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When Does Gamified Training Improve Performance? The Roles of Office and Leader Engagement

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Abstract

Gamified training is a novel management control system in which companies use gamification techniques to engage and motivate employees to learn. This study empirically examines the performance consequences of gamified training using data from a natural field experiment in a professional services firm. We find that, on average, the main effect of adopting the gamified training platform on performance is significantly positive. We also study whether outcomes depend on *how* engaged the office is in the gamified training platform (i.e., office engagement) and *who* is engaged in the gamified training platform (i.e., leader engagement). Our findings suggest that the benefits of gamified training are greater when employees are initially more engaged—as revealed by their readiness to log onto the gamified training platform— and when more leaders, who are actively engaged in selling to clients and who serve as role models for their employees, actively participate in the gamified training platform.

Keywords: gamified training, management control system, engagement

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I. INTRODUCTION

With advances in technology, companies are increasingly adopting novel personnel control systems to guide and motivate employees to perform.¹ One such mechanism is gamified training, that is, training tools that include game-like elements—such as performance-based points, progression through challenges and levels, instant feedback, and competition.^{2, 3} Proponents argue that gamified training, if done well, can help engage employees in learning new concepts, developing problem-solving skills, and taking action to drive their teams' performance (e.g., Kapp 2012, p. 10). However, gamified training is also frequently criticized for distracting employees from other priorities (Yee 2006; Kuss, Louws, and Wiers 2012). In addition, employees may not take the training seriously due to its gamified features (Kelly, Valtchanov, and Webb 2021).

In this study, we examine the performance effects of gamified training and investigate whether its effectiveness is contingent on the initial engagement of leaders and/or their teams. If gamified training enhances performance primarily through fostering greater engagement, then units exhibiting lower initial levels of leader and team engagement might stand to benefit more. Conversely, leaders and teams that engage more promptly could realize greater benefits as they swiftly uncover opportunities to enhance results. Moreover, the system's credibility might increase

¹ Merchant and Van der Stede (2017) define personnel control systems as “systems designed to make it more likely that employees will perform the desired tasks satisfactorily on their own because the employees are experienced, honest, and hard-working and derive a sense of self-realization and satisfaction from performing tasks well” (p. 86). They include: “selection and placement,” “training,” and “job design and provision of necessary resources.”

² Deterding, Dixon, Khaled, and Nacke (2011) define gamification as “the use of game design elements in non-game contexts.”

³ For example, Walmart introduced virtual reality to upgrade employee training at Walmart Academies nationwide. Coca-Cola uses a virtual business simulation game called Revenueopoly to help employees understand how to reach corporate strategic objectives and how to grow revenue in an ever-changing environment.

if leaders engage with the system early on, thereby motivating their teams to treat the training as a serious avenue to boost performance.

We address these questions empirically with a natural field experiment, using data from a global professional services firm that introduced a gamified training platform. This firm offers a broad array of services in various industry sectors. The purpose of the gamified training platform was to deepen employees' awareness and understanding of the firm's value proposition to customers—highlighting its service offerings and capabilities—so that their office teams could identify additional opportunities to generate revenue.

Prior to the adoption of the gamified training platform, the curriculum employees experienced during onboarding training included information about the company's service offerings, which employees were expected to learn. Employees were also encouraged to recommend relevant services to the clients they served. Yet, the firm's leaders believed they could further improve employees' capacity to recognize and recommend opportunities to enhance value for clients. Consequently, they chose to augment the firm's traditional training approach with a gamified training platform. In the training experience, employees could design online avatars and “race around the world” by answering questions about the firm's offerings. A correct answer earned travel points that enabled one to progress in the game. One could also enter “mini-game challenges” to earn points and unlock new levels (see Figure 1). The company expected that the gamified training platform would better engage employees with content about the firm's service offerings, increase their motivation to learn the content, and ultimately enhance employee efficacy and improve firm performance.

---Insert Figure 1 here ---

The firm implemented the gamified training platform in stages in a country with 24 offices with client-facing employees. The company started this implementation in 7 randomly-selected treatment offices in June 2016, 7 in July 2016, 1 in September 2016, and the remaining 9 (control) offices in December 2016. Using longitudinal, de-identified human resources data shared by the firm, our analysis spans 29 months, from the beginning of July 2015 to the end of November 2017. We leverage the randomly-staggered introduction of the training to examine the causal effects of adopting gamified training on performance and explore the conditions under which its adoption is more or less effective.

We examine the effect of the gamified training platform on sales, the number of clients, and the number of client engagements at an office level. Our analyses are based on two identification strategies: First, we use the sample period *before* offices in the control group implemented the platform and use a conventional difference-in-differences research design to investigate whether implementation of the training had an impact on the treated group relative to the control group. Second, leveraging the staggered implementation, we use the full sample and treat the platform launch as the treatment for each office, using pre-intervention offices as controls. Both methodologies provide converging evidence that adopting the gamified training platform has a significantly positive effect on sales. Our results also suggest that gamified training contributes to retaining a larger number of clients, especially as employees increase their usage of the training platform.

In our next set of analyses, we explore two conditions under which the performance effect may be heterogeneous; namely, (a) the level of *office engagement*, measured by the percentage of employees who logged onto the training platform at least once, and by the inverse of the average days between the implementation date of the system and employee's first login date, and (b) the

degree of *leader engagement* in the gamified training platform, measured by the number of participating partners divided by the total number of all participants. First, we find that adopting the platform is associated with better firm performance in offices where employees are initially more engaged—in terms of their willingness to try the gamified training platform and the speed with which they log on to it. This finding suggests that the benefits of gamified training are greater if more employees are engaged with the organization and with acquiring knowledge to achieve organizational goals. Second, we find that the introduction of the platform is associated with greater increases in sales and number of clients in offices where leaders participate more in the game. Our analyses are suggestive of two potential mechanisms driving the positive moderating effect of leadership engagement on the success of the platform: (a) We find that leadership engagement drives greater increases in the number of clients, suggesting that, by virtue of their direct influence on developing client relationships, leaders are in a better position to utilize the knowledge they gained from engagement with the platform; and, (b) we find that the engagement of office employees with the platform tends to follow that of their leaders, suggesting that leaders may exert a positive indirect influence by role modeling (and potentially legitimizing) playing behavior in the gamified training platform.

Our paper makes several contributions to the literature on managerial accounting, information systems, operations, and human resource management. First, we contribute to the recent work that examines the effects of gamified training platforms. For example, in a study conducted by Baxter, Holderness, and Wood (2016)—including an experiment and a field study at a bank that introduced gamified training on issues related to security and internal controls—employees report strongly preferring gamified training over non-gamified training. However, the study showed only modest increases in knowledge after taking the gamified training. Kelly,

Valtchanov, and Webb (2021) show that one company's employees increased their engagement with its online training platform and performed better in online quizzes when doing so was compensated indirectly with the right to use a virtual slot machine generating gift-card prizes rather than compensated directly with gift-card rewards (suggesting that employees find playing, and not just the gift cards, to be rewarding). Further, Ramirez (2017) investigates the impact of a program that combines gamified training elements with non-gamified mentoring on work performance. Ramirez (2017) shows that truck drivers who participate in the program improve their driving efficiency (measured as fuel used per distance traveled). We isolate the effects of a gamified training platform (*neither including mentoring nor rewards*) and find that its implementation has a positive effect on office-level performance outcomes (beyond performance differences in knowledge assessments related to the training). Moreover, the positive effect is more pronounced in more-engaged offices and when leaders participate more in the gamified training.

More generally, we contribute to the growing managerial accounting, information systems, and operations literature on implementing digital information-sharing and training platforms to influence employee outcomes. Regarding the use of digital information-sharing systems, prior research suggests that these systems can help employees reduce duplication in the generation of knowledge and enhance creativity and innovation as employees combine the knowledge and ideas learned through the system with their own (Leonardi 2014, Li and Sandino 2018). Buell, Kim and Tsay (2017) also find that implementing a digital platform increasing operational transparency between employees and customers increases customer satisfaction. Regarding digital training platforms, Fisher, Gallino, and Netessine (2021) find evidence that sales associates in a retail firm taking (non-gamified) online training on product features increase their sales with every additional online module taken. Our study examines the performance effects of implementing a *gamified*

digital training platform in a professional services firm and highlights the relevance of office and leader engagement in enhancing the performance effects of such a platform. In particular, our study suggests that leaders may legitimize engagement in the gamified platform through role modeling, potentially granting employees with license to play (training) games at work.

Finally, our study adds to the recent managerial accounting literature highlighting that control systems do not work in isolation (e.g., Grabner and Moers 2013). Our study suggests that the results expected from a personnel control such as gamified training might depend on other management control systems driving office engagement. This suggests a promising research opportunity to analyze interactions between gamified training and other management control systems, such as cultural controls, previously found to be linked to higher levels of employee engagement (e.g., Rich, Lepine, and Crawford 2010).⁴

The paper continues as follows. Section 2 develops our hypotheses. Section 3 describes the field experiment. Section 4 presents our research design and findings. Section 5 concludes.

II. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

2.1. Effects of Gamified Training

Advances in technology offer companies increasingly innovative means to motivate employees. As firms are increasingly trying to enhance employees' intrinsic motivation to perform, one approach for doing so is gamification, which aims to make learning information relevant to perform, enjoyable in its own right. For example, Home Depot introduced a mobile gamification app called "the PocketGuide," which uses gamification techniques to train new employees while

⁴ Merchant and Van der Stede's (2017) definition of personnel control systems was provided in footnote 1, page 1. They define cultural controls as those that exist "to shape organizational behavioral norms and to encourage employees to monitor and influence each other's behaviors" (p. 86).

on the job.⁵ The company believes such gamified training can enhance employees' learning experience and thus improve their performance. Despite the prevalent use of gamified training, only a few academic studies have examined its effects. We contribute to this emerging literature by conducting a natural field experiment in a global professional services company to examine the performance effects of gamified training.

It is unclear whether or not a gamified training platform aimed at helping employee teams improve their performance, should yield a positive performance outcome. On the one hand, research suggests work tasks perceived as “play” should increase employee satisfaction (Csikszentmihalyi and LeFevre 1989; Sansone, Sachau, and Weir 1989). Gamified training should therefore energize workers' dedication to learning and applying the content of the training to enhancing their performance. Some studies examine the motivational consequences of gamified training. For instance, Baxter, Holderness, and Wood (2016) show that a gamified version of IT security training results in greater trainee satisfaction and modestly-higher levels of learning than a non-gamified version does. Moreover, Kelly, Valtchanov, and Webb (2021) study employees' engagement in an online training platform that rewards performance on training quizzes in a gamified or non-gamified way. The authors find greater training engagement and performance on quizzes when quiz results are rewarded through gamification, suggesting that playing is perceived to be rewarding. Ramirez (2017) examines effects on work performance, noting how truck drivers improve their driving efficiency (measured as fuel used per distance traveled) relative to their peers both during and after a program combining two simultaneous treatments: gamified online training and personal coaching. Both Kelly, Valtchanov, and Webb (2021) and Ramirez (2017) find,

⁵ <https://corporate.homedepot.com/newsroom/onboarding-go-mobile-application-enhances-associate-training>.

however, that the benefits of the gamification tools used for training in their studies only lasted a short while (while the system was novel).⁶

On the other hand, gamified training may backfire. Research has shown that some individuals may dismiss gamified training (e.g., Kelly, Valtchanov, and Webb 2021) or find it distracting (e.g., Yee 2006; Kuss, Louws, and Wiers 2012). In a study, Kelly, Valtchanov, and Webb (2021) observed that employees who opted not to use gamified-training features when such features were introduced, actually decreased their level of training. Conversely, the allure of gamification features might lead some employees to become overly immersed in the game. Kuss, Louws, and Wiers (2012) suggest that introducing gamified components into a business setting could lead employees to feel detached from their primary tasks, potentially undermining their performance. Moreover, in the absence of leader engagement with gamified training, employees may hesitate to spend significant time on such training—even when the training could boost their performance. They could perceive the play-like features of the training as distractions and might abstain from playing, fearing adverse perceptions from their leaders. Consequently, they may not engage in this form of training or stop engaging in it overtime and miss an opportunity to learn strategies to enhance their performance. A comparable effect was documented by Neeley and Leonardi (2018) in the context of social networks: employees reduced their interactions in their enterprises' social networks overtime, even when such interactions helped them improve performance, as they worried that they would be perceived as shirking from doing their work. The

⁶ Our study differs from these two studies in three ways. First, the training content in our setting is not directly tied to the trainee's individual performance, compensation, or promotion. Rather, it is connected to knowledge about services employees could offer to clients which could enhance office performance. Second, the gamified training system in our setting does not involve any mentoring or monetary incentives which, combined with gamified training, may have complex impacts on performance. Third, we explore and highlight the conditions under which the implementation of the gamified training system would be more or less likely to enhance performance.

fundamental insight from these studies is that gamified training could unintendedly lead to decreases rather than increases in performance.

The conflicting arguments described above suggest that the adoption of a gamified training platform may either increase or decrease performance. Therefore, we split our first hypothesis as follows:

Hypothesis 1A (H1A): The introduction of a gamified training platform will have a positive effect on performance.

Hypothesis 1B (H1B): The introduction of a gamified training platform will have a negative effect on performance.

2.2. Conditions Influencing the Efficacy of Gamified Training

In recognition of the conflicting main effects of gamified training documented in the prior literature referenced above, we focus on two potential moderators of the effect of gamified training on firm performance: (a) *office engagement* (how engaged employees are in their work, as manifested by their readiness to log onto a gamified training platform) and (b) *leader engagement* (the extent to which leaders participate in the gamified training platform). We next review the relevant literature and develop hypotheses regarding how these factors may influence the effect of gamified training on performance.

2.2.1. Gamified Training and Office Engagement

Office engagement has gained widespread attention in academia (e.g., Kahn 1990; Saks 2006; Rich, Lepine, and Crawford 2010). Kahn (1990) defines engagement as “the harnessing of organization members’ selves to their work roles; in engagement, people employ and express themselves physically, cognitively, and emotionally during role performance” (p. 694). One stream

of literature examines the antecedents of office engagement in the field, mainly using survey data (e.g., Saks 2006; Rich, Lepine, and Crawford 2010). These studies show greater engagement among employees whose jobs require a greater variety of skills, involve a complete piece of work, are perceived to be important, or offer greater autonomy and feedback (Hackman and Oldham 1980; Saks 2006). They also show that perceived organizational support and the individual's alignment with organizational values and goals are positively associated with office engagement (Saks 2006, Rich, Lepine, and Crawford 2010). Another strand of literature studies the consequences of office engagement and shows that it is positively associated with job satisfaction and negatively associated with intention to quit (e.g., Sonnentag 2003; Schaufeli and Bakker 2004; Saks 2006).

Office engagement can potentially moderate the performance effect of a gamified training platform from two directions. On the one hand, prior research suggests that management control systems do not work in isolation (e.g., Grabner and Moers 2013). We expect office engagement generated through leadership or other systems to have a positive effect on an employee's willingness to engage with a personnel control system like gamified training. In particular, employees with higher levels of engagement may be more likely to take advantage of gamified training to improve at a job in which they are invested. On the other hand, to the extent the gamification feature is designed to motivate employees who would otherwise be less engaged in training (Sailer and Homner 2020), the gamified training platform may be especially helpful in offices with relatively lower initial levels of engagement. Given the conflicting arguments on the moderating effect of office engagement, we therefore hypothesize:

Hypothesis 2a (H2a): The introduction of a gamified training platform will be more beneficial in offices where employees are more engaged.

Hypothesis 2b (H2b): The introduction of a gamified training platform will be more beneficial in offices where employees are less engaged.

2.2.2. Gamified Training and Leader Engagement with the Training Platform

Office leaders' engagement in the gamified training platform, which we call Leader Engagement, can potentially moderate the performance effect of the gamified training platform in two ways. First, employees may view their leader's engagement in the platform as a reference on how to behave to create value (Ivancevich and Donnelly 1970). By taking cues from their leaders on what actions are worth pursuing, office employees may be more willing to use the platform as a tool to boost organizational performance. Furthermore, prior studies have highlighted that a leader's participation in activities that could otherwise be perceived as distractions from work can help employees feel safe to participate in such activities (Neeley and Leonardi 2018). In the context of learning, Vera and Crossan (2004) propose that leaders can motivate others to learn through their own engagement in learning, serving as role models for their employees. Based on these arguments, we conjecture that high leader engagement will make subordinates attach greater importance to the game, take the game seriously, and use it more intensively and more effectively to generate better performance. Second, to the extent that leaders are more likely than subordinates to engage with clients directly, their learning and development through engagement with the platform may have a greater direct impact on the company's performance than the platform engagement of their subordinates. We therefore hypothesize:

Hypothesis 3 (H3): The introduction of a gamified training platform will be more beneficial in offices where leaders are more engaged in the gamified training platform.

III. RESEARCH SETTING AND DATA

The research site for this study is a global professional services company (hereafter, “PSC”). PSC offers a broad array of practices across three main lines of service in various industry sectors and has more than 300 offices worldwide.⁷ Due to its size and complexity, PSC faced a challenge in which employees lacked a detailed understanding of the numerous types of services PSC is able to provide to customers, especially those services that the employees are not directly working on. For example, an employee at the financial risk management department may not be familiar with the cyber security risks that the customer may potentially face and thus may miss an opportunity to recommend PSC’s cyber security consultation services to the customer. PSC has long incorporated information on its service capabilities, i.e., the numerous types of services PSC is able to provide, in the in-person onboarding training for new employees. Employees are also encouraged to recommend services from other departments to the customers they serve. However, these approaches did not generate marked effects.

Because such an understanding was crucial to long-term success—owing to the consultative selling process PSC uses to cultivate business—the company decided to create and deploy a gamified training platform to provide employees with the knowledge and confidence necessary to make PSC’s service capabilities more fully available to its clients and potential clients.

3.1. Natural Field Experiment on the Introduction of a Gamified Training Platform

PSC created a learning tool using game elements to provide employees with information about its service offerings in an engaging manner. Employees designed an avatar and immersed themselves in a virtual world where they could travel to different places and explore different

⁷ We do not provide detailed figures on the size and scope of the company to preserve its anonymity but highlight that it is large.

themes. They could voluntarily participate in the gamified platform using one of four modes: single-player game mode, mini-game mode, quiz mode, or tournament mode. Along this virtual journey, they were asked questions about the firm's service capabilities and could earn points for correct answers. Wrong answers resulted in instant feedback and a detailed explanation. The questions became more difficult as the employees progressed through the game. The gamified experience was enhanced by incorporating options to unlock new locations and complete missions. At the end of the game, the employees' performance was summarized on a global leaderboard along with the performance of other players around the world. This performance contained the rank and learning progress of the players. However, employees were not required to reveal their identity as they could use nicknames and customize their avatar. Figure 1 shows screenshots of the gamified training tool.⁸

The director leading the development and global implementation of the gamified training platform requested our help to test the performance effects of the platform. Following our advice, the company implemented the platform in stages across twenty-four offices (randomly split between a treatment and a control group) in a country with a developed economy where it had yet to implement the platform. This country was chosen by PSC to participate in the experiment due to its relatively large number of offices, which allowed us to collect enough data to conduct analyses with sufficient power to draw meaningful conclusions. After implementation, the company shared de-identified personnel and office data with us so that we could examine the effects of the introduction of the platform as a “natural field experiment” (i.e., a field experiment where the subjects were not aware that an experiment was taking place, Floyd and List 2016).

⁸ As of our last interaction with the director leading this effort at the company, the gamified platform described here continued to be in use.

Figure 2 shows the timeline of the natural field experiment. In the pre-intervention period (before June 2016), the 24 offices participating in the study were randomly divided into a treatment group of 15 and a control group of 9. The company rolled out the gamified training platform to the treatment group in a staggered fashion from June 2016 through September 2016. Specifically, the company implemented the platform in 7 offices in June, 7 in July and 1 in September. For each office, the gamified training platform was made available to all staff at all levels. In December 2016, the company implemented the platform for the control group.

--- Insert Figure 2 here ---

In several ways, this research site provided us with an attractive setting in which to examine the performance consequences of a gamified training platform. First, the digital format of this training allowed us to directly measure how much effort employees put into the training. Specifically, we received data on the amount of time participants spent on the platform and how many questions they answered. Moreover, the data that PSC shared with us included broader measures of engagement, such as office-level and leader-level willingness to log onto the platform, affording a deeper understanding of engagement on the training platform.

Second, our research setting allowed us to study the effect of gamified training on outcomes that could be closely linked with the training content. In particular, the highly consultative selling process of a professional services firm relies on its associates' knowledge and skill to identify and seize client engagement opportunities.

Third, the highly-customized, client-centric nature of work in a professional services context is characterized by a high degree of employee discretion over how time is allocated, discretion that creates variation we exploit in our analysis. In retail or logistics, for example, where

some gamified training effects have also been tested, roles and daily responsibilities tend to be more standardized.

Fourth, prior studies on training or other personnel control systems may be subject to endogeneity problems. For instance, some studies (Birley and Westhead 1990; Deng, Menguc, and Benson 2003) find that training is negatively related to employee productivity, attributing the result to training ineffectiveness. However, this finding may be due to reverse causality in that organizations with employee performance problems are more inclined to provide more training in the hope of improving performance. The natural field experiment in our study is based on the random allocation of offices into a treatment group (where the gamified training platform was introduced first) and a control group (where the platform was introduced later), which enables us to more convincingly draw conclusions with respect to causality than would be the case in a cross-sectional regression study.

Finally, we were able to examine the gamified training platform effects in a realistic environment where none of the employees self-selected into the study and all of the employees experienced the introduction of the platform in their natural work environment (achieving a desirable “mixture of control and realism,” as described by Floyd and List 2016).

3.2. Variables of Interest

Our sample includes monthly office-level data from July 2015 through November 2017, resulting in 665 office-month observations. For each month in the sample period, PSC provided us with anonymized information on the personnel in each office, use of the gamified training platform, and new client engagements generated by each office. With these data, we can analyze the effect of the adoption of the gamified training platform on client engagements and their related revenue. We provide a detailed description of the variables below.

3.2.1. Dependent Variables

We are primarily interested in the effects of gamified training on firm performance, which we measure using five variables: $Sales_{i,t}$ is the natural log of one plus the fees collected by office i in month t , where fees are measured in local currency; $\# Clients_{i,t}$ is the natural log of one plus the number of clients served by office i in month t ; $\# Engagements_{i,t}$ is the natural log of one plus the number of client engagements generated by office i in month t , $\# Engagements from Old Clients_{i,t}$ is the natural log of one plus the number of engagements from old clients for office i in month t , and $\# Engagements from New Clients_{i,t}$ is the natural log of one plus the number of engagements from new clients for office i in month t . All five variables capture data on client engagements, which PSC uses to assess its performance. Table 1 provides descriptive statistics on the firm performance variables. Annually, an average office collected \$4 million in local currency⁹ in sales and generated 71 engagements from an average of 47 clients, of which 34% were new.

--- Insert Table 1 here ---

3.2.2. Measures of Usage of the Training Platform

To measure training more precisely, we use two proxies for employees' extent of use of the gamified training platform: $Time Spent on Training_i$, the average amount of active participation time on the platform per employee in office i (measured in minutes), and $\# Questions Answered_i$, the average number of questions answered per employee in office i . We validate these measures in Table 2. The correlation matrix shows that $Time Spent on Training_i$ is positively associated with $\# Questions Answered_i$ (0.9805, $p < 0.01$), suggesting that these measures move together – more time spent on the platform is consistent with more time engaged in the activity of answering questions.

⁹ The exchange rate between US dollars and the local currency is between 1 and 2 (i.e., 1 US dollar < 1 unit of local currency < 2 US dollars). We do not disclose the exact exchange rate for confidentiality purposes.

3.2.3. Measures of Office Engagement

We use two proxies to measure office engagement. Our first proxy for office engagement is *Willingness to Log On_i*, the percentage of employees who logged onto the training platform at least once in office *i*. We denote this as a measure of office engagement (rather than of usage of the training platform) since it captures evidence of the first instance of platform access before interaction with the platform itself has had a chance to influence employee behavior. As such, offices exhibiting a higher percentage of employees willing to log onto the gamified training platform offer evidence of a higher level of office engagement with firm initiatives. The median willingness to log on to the gamified training platform was 16.3%. We further note that there's considerable variability in this metric across offices, with a maximum rate of 55.8%, suggesting that logging on was discretionary, even in offices with the highest levels of adoption (Table 1). Our second proxy for office engagement is *Login Speed*, the inverse of one plus the average days between the implementation date of the gamified training platform in office *i* and the employee's first login date.¹⁰ Notably, the platform that is the focus of our study was designed and used not as a tool for onboarding new employees but to broaden the familiarity of the firm's highly-specialized associates with its diverse service offerings. The correlation matrix shown in Table 2 demonstrates that *Willingness to Log On* is positively associated with *Login Speed* (0.4671; $p < 0.01$), which aligns with our assertion that these two metrics are positively associated with office engagement.

--- Insert Table 2 here ---

3.2.4. Measures of Leader Engagement in the Gamified Training Platform

We use *Partner Percent_i*, the number of participants in office *i* who are partners divided by the number of participants in office *i*, to proxy for leader engagement since partner is the highest

¹⁰ This proxy is calculated only for employees that logged onto the gamified training platform.

job level in our sample (the other two are staff and manager). The median *Partner Percent* is 9.1%. We further note that *Partner Percent* has a maximum value of 20% and a minimum value of 0%.

3.3. Covariate Balance

Using data from a natural field experiment allows us to draw causal inferences about the effects of the introduction of gamified training (the treatment) on our dependent measures of performance since the treatment offices were selected randomly. To further investigate the robustness of the randomization, we conduct a covariate balance analysis to ensure that treatment and control offices are similar in the pre-intervention period. We compare the values of the primary focal variables across the treatment and control groups three months prior to the intervention, which we report in Table 3. There are no statistically significant differences in sales, number of existing clients, number of client engagements, number of engagements from old clients, number of engagements from new clients, or number of new employees. In general, the assumption that there is no failure in random assignment appears sufficiently satisfied.

--- Insert Table 3 here ---

IV. EMPIRICAL RESEARCH DESIGN AND RESULTS

4.1. The Effects of Gamified Training (H1)

4.1.1. Identification Strategy and Main Results

We use two identification strategies to test our first pair of hypotheses. The first focuses on the period *before* offices in the control group started to implement the gamified training platform (July 2015 through November 2016). We use a conventional difference-in-differences research design to investigate whether the introduction of the gamified training platform had an impact on

the performance of employees in the treatment group, relative to the performance of employees in the control group, who did not receive access to the platform. We estimate the following model:

$$\begin{aligned} Outcome_{i,t} = & \alpha + \beta_1 Post_t \times Treated_i + \beta_2 New\ Employees_{i,t} \\ & + Office\ Fixed\ Effects_i + Month\ Fixed\ Effects_t + \varepsilon_{i,t}, \end{aligned} \quad (1)$$

where $Outcome_{i,t}$ is measured using the five dependent variables described in Section 3.2.1. $Post_t$ is a dummy variable equal to 1 for all months after the month of implementation of the gamified training platform. $Treated_i$ is a dummy variable equal to 1 if the office is assigned to the treatment group. We control for demand for training by adding # $New\ Employees_{i,t}$ (the number of new employees in office i in month t). All estimations include month fixed effects and office fixed effects and standard errors are clustered at the office level. Month fixed effects allow us to control for the seasonality of the company's business operations and for relevant distinctions between pre and post periods; office fixed effects allow us to control for time-invariant office-level characteristics, such as the average ability or motivation of an office's employees. Since $Post$ and $Treated$ are subsumed by the inclusion of month and office fixed effects, we exclude them from the model. The interaction between $Post$ and $Treated$ is our variable of interest, which captures the average treatment effect of the gamified training platform on the outcome variables. We provide detailed variable definitions in the Appendix.

Our second identification strategy exploits the platform's staggered implementation, treating the launch of the gamified training platform as the treatment introduction for each office and using offices that remain in a pre-intervention state as our control group. The advantage of this strategy is that we can use the full sample of data, which allows us to observe the performance effect of the gamified training platform a full 12 months after implementation. We estimate the following model:

$$Outcome_{i,t} = \alpha + \beta_1 Post_t + \beta_2 New\ Employees_{i,t} + Office\ Fixed\ Effects + Month\ Fixed\ Effects + \varepsilon_{i,t}, \quad (2)$$

where $Outcome_{i,t}$ is measured using the five dependent variables described in Section 3.2.1 and $Post_t$ is a dummy variable equal to 1 for all months after the implementation. We control for demand for training by adding $\# New\ Employees_{i,t}$. All estimations include month and office fixed effects, and standard errors are clustered at the office level. Our main variable of interest is $Post_t$, which captures the average treatment effect of the gamified training platform on the outcome variables.¹¹

--- Insert Table 4 here ---

Table 4 provides the results of our tests for H1. The results are consistent with H1A: platform adoption had a significantly positive effect on performance. According to the first specification, the implementation of gamified training increased sales by 35.8% (calculated as $e^{0.306} - 1$), number of clients by 16.3% (calculated as $e^{0.151} - 1$), and number of engagements from new clients by 22.3% (calculated as $e^{0.201} - 1$). According to the second specification, the implementation of gamified training increased sales by 27.1% (calculated as $e^{0.240} - 1$). Since there is a significant increase in sales but not in the number of client engagements, it may suggest that the newly brought business opportunities generate greater revenue than before, when the employees had not been trained in the game. Also, the results suggest that gamified training makes employees more capable of developing new client relationships.

For all tests below, we use the second staggered adoption identification strategy. This helps us maintain a larger sample than the one used in the first identification strategy, thus preserving

¹¹ Baker, Larcker, and Wang (2022) point out the biases of staggered difference-in-difference estimates when treatment effects change over time. To address this concern, in untabulated tests, we re-estimate this equation using the method proposed by Sun and Abraham (2021). The results are consistent: the implementation of the gamified training system significantly increased sales, the number of clients, and the number of engagements from new clients.

more data and providing more comprehensive insights into the effect of the gamified training system.¹²

4.1.2. Post Trends of the Effects of Gamified Training

We next explore how the effect of gamified training on performance evolves over time, by estimating the following equations:

$$Outcome_{i,t} = \alpha + \sum_{k=1}^6 \delta_{k,t} Post_k_Quarter_t + \beta New_Employees_{i,t} + Office\ Fixed\ Effects + Month\ Fixed\ Effects + \varepsilon_{i,t}, \quad (3a)$$

$$Outcome_{i,t} = \alpha + \sum_{k=1}^3 \delta_{k,t} Post_k_halfyear_t + \beta New_Employees_{i,t} + Office\ Fixed\ Effects + Month\ Fixed\ Effects + \varepsilon_{i,t}, \quad (3b)$$

where $Outcome_{i,t}$ is measured using the five dependent variables described in Model (1); $Post_k_Quarter_t$ is a dummy variable equal to 1 for the k^{th} quarter after the implementation and 0 otherwise, and $Post_k_halfyear_t$ is a dummy variable equal to 1 for the k^{th} half-year after the implementation and 0 otherwise. As in previous specifications, we control for # $New_Employees_{i,t}$ and month and office fixed effects and cluster standard errors at the office level.

The estimation results of equations (3a) and (3b) are presented in Panel A and Panel B of Table 5, respectively. For most of the outcome variables, the effect of the gamified training platform on performance kicks in in the second or third quarter and then gradually increases over time, showing that it takes several months for the employees to apply what they learned from the gamified training. This lag may be due, in part, to the duration of the selling cycle in this experimental context. The results also show effects that last much longer than effects documented in prior literature. Specifically, the positive impact of a gamified training platform on truck drivers' driving efficiency documented by Ramirez (2017) lasted only 22 days. A similar effect reported

¹² In untabulated tests, the results remain largely consistent if we use the first identification strategy.

by Kelly, Valtchanov, and Webb (2021) lasted 4 months. However, we find the positive influence of the gamified training platform on performance persists in our data even after one and a half years.

4.1.3. The Effect of Usage of the Training Platform

We investigate whether the usage of the training platform positively moderates the performance effect to further validate that the gamified training platform caused the performance improvement observed. As described in Section 3.2, we use two measures to capture the usage of the training platform: average amount of active time per employee on the gamified training platform (*Time Spent on Training*) and average number of questions answered per employee (*# Questions Answered*). We normalize *Time Spent on Training* and *# Questions Answered* (by subtracting each variable by its mean and dividing the result by the variable's standard deviation) to provide more straightforward interpretations.

The results are reported in Table 6. Usage of the training platform is measured by *Time Spent on Training* in Panel A and by *# Questions Answered* in Panel B. The coefficients on *Post* \times *Time Spent on Training* and *Post* \times *# Questions Answered* are significantly positive for *Sales*, *# Client Engagements* and *# Engagements from Old Clients*, suggesting that usage of the training platform has a positive moderating effect on organizational performance. Specifically, if *Time Spent on Training* increases by one standard deviation (which is equivalent to 5.546 minutes per employee, for all engaged employees), the introduction of the gamified training platform will increase sales by 12.3% (calculated as $e^{0.116} - 1$), the number of client engagements generated by 7.4% (calculated as $e^{0.071} - 1$), and the number of engagements from old clients by 11.6% (calculated as $e^{0.110} - 1$). If *# Questions answered* increases by one standard deviation (which is equivalent to 31.586 minutes per employee, for all engaged employees), the introduction of the

gamified training platform will increase sales by 13.4% (calculated as $e^{0.126} - 1$), the number of client engagements generated by 7.7% (calculated as $e^{0.074} - 1$), and the number of engagements from old clients by 11.5% (calculated as $e^{0.109} - 1$).¹³

--- Insert Table 6 here ---

4.2. Moderators of the Effectiveness of Gamified Training (H2 and H3)

To test our second and third hypotheses, we extend Model (1) as follows:¹⁴

$$Outcome_{i,t} = \alpha + \beta_1 Post_t \times Condition_i + \beta_2 Post_t + \beta_3 New Employees_{i,t} + Office Fixed Effects + Month Fixed Effects + \varepsilon_{i,t}, \quad (4)$$

where $Outcome_{i,t}$ is measured using the five dependent variables described in Model (1), $Post_t$ is a dummy variable equal to 1 for all months after the month of implementation, and $Condition_i$ refers to measures of office engagement (*Willingness to Log On* and *Login Speed*) to test H2 and measures of leader engagement (*Partner Percent*) to test H3. As in previous specifications, we control for $\# New Employees_{i,t}$ and month and office fixed effects and cluster standard errors at the office level. The interaction between $Post$ and $Condition$ is our variable of interest. We normalize *Willingness to Log On*, *Login Speed*, and *Partner Percent* to provide more straightforward interpretations.

4.2.1. The Moderating Effect of Office Engagement (H2)

In this section, we test H2 by exploring the moderating effect of office engagement on the relationship between gamified training and performance. As described in Section 3.2, we use two

¹³ Our results suggest substantial effects from the usage of the platform. Our interpretation of these results is that even modest increases in training across all members of an office can meaningfully enhance a team's knowledge about the firm's offerings, yielding a meaningful increase in recommendations to clients, and in turn, in sales.

¹⁴ We use Model (2) rather than Model (1) in this section because our data on the gamified training platform (*Willingness to log On*, *Time Spent on Training*, and *# Questions Answered*) is a one-time cumulative set of data through November 2017. These are not accurate proxies for employees' input on the gamified training platform for the subsample period based on which we construct Model (1), which ends at the end of November 2016.

measures of office engagement: willingness to log onto the gamified training platform and employee's log-in speed.

Panel A of Table 7 reports results examining the moderating effect of our first office engagement proxy (willingness to log onto the gamified training platform) on the relationship between the gamified training and office-level performance. Consistent with H2, we find that the coefficients on $Post \times Willingness\ to\ Log\ on$ are significantly positive across most outcome variables. Specifically, if *Willingness to Log on* increases by one standard deviation, the introduction of the gamified training platform will increase sales by 15.7% (calculated as $e^{0.146} - 1$), the number of client engagements generated by 7.9% (calculated as $e^{0.076} - 1$), the number of engagements from old clients by 10% (calculated as $e^{0.095} - 1$), and the number of engagements from new clients by 6.8% (calculated as $e^{0.066} - 1$).

Panel B of Table 7 presents the moderating effects of our second office engagement proxy (*Login Speed*) on the performance effects of the gamified training platform. The coefficient on $Post \times Login\ Speed$ is positively associated with *Sales*. Specifically, if *Login Speed* increases by one standard deviation, the introduction of the gamified training platform will increase sales by 13.4% (calculated as $e^{0.126} - 1$).

Taken together, our findings support our second hypothesis, suggesting that office engagement is a performance enabler when introducing gamified training, suggesting increased awareness of the company's core services among an office team is likely to drive performance. Gamified training is most beneficial when the recipients are already engaged with the

organization.¹⁵ Our results further suggest that gamified training is not a panacea for disengaged workers.

--- Insert Table 7 here ---

4.2.2. The Moderating Effect of Leader Engagement (H3)

Finally, we investigate how leader engagement, proxied by the percentage of participants who are partners (*Partner Percent*), moderates the performance effect of gamified training. We report the results in Table 8. Consistent with H3, we find that partner engagement positively moderates the performance effect of the gamified training platform on sales and clients. Specifically, if *Partner Percent* increases by one standard deviation, the introduction of the gamified training platform will increase sales by 18.9% (calculated as $e^{0.173} - 1$) and the number of clients by 7.4% (calculated as $e^{0.071} - 1$).

--- Insert Table 8 here ---

As discussed in Section 2.2.2, the positive moderating effect of leader engagement may be generated through two channels: the effect of leaders' "leading by example" on employees, and leaders' direct impact on the company's external engagements with clients, such as cultivating new customers.

We perform two exploratory tests to shed more light on the two channels. First, we compare the moderating effect of leader engagement and office engagement by including both interactions in one equation and present the results in Table 9. We find that leader engagement contributes

¹⁵ Note that the positive effect of gamified training on performance could have been driven by an increase in employee engagement and/or by an increased awareness of the companies' core offerings. Our results do not seem to support the idea that improvements in performance were driven by improvements in engagement due to gamified training, as we find that offices with greater (rather than lower) initial engagement benefited more from the system. To further explore this, in untabulated analyses, we examined the effects of gamified training on employee turnover, a proxy capturing employee engagement or commitment. We find that the implementation of the gamified training platform has no significant impact on employee turnover, further confirming our intuition.

more to sales and clients, whereas office engagement contributes more to expanding the number of client engagements. This suggests that one driver of the moderating effect of the leaders' engagement on performance centers around their direct access to clients. Second, to explore whether the leaders indirectly affect performance by 'leading by example,' we examine whether employees sign onto the platform after their leaders. In Figure 3, we plot the cumulative sign-up rate of partners and employees on each day since the implementation of the gamified training platform. The graph shows that the patterns of employee sign-up rate and partner sign-up rate over time are similar, with employee sign-up rate slightly lagging behind partners. This is consistent with the idea that high leader engagement might additionally improve office engagement through role modeling (and potentially legitimizing) playing with the gamified training platform. Taken together, our results in Figure 3 and Table 9 lend some support for both channels.

--- Insert Figure 3 here ---

--- Insert Table 9 here ---

V. CONCLUSION

Gamified training has been widely used to engage and motivate employees to learn, but research examining its effectiveness in improving organizational performance is scant, largely because observational data are scarce.

Using data from a natural field experiment led by a large professional services firm that was adopting a gamified training platform, we examine the platform's impact on measures of monthly performance that are consequential to the organization: sales, clients served, client engagements surfaced, engagements from old clients retained and engagements from new clients cultivated. We find that, in general, the implementation of the gamified training platform increases

office performance, using both the traditional difference-in-differences specification and the staggered adoption specification. In the first specification, the implementation of the system increased sales by 35.8%, number of clients by 16.3%, and number of engagements from new clients by 22.3%. In the second specification, the implementation of the system increased sales by 27.1%. Moreover, the performance effect takes time to manifest. The finding that high usage of the training platform positively moderates the effect further validates our conclusion that the increase in office performance is caused by the implementation of the gamified training platform.

We next explore the heterogeneous treatment effect by examining two potential moderators of the effect of gamified training on performance: (a) *office engagement* (how engaged the office is, measured by the percentage of employees who logged onto the training platform at least once and the inverse of the average days between the implementation date of the system and employee's first login date) and (b) *leader engagement* (how engaged leaders are in the gamified training platform, measured by the number of participants who are partners divided by the number of all participants).

We find that both measures of office engagement positively moderate the impact of gamified training on performance. Controlling for other factors, a one standard deviation increase in *Willingness to Log on* (one measure of office engagement) will increase sales by 15.7%, the number of client engagements generated by 7.9%, the number of engagements from old clients by 10% and the number of engagements from new clients by 6.8%. Similarly, a one standard deviation increase in *Login Speed* (the other measure of office engagement) will increase sales by 13.4%.

We also find that leader engagement positively moderates the impact of gamified training on performance. Specifically, in our analysis, a one standard deviation increase in *Partner Percent*

(the measure of leader engagement) increased sales by 18.9% and the number of clients served by 7.4%.

Despite the advantages of using a natural field experiment to examine the performance consequences of adopting a gamified training platform, our findings are subject to some limitations. First, we examine the incremental effects of gamified self-study training above and beyond traditional in-person training. Because the company did not experiment with other modalities, we cannot fully disentangle the effects of gamified training relative to other types of training (e.g., gamified in-person training or virtual, non-gamified training). Follow-up studies could further explore and compare the effects of gamified virtual training with other modes of training. Our moderated analyses focus on conditions specifically relevant to the gamified training that we study, providing insights on when this form of training works better and when it does not work as well. Second, our analyses are based on data from a single company, which may hinder their generalizability to other settings. However, the professional service firm we analyze has much in common with a broad class of service organizations where employees are provided with information about the company's portfolio of offerings and are encouraged to consultatively sell services to existing and potential clients. Moreover, although we analyze a set of conditions that may moderate the relationships between gamified training and various measures of performance, this set is by no means exhaustive and we encourage future researchers to study other possible moderators, such as corporate culture.

Our results contribute to a deeper understanding of how and when gamified training can help performance. In particular, they suggest that gamified training can motivate employees in highly engaged offices to train harder to boost their performance and that gamification will be more helpful if the leaders participate more.

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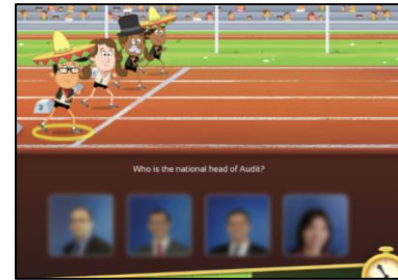
Appendix

Definitions of Variables

Variable	Description
$Sales_{i,t}$	Natural log of one plus the fees (measured in local currency) in office i in month t
$\# Clients_{i,t}$	Natural log of one plus the number of clients in office i in month t
$\# Client Engagements_{i,t}$	Natural log of one plus the number of client engagements with fees in office i in month t
$\# Engagements from Old Clients_{i,t}$	Natural log of one plus the number of engagements from old clients in office i in month t
$\# Engagements from New Clients_{i,t}$	Natural log of one plus the number of engagements from new clients in office i in month t
$\# New Employees_{i,t}$	Number of new employees in office i in month t
$Time Spent on Training_i$	Average amount of active time in training per employee in office i as of June 2018 (in minutes)
$\# Questions Answered_i$	Average number of questions answered per employee in office i as of November 2017
$Willingness to Log On_i$	Percentage of employees who logged onto the training platform at least once in office i through November 2017
$Login Speed$	The inverse of one plus the average days between the implementation date of gamified training platform in office i and the employee's first login date (calculated only for employees that logged onto the platform)
$Partner Percent$	The number of participants in office i who are partners divided by the number of all participants in office i

Figure 1: Screenshots of Gamified Training Platform

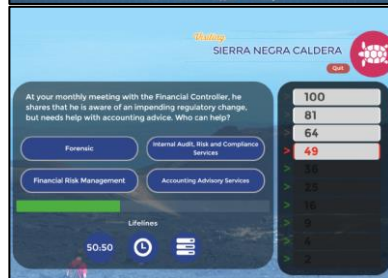
A. Employees design their characters and compete by quickly answering questions about the firm and its offerings.



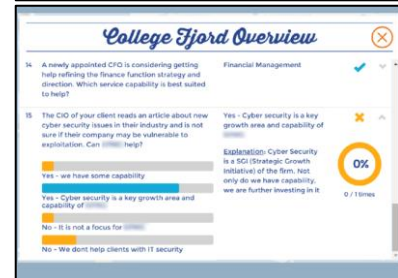
B. Employees unlock locations with new challenges as they progress through the experience.



C. The platform uses five quiz modes to engage users throughout the experience.



D. Along the way, employees can review the correct answers to questions they missed and see how others responded to those questions.



E. A scoring system and leaderboard allow employees to track their progress and compare their performance to that of others.



Figure 2: Timeline of Field Experiment

Figure 2 illustrates the schedule of the field experiment testing the effects of a gamified training platform.

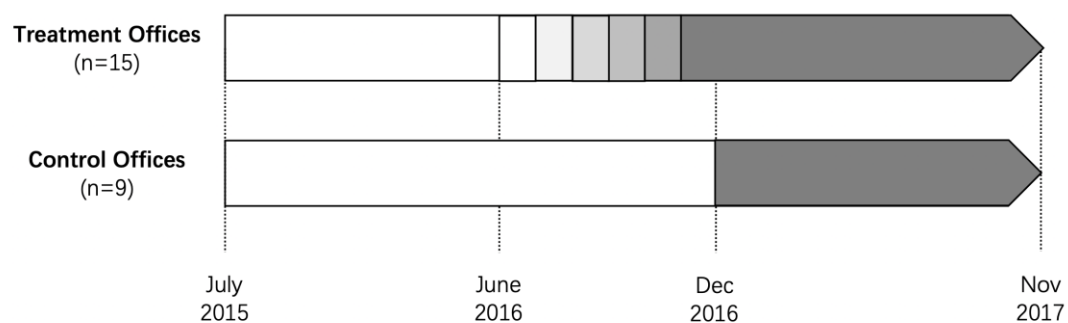


Figure 3: Moderating Effect of Leader Engagement

Figure 3 plots the cumulative sign-up rate of partners (blue line) and employees (orange line) each day after the implementation of the gamified training platform. The x-axis is the number of days since the implementation. The y-axis is the cumulative sign-up rate. The x-axis ends at 450 days since treatment because nobody signs up after that.

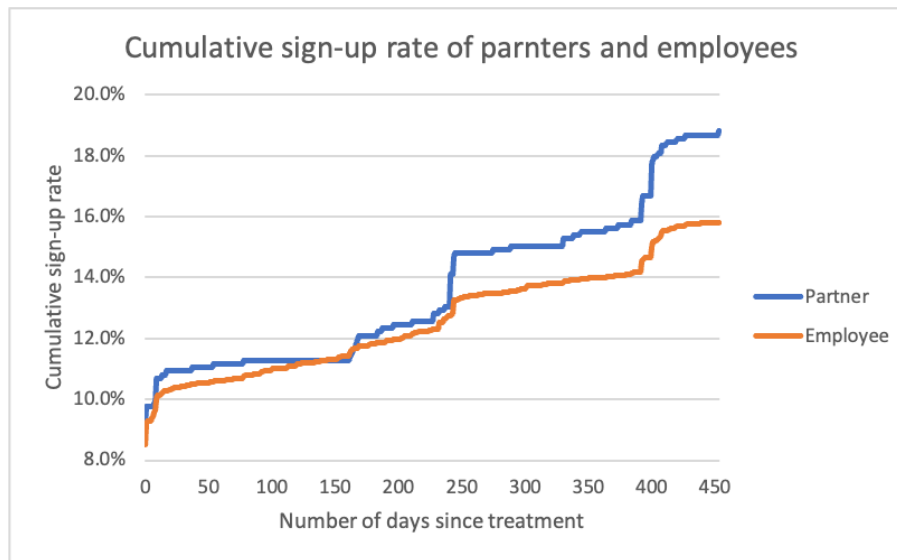


Table 1: Descriptive Statistics

Table 1 summarizes the characteristics of the sample of offices at the office-year level. All variables are defined in the Appendix.

	count	mean	p50	sd	min	p25	p75	max
Sales	665	12.727	12.297	2.399	0.000	11.302	14.128	18.372
# Clients	665	3.123	2.996	1.168	0.693	2.398	3.714	6.131
# Client Engagements	665	3.450	3.332	1.276	0.000	2.639	4.190	6.469
# Engagements from Old Clients	665	3.278	3.135	1.315	0.000	2.485	3.989	6.455
# Engagements from New Clients	665	2.471	2.485	1.322	0.000	1.792	3.367	5.602
# New Employees	665	4.862	1.000	18.310	0.000	0.000	3.000	208.000
Time Spent on Training	665	4.174	1.763	5.546	0.147	0.916	5.468	23.958
# Questions Answered	665	25.015	13.212	31.586	1.117	5.066	26.739	129.181
Willingness to Log on	665	0.216	0.163	0.150	0.029	0.111	0.238	0.558
Login Speed	665	0.115	0.016	0.248	0.003	0.006	0.054	1.000
Partner Percent	665	0.088	0.091	0.056	0.000	0.067	0.133	0.200

Table 2: Correlation Matrix

Table 2 reports the correlation matrix for the variables defined in the Appendix. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

No.		1	2	3	4	5	6
1	Sales	1					
2	# Clients	0.8366***	1				
3	# Client Engagements	0.8462***	0.9721***	1			
4	# Engagements from Old Clients	0.8438***	0.9046***	0.9242***	1		
5	# Engagements from New Clients	0.5682***	0.7507***	0.7232***	0.5872***	1	
6	# New Employees	-0.2164***	-0.2320***	-0.2443***	-0.2812***	-0.1618***	1
7	Time Spent on Training	0.0934**	0.2066***	0.1611***	0.1277***	0.1632***	-0.0980**
8	# Questions Answered	0.1435***	0.2500***	0.1998***	0.1677***	0.1862***	-0.1040***
9	Willingness to Log on	0.2361***	0.3285***	0.2752***	0.2491***	0.2367***	-0.0927**
10	Login Speed	0.1846***	0.1495***	0.1365***	0.1313***	0.0544	-0.0829**
11	Partner Percent	0.0797**	0.0213	0.0065	0.0709*	-0.0295	0.1309***
No.		7	8	9	10	11	
7	Time Spent on Training	1					
8	# Questions Answered	0.9805***	1				
9	Willingness to Log on	0.7752***	0.8594***	1			
10	Login Speed	0.2332***	0.3268***	0.4671***	1		
11	Partner Percent	0.0943**	0.1541***	0.2500***	0.0738*	1	

Table 3: Covariate Balance

Table 3 reports covariate balance between Treated and Control offices for all main variables three months before the launch of gamified training. Treated refers to offices that implemented gamified training before December 2016. Control refers to offices that did so in December 2016. All other variables are defined in the Appendix. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Control Offices	Treated Offices	Difference	T-stat
Sales	12.810	12.409	0.401	0.573
# Clients	3.322	3.270	0.052	0.166
# Client Engagements	3.692	3.613	0.078	0.241
# Engagements from Old Clients	3.336	3.253	0.083	0.248
# Engagements from New Clients	3.024	2.953	0.071	0.234
# New Employees	1.037	4.857	-3.820	-1.327

Table 4: Effect of Gamified Training Platform on Performance (Test of H1)

This table reports results from tests examining the effect of gamified training on offices' subsequent performance. Panel A reports the estimations based on the sample period before offices in the control group started to implement gamified training. Panel B reports the estimations based on the full sample period. *Post* is a dummy variable equal to 1 for all months after the month of implementation of gamified training. *Treated* is a dummy variable equal to 1 if the office implemented gamified training before December 2016. All variables are defined in the Appendix. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A: Difference-in-differences (sample period <i>before</i> the launch of the platform in the control offices)					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post × Treated	0.306* (2.02)	0.151* (1.76)	0.042 (0.44)	0.062 (0.64)	0.201* (1.76)
# New Employees	-0.011*** (-4.05)	-0.004*** (-4.93)	-0.006*** (-5.29)	-0.003** (-2.58)	-0.010*** (-10.47)
Constant	15.484*** (71.58)	4.820*** (64.69)	5.375*** (55.82)	5.541*** (40.89)	1.507*** (8.09)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	391	391	391	391	391
Adj. R-sq	0.839	0.918	0.900	0.863	0.871

Panel B: Staggered treatment (full sample period)					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post	0.240*	0.029	-0.047	-0.009	0.058
	(1.95)	(0.48)	(-0.54)	(-0.09)	(0.74)
# New Employees	-0.004**	-0.001**	-0.002**	-0.000	-0.004***
	(-2.29)	(-2.16)	(-2.17)	(-0.07)	(-8.34)
Constant	15.580***	4.782***	5.362***	5.508***	1.597***
	(76.90)	(58.67)	(57.52)	(41.56)	(8.16)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.843	0.914	0.897	0.860	0.870

Table 5: Post Trends of the Performance Effects of Gamified Training (Test of H1)

This table reports the estimation results of how the effect of gamified training on offices' subsequent performance evolves overtime. *post1quarter* is a dummy variable equal to one for the first three months after the office implements gamified training. *post1half* is a dummy variable equal to one for the first six months after the office implements gamified training. All other variables are defined in the Appendix. All estimations include office and month fixed effects. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A: post quarters					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post1quarter	0.224 (1.59)	0.087 (1.20)	-0.027 (-0.30)	0.037 (0.36)	0.114 (1.23)
Post2quarter	0.381** (2.10)	0.155* (1.78)	0.026 (0.23)	0.140 (1.05)	0.115 (1.00)
Post3quarter	0.365 (1.56)	0.264** (2.26)	0.134 (0.99)	0.304* (2.00)	0.212 (1.25)
Post4quarter	0.461 (1.32)	0.381** (2.29)	0.085 (0.47)	0.321 (1.65)	0.327 (1.51)
Post5quarter	0.526 (1.18)	0.560** (2.40)	0.269 (1.16)	0.537* (1.81)	0.445 (1.61)
Post6quarter	0.472 (0.73)	0.508** (2.36)	0.094 (0.38)	0.480 (1.58)	0.303 (1.02)
# New Employees	-0.004** (-2.40)	-0.001** (-2.67)	-0.002** (-2.64)	-0.000 (-0.15)	-0.005*** (-9.55)

Constant	15.609*** (69.51)	4.835*** (54.69)	5.388*** (50.69)	5.563*** (37.82)	1.632*** (8.33)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.842	0.915	0.897	0.861	0.870
Panel B: post half-years					
	(1) Sales	(2) # Clients	(3) # Client Engagements	(4) # Engagements from Old Clients	(5) # Engagements from New Clients
Post1half	0.267** (2.09)	0.100 (1.44)	-0.004 (-0.04)	0.069 (0.69)	0.108 (1.19)
Post2half	0.332 (1.41)	0.269** (2.24)	0.109 (0.83)	0.272* (1.78)	0.245 (1.47)
Post3half	0.410 (0.98)	0.476** (2.38)	0.225 (1.12)	0.473 (1.68)	0.371 (1.52)
# New Employees	-0.004** (-2.36)	-0.001** (-2.57)	-0.002** (-2.32)	-0.000 (-0.16)	-0.004*** (-8.84)
Constant	15.597*** (73.06)	4.827*** (55.46)	5.389*** (52.36)	5.558*** (38.49)	1.628*** (8.29)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.843	0.915	0.897	0.861	0.870

Table 6: Effects of Usage of the Training Platform on the Performance Effects of Gamified Training (Test of H1)

This table reports the results from the cross-sectional tests on usage of the training platform, which is proxied by employees' average active time and the number of questions they answered. *post* is a dummy variable equal to 1 for all months after the month of implementation of gamified training. All other variables are defined in the Appendix. *Time Spent on Training* and *# Questions Answered* are normalized to have a mean of 0 and a standard deviation of 1. All estimations include office and month fixed effects. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A: Time Spent on Training					
	(1) Sales	(2) # Clients	(3) # Client Engagements	(4) # Engagements from Old Clients	(5) # Engagements from New Clients
Post × Time Spent on Training	0.116* (1.80)	0.004 (0.16)	0.071** (2.30)	0.110*** (4.60)	0.011 (0.32)
Post	0.241* (2.06)	0.029 (0.48)	-0.047 (-0.54)	-0.008 (-0.08)	0.057 (0.72)
# New Employees	-0.004** (-2.20)	-0.001** (-2.17)	-0.002* (-2.06)	0.000 (0.07)	-0.004*** (-8.22)
Constant	15.611*** (76.07)	4.783*** (56.26)	5.380*** (56.30)	5.538*** (39.75)	1.599*** (8.08)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.843	0.914	0.898	0.862	0.870

Panel B: # Questions Answered					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post × # Questions Answered	0.126* (1.93)	0.005 (0.18)	0.074** (2.49)	0.109*** (3.95)	0.018 (0.53)
Post	0.241** (2.09)	0.029 (0.48)	-0.047 (-0.54)	-0.008 (-0.09)	0.057 (0.72)
# New Employees	-0.004** (-2.19)	-0.001** (-2.17)	-0.002* (-2.05)	0.000 (0.08)	-0.004*** (-8.19)
Constant	15.614*** (75.91)	4.783*** (56.31)	5.381*** (56.20)	5.538*** (39.73)	1.601*** (8.10)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.844	0.914	0.898	0.862	0.870

Table 7: Moderating Effects of Office Engagement on the Performance Effects of Gamified Training (Test of H2)

This table reports the results from the cross-sectional tests on office engagement, which is proxied by the percentage of employees who participate in the game and employees' login speed. *post* is a dummy variable equal to 1 for all months after the month of implementation of gamified training. All other variables are defined in the Appendix. *Willingness to Log on* and *Login Speed* are normalized to have a mean of 0 and a standard deviation of 1. All estimations include office and month fixed effects. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A: Willingness to Log on					
	(1) Sales	(2) # Clients	(3) # Client Engagements	(4) # Engagements from Old Clients	(5) # Engagements from New Clients
Post × Willingness to Log on	0.146* (2.04)	0.023 (0.88)	0.076*** (3.11)	0.095** (2.44)	0.066** (2.26)
Post	0.241** (2.10)	0.029 (0.48)	-0.047 (-0.54)	-0.008 (-0.09)	0.058 (0.72)
# New Employees	-0.004** (-2.19)	-0.001** (-2.11)	-0.002* (-2.06)	0.000 (0.01)	-0.004*** (-8.13)
Constant	15.579*** (77.83)	4.782*** (58.22)	5.361*** (56.40)	5.508*** (40.77)	1.595*** (8.23)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.844	0.914	0.898	0.861	0.871

Panel B: Employees' login speed					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post × Login Speed	0.126*** (2.90)	0.014 (0.55)	0.028 (0.84)	0.024 (0.77)	-0.015 (-0.37)
Post	0.241* (2.02)	0.029 (0.48)	-0.047 (-0.54)	-0.008 (-0.08)	0.057 (0.72)
# New Employees	-0.004** (-2.22)	-0.001** (-2.13)	-0.002** (-2.15)	-0.000 (-0.03)	-0.004*** (-8.14)
Constant	15.606*** (76.56)	4.785*** (57.40)	5.367*** (57.26)	5.514*** (41.23)	1.593*** (8.13)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.844	0.914	0.897	0.860	0.870

Table 8: Moderating Effects of Leader Engagement on the Performance Effects of Gamified Training (Test of H3)

This table reports the results from the cross-sectional tests on the percent of partners in participants. *post* is a dummy variable equal to 1 for all months after the month of implementation of gamified training. All other variables are defined in the Appendix. *Partner Percent* is normalized to have a mean of 0 and a standard deviation of 1. All estimations include office and month fixed effects. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post × Partner Percent	0.173*** (3.09)	0.071** (2.21)	0.048 (1.39)	0.059 (1.32)	0.042 (0.85)
Post	0.241* (1.92)	0.029 (0.44)	-0.047 (-0.51)	-0.008 (-0.08)	0.058 (0.70)
# New Employees	-0.004** (-2.59)	-0.002** (-2.43)	-0.002** (-2.29)	-0.000 (-0.22)	-0.004*** (-8.33)
Constant	15.566*** (77.40)	4.776*** (59.45)	5.358*** (57.97)	5.504*** (41.76)	1.592*** (8.13)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.844	0.915	0.897	0.861	0.870

Table 9: Moderating Effects of Leader Engagement and Office Engagement on the Performance Effects of Gamified Training

This table reports the results from the cross-sectional tests on the percent of partners in participants and office engagement, which is proxied by the percentage of employees who participate in the game in Panel A and employees' login speed in Panel B. *post* is a dummy variable equal to 1 for all months after the month of implementation of gamified training. All other variables are defined in the Appendix. *Time Spent on Training*, *# Questions Answered* and *Partner Percent* are normalized to have a mean of 0 and a standard deviation of 1. All estimations include office and month fixed effects. T-statistics, reported in parentheses, are based on standard errors clustered at the office level. *, **, and *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A: Willingness to Log on					
	(1) Sales	(2) # Clients	(3) # Client Engagements	(4) # Engagements from Old Clients	(5) # Engagements from New Clients
Post × Willingness to Log on	0.109 (1.61)	0.005 (0.22)	0.068** (2.77)	0.085* (2.01)	0.059* (1.85)
Post × Partner Percent	0.146** (2.22)	0.070** (2.08)	0.031 (0.95)	0.038 (0.78)	0.027 (0.57)
Post	0.241* (2.03)	0.029 (0.44)	-0.047 (-0.52)	-0.008 (-0.08)	0.058 (0.70)
# New Employees	-0.004** (-2.46)	-0.002** (-2.45)	-0.002** (-2.18)	-0.000 (-0.09)	-0.004*** (-8.21)
Constant	15.567*** (77.64)	4.776*** (59.19)	5.358*** (56.56)	5.505*** (40.68)	1.593*** (8.21)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.844	0.915	0.898	0.861	0.871

Panel B: Employees' login speed					
	(1)	(2)	(3)	(4)	(5)
	Sales	# Clients	# Client Engagements	# Engagements from Old Clients	# Engagements from New Clients
Post × Login Speed	0.114** (2.73)	0.009 (0.37)	0.025 (0.85)	0.020 (0.83)	-0.018 (-0.52)
Post × Partner Percent	0.165*** (3.24)	0.070** (2.19)	0.046 (1.33)	0.058 (1.30)	0.043 (0.88)
Post	0.242* (1.99)	0.029 (0.44)	-0.047 (-0.51)	-0.008 (-0.08)	0.057 (0.69)
# New Employees	-0.004** (-2.53)	-0.002** (-2.44)	-0.002** (-2.27)	-0.000 (-0.18)	-0.004*** (-8.09)
Constant	15.590*** (76.87)	4.778*** (58.48)	5.363*** (57.72)	5.508*** (41.48)	1.589*** (8.07)
Office FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
N	665	665	665	665	665
Adj. R-sq	0.845	0.915	0.897	0.860	0.870