998), indicating how we investigated our research questions. In this model, we predict the time effect on users' profile completion, especially the time effect after implementing a progress bar. We also explore the interaction effect of time and progress bar implementation on users' profile completion. A specific description of how we address these research questions is covered in the next section.

# Methodology

This section presents our methodology and how we analyze the implementation of a progress bar in a real-world collaboration platform.

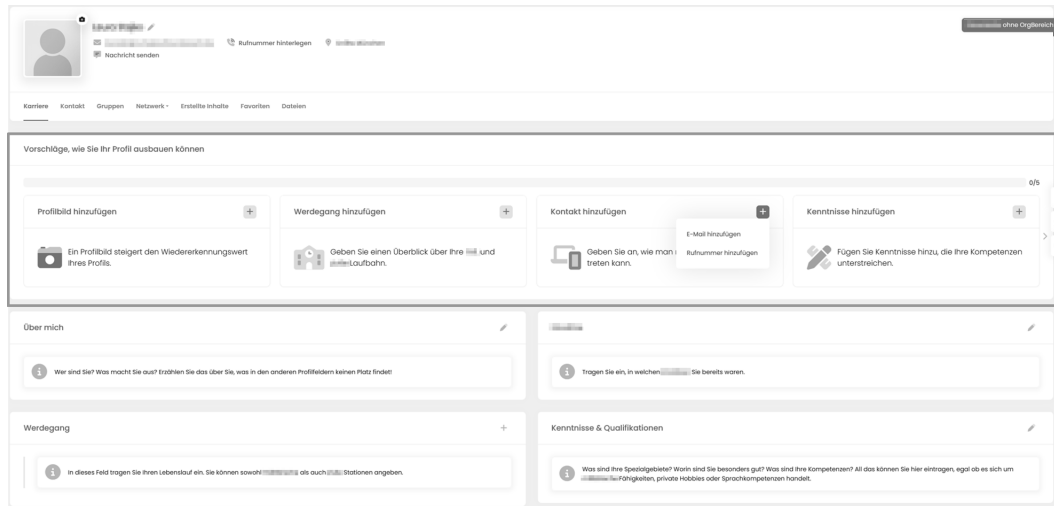


Figure 2. Screenshot of a sample profile on the enterprise collaboration platform with the uncompleted progress bar (highlighted the frame).

The platform we are looking at is an in-house development of a platform for collaboration, learning, coordination, and communication in a large public sector organization. The COVID-19 pandemic required the organization to look for a digital collaboration tool. An already existing platform for education and collaboration was relaunched in January 2022, and its use was extended and made available throughout the whole institution. Subsequently, more and more users from different parts of the institutions within the organization started participating on the platform for various purposes, namely offering online training sessions, arranging meetings, offering documentation, publishing internal job offerings, etc. However, the user profiles on the platform lacked completeness. Hence, the platform development team introduced a new feature, a progress bar, to increase user motivation to add information to their profiles. This new gamification feature was launched on the 17th of January, 2023. Figure 2 shows a sample profile with an uncompleted progress bar, and figure 3 displays a profile where two profile components proposed by the progress bar have been filled out, and consequently, the progress bar recorded this completion progress.

All platform users agreed to the terms of use and accepted the organization's data privacy policy, which covers all relevant aspects of ethics and data privacy. The platform stores and processes the users' personal data in a way aligned with the general data protection regulation (GDPR). As stated in the terms of use, the evaluation of the user data is only done for statistical purposes in an anonymized and aggregated format. We cannot analyze the users' content and demographic

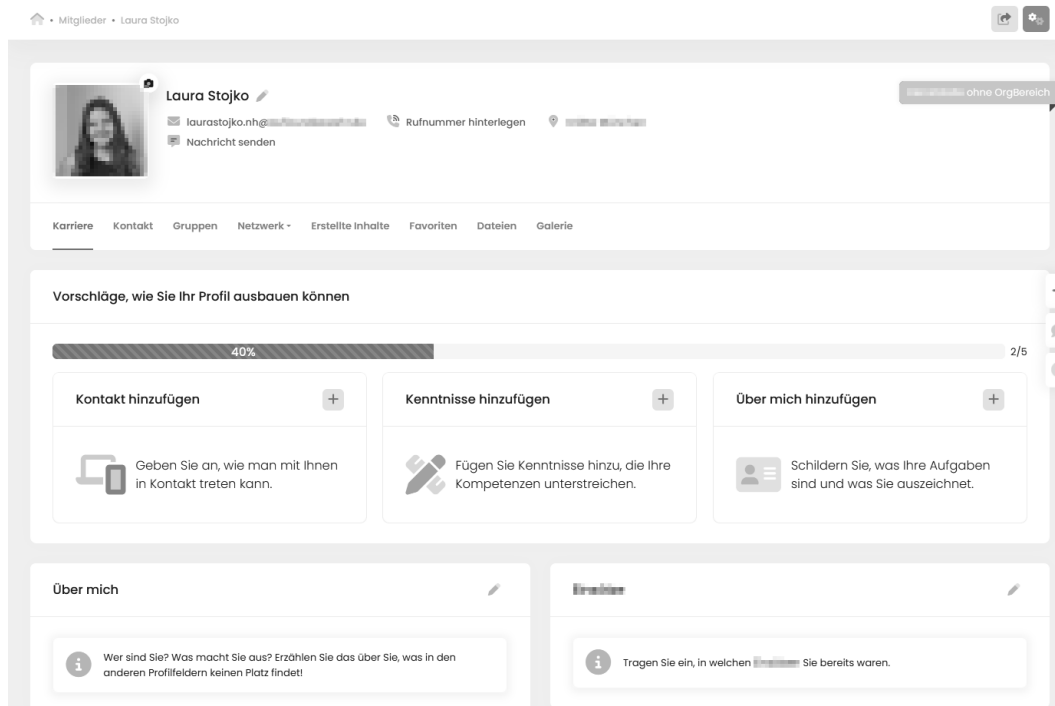


Figure 3. Screenshot of a sample profile with a profile completion rate of 40%, indicated by the progress bar, extended view.

information. Due to the organization's privacy regulations that prohibit the disclosure of user data to a third party, we cannot share the raw data.

In this study, we adopted a quasi-experimental design to investigate our research questions. Quasi-experimental designs have several benefits, such as improved feasibility and practicality of implementation, especially when participant randomization is challenging or even not feasible (Handley et al., 2018). Moreover, quasi-experimental designs frequently incorporate pre-existing conditions, which enhances the study's external validity by replicating real-world scenarios (Reichardt, 2009). Of note, a simple pretest-posttest-comparison (profile completion before vs. after implementation of the progress bar) would have three important disadvantages: Composition between the samples could differ, for example, due to participant attrition, history effects could occur (parallel to the introduction of the feature), and simple reactivity might result. However, and even more importantly, the design we use here has two important advantages. First, we collect several waves of data both before and after the implementation, and thus, we can analyze differences in change scores. Second, these data also allow us to discern the short-term and long-term effects of implementing a new platform feature.

## Data Collection

We collected data at six evaluation times. The following list provides an overview of the evaluation dates in the yyyy-mm-dd format. It includes the total number of profiles we gathered information from at that specific time:

- $t1_{(before)}$  2022-03-29: 8,001 profiles
- $t2_{(before)}$  2022-07-12: 13,996 profiles
- $t3_{(before)}$  2022-10-11: 19,054 profiles
- $t1_{(after)}$  2023-02-01: 28,573 profiles
- $t2_{(after)}$  2023-05-01: 37,915 profiles
- $t3_{(after)}$  2023-08-01: 45,882 profiles

At each evaluation time, the data export included all profiles of the individuals who were registered on the platform at that specific time. The data describes whether the respective profile components were part of the profile (0 - no data, 1 - data available), e.g., “1” if the profile contained a profile picture or “0” if there was no profile picture. The six profile components comprised phone, E-Mail, about, picture, career, and knowledge and competencies. The profile sum score was calculated by adding the scores of all six profile components of each user on the platform, indicating their profile completion.

As evidenced by the number of profiles, the number of users has increased. Consequently, the number of profiles we analyzed in our study varied at the evaluation dates. The reason for the extreme changes in user numbers was that several parts of the organization used the enterprise collaboration platforms consecutively when they identified the need to improve collaboration, learning, and communication. For instance, one part of the organization determined that it was necessary to organize internal training through self-training and online and offline sessions. Subsequently, they added all relevant business unit employees to the platform and used it to manage and communicate their specific training possibilities. In the end, we analyzed the profile completion of 46,530 participants over our evaluation period of more than a year, which is more than the number of profiles of our last evaluation time, 2023-08-01, as it also includes profiles deleted during our study. This means that not all profiles have been subject to the analysis at all evaluation times. The baseline time of our research,  $t1_{(before)}$ , consisted of 8,001 profiles migrated predominantly from the previous platform and used exclusively for one organization’s business unit.

## Data Analysis

We scrutinize whether users’ profile completion behavior changed over time and whether the progress bar implementation affected this change process. Since profile completion was assessed at several points in time, we computed multilevel models with the measurement points of the profile completion on level–1 and the participants on level–2 (Singer and Willett, 2003). Furthermore, linear mixed-effect models are flexible in terms of data structure. In particular, the timing



of observations can differ between subjects, and the distance between adjacent time points can vary (Long, 2012).

First, we defined the six evaluation times using the number of weeks that had passed after  $t_1$  as follows:  $t_{1(\text{before})} = 0$  [baseline],  $t_{2(\text{before})} = 15$ ,  $t_{3(\text{before})} = 28$ ,  $t_{1(\text{after})} = 45$ ,  $t_{2(\text{after})} = 57$ ,  $t_{3(\text{after})} = 70$ . Following that, we examined which time moment best corresponds to the data. Note that our data spanned six different times; a nonlinear curve might help select the appropriate time predictor. Subsequently, we applied polynomials, which were power transformations of the original time predictor, to represent nonlinear trends (Long, 2012). The model fits of the linear, quadratic, cubic, and quartic models were compared by the deviance statistic (Singer and Willett, 2003), which are 132070.6, 131798.2, 131793.9, and 131814.6, respectively. Thus, the cubic model had the smallest value, indicating the best-fitting time moment with the data. Next, we computed linear mixed models with linear, quadratic, and cubic effects of time. Additionally, we included the main effect of the progress bar and the interaction effect of time and the progress bar. The models included random intercepts and slopes on level-2.

	profile sum score		
	Model 1	Model 2	Model 3
fixed effects			
(intercept)	1.00***	1.00***	0.99***
level 1 (within subjects)			
time	0.01***	0.01***	0.01***
time <sup>2</sup>	-0.00***	-0.00***	-0.00***
time <sup>3</sup>	0.00***	0.00***	0.00***
progress bar		0.02***	-0.08***
time × progress bar			0.00***
level 2 (between-subjects)			
random effects			
level 1 (within-subject)			
residual variance	0.03***	0.03***	0.03***
level 2 (between-subjects)			
intercept	0.58***	0.58***	0.58***
slope	0.01***	0.01***	0.01***
intercept/slope (correlation)	-0.44***	-0.44***	-0.44***
model fit			
deviance (-2LL)	131793.93	131782.71	131772.23
change in deviance ( $\Delta$ -2LL)		11.22***	10.47**
AIC	131809.93	131800.71	131792.23
BIC	131889.45	131890.17	131891.64

Table I. Overview of the different statistical models applied for data analysis. N = 46530; coefficients are unstandardized; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  Note: AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, both are ad hoc criteria to compare the relative goodness-of-fit of the models. Lower AIC values or higher BIC values indicate a model is considered better.

## Results

Table I summarizes the results of the hierarchical linear mixed-effect models. We analyzed three models, each in one column in Table I: Model 1 included the linear, quadratic, and cubic effects of time. In Model 2, we also included the progress bar's main effect; finally, in Model 3, we added the interaction effect of time and implementing the progress bar to examine whether the effect of progress bar implementation changes over time. Table I first shows the estimated coefficients for the fixed effects in each model. Fixed effects are the estimated average relationships between time and profile sum score, progress bar implementation, and profile sum score, as well as between the interaction of time and progress bar implementation and profile sum score. The significance of time and its squared and cubed terms indicates that the effect of time on profile completion is not linear. The main effect of progress bar implementation, which mainly verifies the effect of introducing the progress bar, is significant in Model 2, and its interaction with time is significant in Model 3, suggesting that the progress bar implementation has a differential impact on profile completion over time. Table I also shows the estimates for the random effects, which are effects that can vary across individuals or levels. Random effects indicate significant variation at both the within-subject and between-subject levels. Slope suggests that the slope of time can vary between participants. The negative and significant correlation between intercepts and slopes indicates that participants with a higher starting point may have a slower rate of change or vice versa. Model fit provides statistics used to compare the models. Significant change in deviance suggests improvements in model fit.

As a visual representation, Figure 4 and Figure 5 present these main effects of time on the change of profile completion and the interaction of time and progress bar implementation on users' profile completion behavior. The x-axis is the evaluation time calculated in weeks. A vertical line on the x-axis marks the time point of implementing the progress bar. The y-axis is the profile sum score that runs upwards, showing how complete a user's profile is. The cubic change curve line represents the effect of time, indicating changes in users' profile completion over time with an increase directly after implementing the progress bar, subsequently a decrease and a slow increase again (Figure 4). In Figure 5, the dotted line demonstrates the timeline of change of profile completion without progress bar implementation, and the straight line represents the timeline of change of profile completion with a progress bar implementation. The increase in profile completion indicates a more considerable change in slope, suggesting the interaction effect between time and the progress bar.

Our findings present the positive effect of implementing a progress bar on users' profile completion behavior, with increased profile completion rates through introducing a progress bar. A positive relationship exists between time and users' profile completion, especially a more substantial positive effect after implementing a progress bar. These results implicate the effectiveness of implementing a progress bar on users' profile completion behavior on enterprise collaboration

platforms and the impact of time on the change in user behavior, which answers our research questions as it shows that it is a long-lasting effect and not just a flash in the pan.

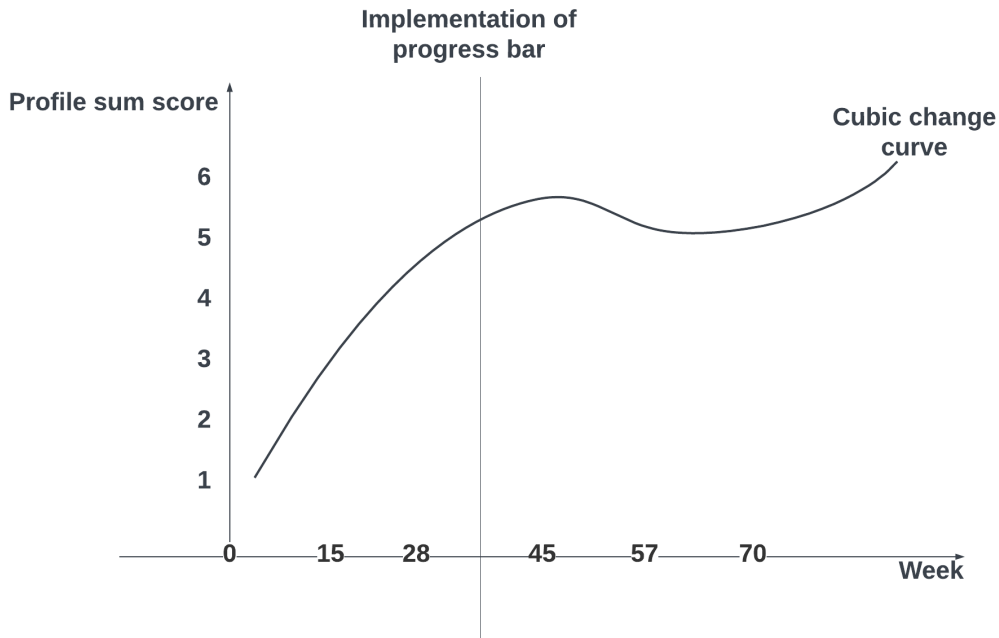


Figure 4. The cubic change curve of the extent of users' profile completion over time.

## Discussion and Limitations

The current study started with the observation that enterprise collaboration platforms often lack individual activities. One solution to this problem is implementing motivating design features, such as gamification elements. We analyzed data from a platform that implemented one such feature, a progress bar of users' profile completions. This is of interest because activities on a platform depend on the availability of other users with knowledge, skills, interests, backgrounds, etc., which should also be visible to other platform members. With enterprises investing a tremendous budget in implementing such collaboration platforms, the results of this study are crucial to increase potential user participation and ultimately foster knowledge exchange to help improve the company's competitiveness. We found that implementing a gamification element of the progress bar could motivate users to fill in more information in their profiles. More specifically, the results of our study reveal a nonlinear curve of change in profile completion behavior over time, showing an initial increase in completion rates after implementing a new feature (progress bar), followed by a subsequent decrease, and ending in a second rise, see details in Figure 4. This shows that

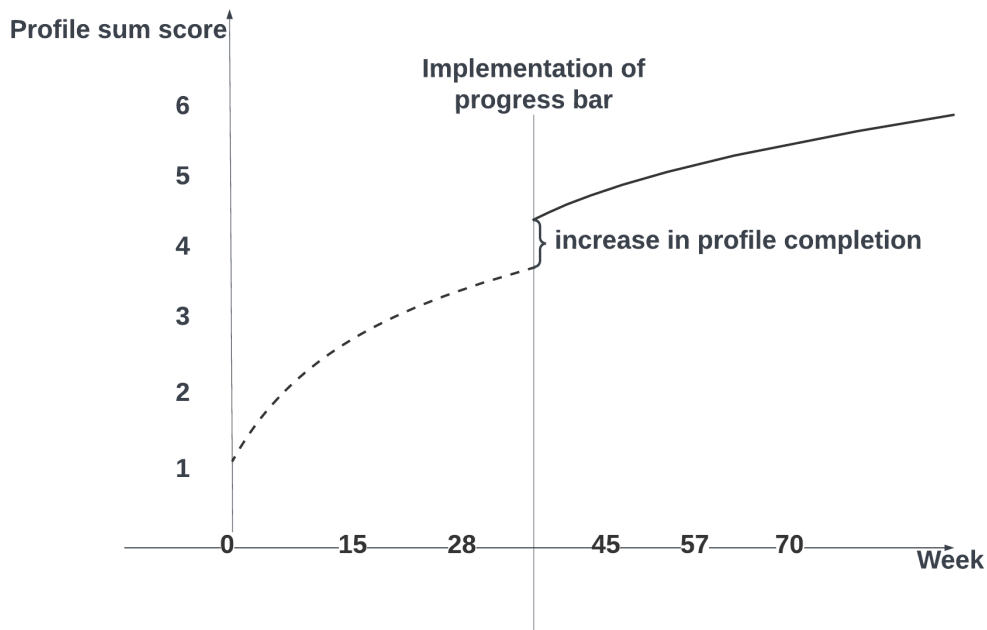


Figure 5. The effect of a progress bar on users' profile completion. The dotted line illustrates the timeline without a progress bar. The straight line illustrates the timeline with a progress bar. The difference between these two lines illustrates the increase in profile completion after implementation of a progress bar.

implementing a progress bar considerably impacts profile completion rates. It resulted in an immediate increase, leading to some fluctuations over time. The observed phenomenon of the initial increase, after introducing a new feature, and a subsequent decrease describes the novelty effect, which is essential to consider for evaluating new features (Koch et al., 2018). Nevertheless, the progress bar plays an essential role in motivating users to complete their profiles within the collaboration platforms, as demonstrated by the steeper increase in completion rates after implementing a progress bar (Figure 5).

According to earlier research, various gamification elements could intrinsically motivate users to perform their tasks (Xi and Hamari, 2019; Ryan et al., 2006). The progress bar provides a simple, understandable visual indication expressing an individual's sense of achievement. It gives users a concrete indicator of how far they've come and how much more they still need to do. This ease of usage could lead to a positive user experience. Furthermore, the progress bar is a good option for profile completion in the platform context of our study. Considering previous research insights, the *performance* of profile completion has also been positively affected by using this gamification feature, which further substantiates the findings of Mekler et al. (2017) and Mazarakis and Bräuer (2020).

Our study also highlights practical implications for organizations. They could think of including a progress bar on similar platforms. By doing so, organizations may improve user engagement and increase task completion. Platform designers in

organizations should carefully choose gamification elements based on the platform's specificity. One of our findings indicates the fluctuations in users' profile completion over time, which signals to organizations that they should not only implement gamification elements but also examine their long-term influence. Quasi-experimental designs with repeated measures can show that such changes have an evidence-based foundation.

Some limitations within our study show potential for future research. Our data only contained boolean values that represented whether or not the respective profile components had been filled out. The quality of the profiles, e.g., how much information has been shared within the "about" field, has not been investigated within this study. In our study, we did not differentiate or weigh the importance of the profile components. A closer look at this might show us more information about the effectiveness of a progress bar relating to specific components. In addition, we considered all user profiles on the platform without considering individual differences. One example might be users' general activity levels. There might have been users who were not interested in becoming active participants on the platform but only used it to complete one mandatory task, e.g., data privacy training, and afterward never logged in again. Thus, it would be interesting to see how individual differences are related to the effects of comparable interventions on digital collaboration platforms.

## Conclusions

Our investigation of users' profile completion rates on the collaboration platform of a large public sector organization revealed valuable findings. This study indicates that a progress bar effectively enhanced users' profile completion rates in enterprise collaboration platforms. Moreover, there was an interplay between users' profile completion, time, and implementation of the progress bar. In detail, users' profile completion rates show a steeper increase after the implementation of a progress bar compared to users' profile completion rates without a progress bar, proving this gamification element successfully motivated users to add information to the platform.

In addition to this clear result about the effectiveness of progress bars, we see a contribution of this paper in proposing and using a linear mixed-effect model-based approach to conduct the analysis. We have briefly discussed why this approach is superior to simply comparing access counts, as often done in evaluating new features.

While this study has shown positive effects of the gamification element "progress bar" on collaboration platforms over time, it is crucial to recognize the limitations that point to potential directions for further research in this area. Our study is a basis for further research into gamification on enterprise collaboration platforms. As proven, such simple gamification elements could help improve long-term success in platforms and foster knowledge exchange within organizations by connecting employees. Digital tools like these have great

potential to shape the way we will work in the future. Further research projects could build on the insights of this work and explore additional intriguing questions, such as examining the correlation between profile completion and actual participation or user types on enterprise collaboration platforms (Schwade and Schubert, 2019) or further investigating the profile completion patterns of deleted profiles.

## Acknowledgments

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## References

- Chin, P. Y., Evans, N., Liu, C. Z., & Choo, K. K. R. (2020). Understanding Factors Influencing Employees' Consumptive and Contributive Use of Enterprise Social Networks. *Information Systems Frontiers*, 22(6), 1357–1376, <https://doi.org/10.1007/S10796-019-09939-5/TABLES/7>.
- Daniels, R. A., Pemble, S. D., Allen, D., Lain, G., & Miller, L. A. (2021). LinkedIn Blunders: A Mixed Method Study of College Students' Profiles. *Community College Journal of Research and Practice*, 47(2), 90–105, <https://doi.org/10.1080/10668926.2021.1944932>.
- De Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: a research agenda. *Journal of Information Technology*, 33(2), 124–135.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, MindTrek 2011*, volume 11 (pp. 9–15).
- Foster, R. N. (1986). *Innovation: The Attacker's Advantage*. Summit Books.
- Gewehr, B., Gebel-Sauer, B., & Schubert, P. (2017). Social network of business objects (sonbo): An innovative concept for information integration in enterprise systems. *Procedia computer science*, 121, 904–912.
- Greeven, C. & Williams, S. (2017). Enterprise collaboration systems: addressing adoption challenges and the shaping of sociotechnical systems. *International Journal of Information Systems and Project Management*, 5(1), <https://aisel.aisnet.org/ijispm/vol5/iss1/2>.
- Hacker, J., Bernsmann, R., & Riemer, K. (2017). Dimensions of User Behavior in Enterprise Social Networks. *Knowledge Management and Organizational Learning*, 3, 125–146, [https://doi.org/10.1007/978-3-319-45133-6\\_7](https://doi.org/10.1007/978-3-319-45133-6_7).
- Haghir Chehreghani, M. (2017). Feature-oriented analysis of user profile completion problem. In J. M. Jose, C. Hauff, I. S. Altungovde, D. Song, D. Albakour, S. Watt, & J. Tait (Eds.), *Advances in Information Retrieval* (pp. 304–316). Cham: Springer International Publishing.
- Handley, M. A., Lyles, C. R., McCulloch, C., & Cattamanchi, A. (2018). Selecting and improving quasi-experimental designs in effectiveness and implementation research. *Annual review of public health*, 39, 5–25.

- Hazimeh, H., Mugellini, E., & Khaled, O. A. (2019). Reliable user profile analytics and discovery on social networks. In *Proceedings of the 2019 8th International Conference on Software and Computer Applications*, ICSCA '19 (pp. 496–500). New York, NY, USA: Association for Computing Machinery.
- Herzog, C. & Richter, A. (2016). Use cases as a means to support the appropriation of enterprise social software. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 4072–4081).: IEEE.
- Herzog, C. & Steinhuser, M. (2016). The impacts of enterprise social software on the innovation process. In *2016 IEEE 20th International Enterprise Distributed Object Computing Conference (EDOC)* (pp. 1–10).: IEEE.
- Koch, M., von Luck, K., Schwarzer, J., & Draheim, S. (2018). The Novelty Effect in Large Display Deployments – Experiences and Lessons-Learned for Evaluating Prototypes. In *Proc. 16th European Conference on Computer-Supported Cooperative Work: European Society for Socially Embedded Technologies (EUSSET)*.
- Laitinen, K. & Sivunen, A. (2021). Enablers of and constraints on employees' information sharing on enterprise social media. *Information Technology and People*, 34(2), 642–665, <https://doi.org/10.1108/ITP-04-2019-0186>.
- Leonardi, P. M., Huysman, M., & Steinfield, C. (2013). Enterprise Social Media: Definition, History, and Prospects for the Study of Social Technologies in Organizations. *Journal of Computer-Mediated Communication*, 19(1), 1–19, <https://doi.org/10.1111/jcc4.12029>.
- Long, J. D. (2012). *Longitudinal data analysis for the behavioral sciences using R*. Sage.
- Mazarakis, A. & Bräuer, P. (2020). Gamification of an open access quiz with badges and progress bars: An experimental study with scientists. In *GamiFIN* (pp. 62–71).
- Mazarakis, A. & Bräuer, P. (2023). Gamification is Working, but Which One Exactly? Results from an Experiment with Four Game Design Elements. *International Journal of Human-Computer Interaction*, 39(3), 612–627, <https://doi.org/10.1080/10447318.2022.2041909>.
- Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. *Computers in Human Behavior*, 71, 525–534, <https://doi.org/10.1016/J.CHB.2015.08.048>.
- Meske, C., Brockmann, T., Wilms, K., & Stieglitz, S. (2016). Gamify employee collaboration - A critical review of gamification elements in social software. *CoRR*, *abs/1606.01351*, <https://doi.org/10.48550/arXiv.1606.01351>.
- Meske, C., Brockmann, T., Wilms, K., & Stieglitz, S. (2017). Social Collaboration and Gamification. In S. Stieglitz, C. Lattemann, S. Robra-Bissantz, R. Zarnekow, & T. Brockmann (Eds.), *Gamification: Using Game Elements in Serious Contexts* (pp. 93–109). Cham: Springer International Publishing.
- Meske, C., Junglas, I., & Stieglitz, S. (2019). Explaining the emergence of hedonic motivations in enterprise social networks and their impact on sustainable user engagement. *Journal of Enterprise Information Management*, 32(3), 436–456, <https://doi.org/10.1108/JEIM-08-2018-0177>.
- Nielsen, P. & Razmerita, L. (2014). Motivation and knowledge sharing through social media within danish organizations. In *Creating Value for All Through IT: IFIP WG 8.6 International Conference on Transfer and Diffusion of IT, TDIT 2014, Aalborg, Denmark, June 2-4, 2014. Proceedings* (pp. 197–213).: Springer.

- Nikula, U., Jurvanen, C., Gotel, O., & Gause, D. C. (2010). Empirical validation of the classic change curve on a software technology change project. *Information and Software Technology*, 52(6), 680–696.
- Nitschke, C. S. (2021). *Monitoring Enterprise Collaboration Platform Change and the Building of Digital Transformation Capabilities: An Information Infrastructure Perspective (doctoral dissertation)*. Dissertation, Universität Koblenz-Landau, <https://kola.opus.hbz-nrw.de/opus45-kola/frontdoor/index/index/docId/2229>.
- Nonaka, I. & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press.
- Nonaka, I., Takeuchi, H., & Umemoto, K. (1996). A theory of organizational knowledge creation. *International Journal of Technology Management*, 11(7-8), 833–845, <https://doi.org/10.1504/IJTM.1996.025472>.
- Reeves, B. & Read, L. (2009). *Total Engagement: Using Games and Virtual Worlds to Change the Way People Work and Businesses Compete*. Harvard Business Press.
- Reichardt, C. S. (2009). Quasi-experimental design. In *The Sage handbook of quantitative methods in psychology*. (pp. 46–71). Thousand Oaks, CA: Sage Publications Ltd.
- Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, 30, 344–360.
- Sailer, M., Hense, J., Mandl, H., & Klevers, M. (2013). Psychological perspectives on motivation through gamification. *Interaction Design and Architecture(s) Journal*, 19, 18–37, <https://doi.org/10.55612/s-5002-019-002>.
- Schiller, C. & Meiren, T. (2018). Enterprise Social Networks for Internal Communication and Collaboration. In *2018 IEEE International Conference on Engineering, Technology and Innovation, ICE/ITMC 2018 - Proceedings*: Institute of Electrical and Electronics Engineers Inc.
- Schneider, D. M. & Goldwasser, C. (1998). Be a model leader of change. *Management Review*, 87(3), 41.
- Schubert, P. & Glitsch, J. (2016). Use cases and collaboration scenarios: how employees use socially-enabled enterprise collaboration systems (ecs). *International Journal of Information Systems and Project Management*, 4, <https://doi.org/10.12821/ijispm040203>.
- Schubert, P., Hager, J., & Paulsen, L. (2014). Auswirkungen von Gamification in Enterprise Collaboration Systems. In *Mensch & Computer 2014 - Tagungsband* (pp. 3–14). Berlin: De Gruyter Oldenbourg.
- Schubert, P. & Williams, S. (2013). The Concept of Social Business: Oxymoron or Sign of a Changing Work Culture? In *BLED 2013 Proceedings*, <https://aisel.aisnet.org/bled2013/26>.
- Schubert, P. & Williams, S. P. (2022). Enterprise collaboration platforms: An empirical study of technology support for collaborative work. *Procedia Computer Science*, 196, 305–313.
- Schwade, F. & Schubert, P. (2017). Social Collaboration Analytics for Enterprise Collaboration Systems: Providing Business Intelligence on Collaboration Activities. In *Hawaii International Conference on System Sciences 2017 (HICSS-50)*, [https://aisel.aisnet.org/hicss-50/cl/data\\_science\\_for\\_collaboration/4](https://aisel.aisnet.org/hicss-50/cl/data_science_for_collaboration/4).



- Schwade, F. & Schubert, P. (2019). Developing a user typology for the analysis of participation in enterprise collaboration systems. In *Proceedings of the Annual Hawaii International Conference on System Sciences* (pp. 460–469).
- Singer, J. D. & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press.
- Suh, A. & Wagner, C. (2017). How gamification of an enterprise collaboration system increases knowledge contribution: an affordance approach. *Journal of Knowledge Management*, 21(2), 416–431, <https://doi.org/10.1108/JKM-10-2016-0429>.
- Trier, M., Fung, M., & Hansen, A. (2017). Uncertainties as barriers for knowledge sharing with enterprise social media. In *25th European Conference on Information Systems (ECIS)* (pp. 1619–1630). Guimarães, Portugal, [http://aisel.aisnet.org/ecis2017\\_rp/104](http://aisel.aisnet.org/ecis2017_rp/104).
- van Dijck, J. (2013). ‘you have one identity’: performing the self on facebook and linkedin. *Media, Culture & Society*, 35(2), 199–215, <https://doi.org/10.1177/0163443712468605>.
- Van Osch, W., Steinfield, C. W., & Balogh, B. A. (2015). Enterprise social media: Challenges and opportunities for organizational communication and collaboration. In *48th Hawaii International Conference on System Sciences* (pp. 763–772).: IEEE.
- Werbach, K. & Hunter, D. (2012). *For the Win: How Game Thinking can Revolutionize your Business*. Wharton Digital Press.
- Williams, S. P., Mosen, J., & Schubert, P. (2020). The structure of social documents. In *Proceedings of the Annual Hawaii International Conference on System Sciences*, volume 2020-Janua (pp. 2825–2834).
- Williams, S. P. & Schubert, P. (2018). Designs for the digital workplace. *Procedia computer science*, 138, 478–485.
- Xi, N. & Hamari, J. (2019). Does gamification satisfy needs? a study on the relationship between gamification features and intrinsic need satisfaction. *International Journal of Information Management*, 46, 210–221.
- Yousaf, S., Imran Rasheed, M., Kaur, P., Islam, N., & Dhir, A. (2022). The dark side of phubbing in the workplace: Investigating the role of intrinsic motivation and the use of enterprise social media (ESM) in a cross-cultural setting. *Journal of Business Research*, 143, 81–93, <https://doi.org/10.1016/J.JBUSRES.2022.01.043>.