นิพนธ์ต้นฉบับ

(Original article)

The study of personal OKRs on goal setting with voice user interface

การศึกษาการตั้งเป้าหมายส่วนบุคคลด้วยส่วนประสานต่อกับผู้ใช้งานด้วยเสียง

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Received: January 29, 2024/ Revised: May 27, 2024/ Accepted: June 17, 2024

ABSTRACT: Navigating the landscape of self-directed learning proves to be a formidable challenge for millennials, especially when the need arises for upskilling and reskilling in their professional journeys. Despite the recognized importance of Objectives and Key Results (OKRs), the current setup remains a complex task. To address this issue directly, our study explores the design of a Voice User Interface (VUI) aimed at assisting individuals not only in setting but also in tracking and measuring their goals, incorporating a strategic approach to habit formation. This study employs a mixed-methods approach. Engaging 24 participants, this research investigates the implementation of Personal OKRs through VUI, revealing insights gathered over a dedicated one month learning period. Results showcased a noteworthy achievement, with over half successfully surpassing the commit level (0.3) and one-third reaching the stretch level (0.7). Upskill group exhibited higher grit scores and more frequent logins than the Reskill group. Emphatically, participants acknowledged the seamless integration of SMART goals, habit strategies, and scores into the fabric of Personal OKRs.

Keywords: OKRs system; Voice User Interface; Habit forming; SMART goals; Self-Directed Learning

บทคัดย่อ: การเรียนรู้ด้วยตนเองเป็นสิ่งที่ท้าทายกับคนรุ่นมิลเลนเนียล (Gen Y)โดยเฉพาะความต้องการที่จะเพิ่มทักษะหรือเรียนรู้ทักษะใหม่เพื่อจะได้ทำงานอย่างมืออาชีพ เครื่องมือการตั้งเป้าหมายและผลลัพธ์ (Objectives and Key Results) ที่ใช้กันแพร่หลายค่อนข้างที่จะซับซ้อน ดังนั้นการศึกษาครั้งนี้เป็นการออกแบบส่วนต่อประสานกับผู้ใช้ด้วยเสียง (Voice User Interface) เพื่อช่วยให้ผู้ใช้ในเรื่องการตั้งค่า รวมถึงการติดตามและวัดผลของเป้าหมายโดยผสมผสานแนวทางเชิงกลยุทธ์ในการสร้างนิสัยทางพฤติกรรม การศึกษานี้ใช้วิธีวิทยาแบบผสมที่มีผู้เข้าร่วม 24 คนเข้ามาทำการทดลองในช่วงระยะเวลา 1 เดือน ผลลัพธ์แสดงให้เห็นว่า มากกว่าครึ่งหนึ่งประสบความสำเร็จในระดับที่ 0.3 จำนวนหนึ่งในสามบรรลุผลถึงระดับ 0.7 กลุ่มที่ต้องการเพิ่มทักษะมีคะแนน Grit สูงกว่ากลุ่มเรียนรู้ทักษะใหม่และเข้าไปในระบบมากกว่า ผู้ทดสอบรายงานว่า การบูรณาการเป้าหมายด้วย SMART กลยุทธ์การสร้างนิสัย และมาตรวัดผลลัพธ์มีการเข้ากันอย่างดี

คำสำคัญ: ระบบตั้งเป้าหมาย; ส่วนต่อประสานกับผู้ใช้ด้วยเสียง; การสร้างนิสัย; เป้าหมายแบบ SMART; การเรียนรู้ด้วยตนเอง

1. INTRODUCTION

According to the Office of the National Economic and Social Development Council (NESDC, 2021) in Thailand, the 8.7 million employees is at risk of unemployment, which represents a 2.25

percent. Among the unemployed, those with higher education experienced the highest unemployment rate at 3.63 percent, followed by vocational degree holders at 3.16 percent[1]. Notably, Millennials (individuals aged 23-38) constitute approximately one-third of the global workforce, with this demographic projected to comprise the predominant segment of the labor market[2]. The COVID-19 pandemic has accelerated the need to transition into the digital era, with 40% of within workers requiring reskilling of six months or less. A sharp rise has been observed in the number of CEOs who expect their workers to acquire new skills on the job, from 65% in 2018 to 94% currently[3]. Reskilling goal is to develop new careers and competencies. Upskilling, on the other hand, the goal is to improve one's current position, allowing employees to enhance their existing skill set and stay relevant in their career. The advent of digital transformation has led to the creation of new jobs related to digital technology while rendering other jobs obsolete, where automation and artificial intelligence can effectively replace human labour. The education system must be retooled to optimize the acquisition of new skills such as strong fundamentals in writing, reading, coding and math, creativity, critical thinking, communication, collaboration, grit, self-motivation, lifelong learning habits, entrepreneurship, and improvisation at every level[4]. In addition to traditional educational systems, self-directed learning can prove to be a beneficial tool for employees who have time constraints and may not be able to participate in formal training programs, thereby reducing the cost of training. Self-directed learning offers the advantage of enabling individuals to access learning materials and information at their own pace and convenience. To facilitate self-directed learning, both motivation and the cultivation of habit are imperative. The former serves to drive engagement and effort, increasing the likelihood of individuals in seeking out resources, establishing goals, and persevering in the face of challenges. The latter provides a structure and consistency to the learning process. By allotting regular and dedicated time and resources to self-directed learning, individuals are better equipped to manage their learning goals in the long term.

The present study centres on personal goal setting and motivation. The novel approach to goal setting proposed by Intel's CEO, Andy Grove, involves a straightforward system that comprises solely of an objective and its corresponding key results[5]. However, careful consideration must be given to the formulation of OKRs to ensure their efficacy, as it is impracticable for learners to attain their goals in the absence of clear objectives and key results. The concept of Personal OKRs, introduced by Rompo[6], has gained practical use. However, it lacks extensive examination, particularly in applying the traditional OKRs setting to life goals. While many companies employ individual OKRs for aligning tasks with organizational objectives, Personal OKRs focus on achieving life goals. In contrast to corporate OKRs, the approach for Personal OKRs is driven by instinctive

motivation rather than extrinsic motivation, such as on satisfaction and enjoyment. One key strategy involves habit formation, with Rompo[6] recommending the use of a calendar checklist to establish a daily routine. Expanding on this concept, habits play a crucial role as a mechanism driving the success of key results. Habits typically evolve through a loop of cue, routine, and reward, thereby enhancing automaticity. Recognizing the achievements in OKRs involves more than a numerical assessment; it extends to the psychological realm. Positive affirmations, linked to result scores as rewards, create a reinforcement loop that contributes to habit formation. Niven & Lamorte[7] further categorize scores into three levels—0.3, 0.7, and 1.0—representing achievable, challenging, and extremely ambitious outcomes. However, the applicability of this framework to Personal OKRs remains to be established. The primary challenge in OKRs lies in aligning key results precisely with defined objectives and determining appropriate target levels for scoring.

1.1 Conceptual Framework

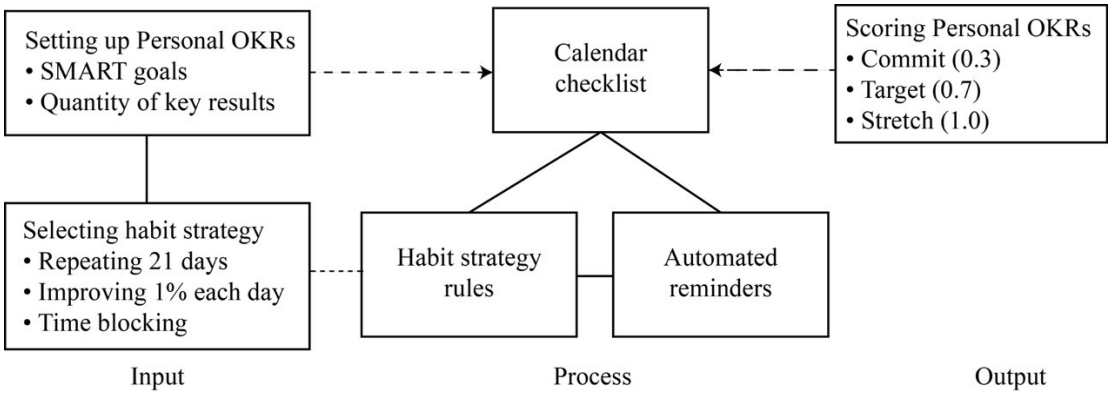

Fig 1. Conceptual Framework of Personal OKRs with VUI

In this investigation, the conceptual framework is a synthesis of various components categorized into three parts: input, process, and output (Fig 1). The input involves users setting up Personal OKRs and selecting habit strategy. The process phase details how the system facilitates habit formation through the utilization of the calendar checklist, habit strategy rules, and automated reminders. The output entails a comparison between the anticipated key results and the actual outcomes, benchmarked against metrics. The combination of habit strategy rule, calendar checklist, and automated reminder covers essential aspects of goal setting and achievement:

- Behavioural reinforcement (habit strategy) ensures users develop sustainable habits.
- Organizational structure (calendar checklist) provides a clear plan and visual progress tracking.
- Action prompts (automated reminder) ensure consistent engagement and accountability.

Together, these processes create a comprehensive support system that enhances the effectiveness of the application in helping users achieve their personal goals using a VUI system.

1.1.1 Input

The OKRs system incorporates SMART goals as a foundational framework, particularly in the establishment of key results. One significant challenge lies in determining the quantification of key results, a task often requiring prior experience. Subsequently, individuals are advised to choose a habit strategy that aligns with their personal characteristics, encompassing factors like lifestyle and preferences.

1.1.2 SMART goals

The OKRs framework outperforms the SMART (specific, measurable, achievable, relevant, and time-bound) goals approach, particularly in terms of performance tracking[8]. Specifically, a goal should be clear and specific, have criteria for measuring progress and accomplishment, be achievable, be relevant and aligned with other goals, and have a deadline or time frame.

Educators encounter difficulties in formulating effective goals that meet the SMART criteria and facilitate progress. Crafting SMART goals can be a complex problem-solving endeavour for many teachers[9]. Additionally, SMART goals provide a framework for setting objectives but may lack practicality and detailed guidance for their attainment, introducing a potential risk of negative consequences[10]. These repercussions include stress, anxiety, pressure, threat appraisals, hindrance to learning, unethical conduct, and reduced intrinsic motivation[11]. Conversely, OKRs serve as a goal-setting framework that incorporates a measurable and results-oriented approach. Although SMART goals provide a model for goal setting, it can be used in conjunction with OKRs to enhance the efficacy of the traditional goal-setting process. By applying a variation of SMART criteria to OKRs, the process of setting objectives and key results can be strengthened. For example, using SMART goals as key results can lead to more precise monitoring of progress. In this study, participants are required to outline both five- and three-year goals, specifying the key results necessary for goal achievement.

1.1.3 Quantity of key results

The system aggregates the number of key results to provide users with a clear understanding of the required achievements for the commit, target, and stretch levels. This summation process is automated for user convenience.

1.1.4 Selecting habit strategy

Due to their work conditions, millennials are often required to allocate time outside of work hours for learning, as they are unable to follow traditional school schedules. Self-directed learning has been identified as a preferred approach for upskilling or reskilling employees. Various apps are

available to assist individuals in developing a regular learning routine; however, research has indicated that while 115 habit formation apps may support repetition, they may not facilitate habit development[12]. These apps should integrate habit strategies to enhance their effectiveness. To achieve higher automaticity, positive reinforcement is recommended. The OKRs framework is an effective example of positive reinforcement, providing valuable feedback to learners. However, while business OKRs may have their own strategies, personal OKRs require the use of habit strategies to achieve desired outcomes. Many practitioners suggest habit strategies such as "improving 1% each day"[13], time blocking[14], and 21-days repetition[15].

1.1.5 Process

Numerous applications cater to habit formation and OKRs, but these software solutions often lack integration with input methods like the Voice User Interface (VUI). The VUI offers advantages in terms of natural language and streamlines the goal-setting process. Previous research demonstrated that using voice commands resulted in an average execution time improvement of 33.8% compared to touch screen commands, according to the KLM-GOMS model[16]. Furthermore, Voice User Interfaces (VUIs) can be enhanced through the integration of Natural Language Processing (NLP). For example, research on VUIs in clinical settings has shown that NLP significantly improves the accuracy of transcribing and comprehending medical terminology. This leads to increased efficiency and a reduction in the cognitive load on healthcare providers. Such context-aware interactions are essential for delivering relevant responses tailored to the user's current tasks and historical data[17].

The SMART goals checklist was utilized by users to validate whether their key results align with the established framework. The calendar checklist supports the establishment of learning routines to foster habit formation. Additionally, automated reminders ensure that users do not forget to log in to the system.

1.1.6 Output

In the context of the output generated by the OKRs system, the calculation of key results, including quantities, is performed by the computer. This information operates as a feedback loop, offering insights into the progress made. For instance, the number of achieved targets can indicate how far users are from their set targets.

1.1.7 Scoring OKRs

OKRs can be evaluated across three levels: commit, target, and stretch[18]. The commit level requires less effort, with a 90% chance of success or a score of 0.3. The target level is set at a higher difficulty, but still realistically achievable with a 50% chance of success or a score of 0.7. The stretch level is considered the most ambitious outcome, yet still attainable with a 10% chance of success, equivalent to a score of 1.0. The appropriateness of each score level is based

on the ability of the subject, where a score of 0.3 should not be too difficult, while 0.7 should provide an appropriate challenge. A score of 1.0 denotes outstanding progress. The challenge in estimating the number of key results arises from the potential for participants to either overestimate or underestimate the desired target level. This necessitates a calculation based on the task in the calendar, accounting for both weekdays and weekends. The results of each calendar checklist can be presented in the form of a dashboard. This visualization of the learning process aids learners in monitoring their progress and estimating the time required to complete tasks. A simplified summary in the form of a gauge serves as an indicator, highlighting the level of achievement.

1.2 Research Objectives

This study aims to explore the effectiveness of the Personal OKRs system on individuals' goal setting with a Voice User Interface system (VUI). The research questions are as follows:

1. How does the implementation of the Personal OKRs system affect individuals in terms of goal setting, performance, and overall achievement?
2. How do habit strategies contribute to subjects' goal achievement, and which specific strategy proves to be most effective?
3. To what extent is the adoption of Personal OKRs at the metric levels a valuable framework for subjects, serving as a meaningful benchmark for their progress and goals?
4. How does the frequency of VUI system logins influence the likelihood of achieving or failing to meet objectives?
5. To what extent do system reminders contribute to goal achievement or the development of habits?"

2. METHOD

This study employs a mixed-methods approach. The quantitative component involves a one-sample t-test on the OKRs scores and the Kruskal-Wallis H test comparing OKRs and Grit scores within the Upskill and Reskill groups. The qualitative approach is essential for comprehending the rationale behind participants' behaviour.

2.1 Participants

The study recruited a total of 24 Millennial subjects between the ages of 21 and 37 through social media. Participants included individuals employed in both full-time jobs and freelance positions. The selection criteria excluded university students, as their needs and context may differ from those in the reskill and upskill workforce. The participants were employed in various fields,

including UX/UI design (23%), digital marketing (14%), merchant (9%), architect (9%), designer (9%), and other fields (27%), and included an equal number of upskill and reskill subjects. The Reskill group comprised individuals seeking to transition to a new career. For example, a clinical psychologist aspiring to become a programmer. In contrast, the Upskill group consisted of individuals aiming to enhance their current career. For instance, a UX writer aspiring to advance to the role of a UX researcher. The cohort consisted of 19 female and 6 male participants, with one subject dropping out of the study. The upskill subjects had a professional background and were advancing toward senior and management positions. To encourage engagement, each participant was remunerated with $94. The research received approval from the Ethics Committee (KMUTT-IRB-2022/07011/219). Participants were obligated to provide informed consent before participating in this experiment

2.2 Instruments and Data Collection Techniques

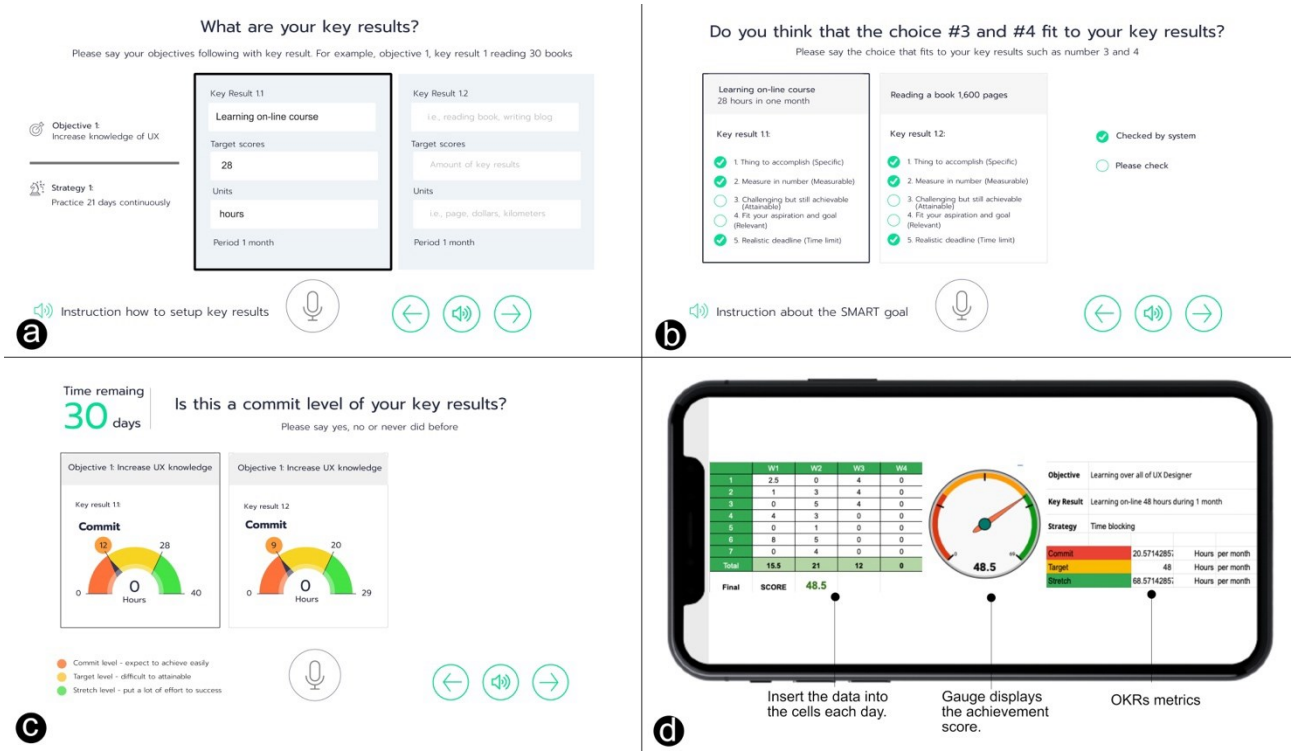

Fig 2. Integration of Voice User Interface and Hub Display: a) Entering Objectives and Key Results, b) Assessing SMART Goal Criteria, c) Establishing commit and target levels, and d) Utilizing Calendar Checklist and Dashboard.

The instruments and methods were classified into two parts. The first part involved using the Wizard of Oz method, applied during the input data phase by setting the objectives and key results. Participants engaged in conversations with test monitors who controlled the voice assistant's responses. The second part consisted of data input using a calendar checklist via Google

Sheet, allowing participants to input their data on their phones using a keyboard. Additionally, our staff sent reminders through social media communication platforms like LINE.

The purpose of the Wizard of Oz method was to simulate a Voice User Interface (VUI) similar to the Nest Hub, a smart display device developed by Google. This device allows users to interact using voice commands and gestures (Fig 2 a-c). Specifically, the study simulated the use of the OKRs app on a tablet. During the experiment, participants interacted with the tablet while two remote test monitors facilitated the process. One monitor was responsible for typing the text that would be converted into bot voice, while the other adjusted the data on the tablet in response to the participants' voice commands.

The implementation of the study was conducted via a computer screen accessed through a Zoom meeting. Prior to commencing the Zoom meeting, participants were instructed to review the OKRs setting and VUI manual. Upon completion of the one-month period, participants were tasked with completing a questionnaire incorporating the 10-item Grit scale. This scale, developed to gauge individuals' grittiness, assesses both passion and perseverance. The aim of employing the Grit scale is to discern the variance in the level of effort between the Reskill and Upskill groups. It comprises five items targeting the subject's consistency of interests (e.g., "I frequently establish a goal but subsequently opt to pursue an alternative objective.") and another five items evaluating the subject's perseverance of effort (e.g., "I am persistent, and I don't easily give up."). Participants provided ratings on a 5-point scale, varying from 1 (not at all like me) to 5 (very much like me), following the methodology outlined by Duckworth et al.[19]. Individuals who engage in self-directed learning may require a high level of passion and perseverance. Grit has been shown to have incremental predictive validity for success measures[19]. There exist two variations of the grit scale, with one comprising of 8 items and the other with 12 items. Nonetheless, for application with voice user interface, a 10-item version of the grit scale has been considered as suitable.

2.3 Procedure

The study employed a bot to facilitate the input of OKRs data for the participants. The system converted speech to text and automatically filled in the form. The rationale for utilizing a bot for data input is its ability to verify the validity and reliability of the user-inputted data. The key result form consisted of the name of the key result, target scores, and units (see Fig.2a). The experiment had three phases.

2.3.1 Initial Setup Phase: subjects set up their objectives and key results using the OKRs application. The SMART guidelines were then applied to check their key results, and subjects were asked to confirm the written key results (see Fig.2b). The subjects had the autonomy to select

their own scores for the commit, target, and stretch levels of the OKRs system, with values of 0.3, 0.7, and 1, respectively (see Fig.2c). The gauge used three colours (red, yellow, and green) to indicate the commit, target, and stretch levels. They were assigned to achieve the target level. Afterwards, they interacted with the VUI system for about 40 minutes. The process includes the introduction of OKRs terminology around 5 mins, input the data by using VUI around 25 minutes and rating the ease of use around 10 minutes. During this interview, participants explained their rationale for rating the system in terms of its ease of use.

2.3.2 One-Month Experiment Phase: This is an experiment over one month. The participants were mandated to log in each time they engaged in self-study by using their own mobile phone and input their data by using keyboard (see Fig. 2d). In the event of no login activity for three consecutive days, a reminder was sent to them by the bot. The use of a bot reminder aligns with the VUI theme, which is more naturally employed compared to text reminders. Researchers assign them to achieve the score of target level. The system used a bot voice to remind subjects to activate their learning every three days.

2.3.3 Post-Experiment Evaluation Phase: This phase is after a month. Subjects came to report their result and completed a survey that included the 10-item grit scale and an evaluation of the OKRs system.

2.4 Data Analysis

The individual results of OKRs were plotted using SPSS in a histogram format with a distribution curve. Due to the differences in participants' key results, it is impossible to compare them using a single, uniform task. Nevertheless, participants set their own baselines and compare them against the OKRs metrics at the 0.3 and 0.7 levels. Regarding the habit strategy, calculations were based on the percentage of participants who utilized one of three techniques: time blocking, repeating the habit for 21 days, and improving by 1% each day. Login frequency to the Google sheet was calculated by determining the total number of participants who logged in over 28 days across two groups, both upskill and reskill. The result of this system reminder effectiveness was determined by calculating the mean.

3. RESULTS

3.1 The result of personal OKRs implementation on goal setting, performance, and overall achievement.

Following twenty-eight days of tracking their OKRs, participants achieved a mean OKRs score ranging between 0.3 and 0.7 (M=0.55, SD=0.27). Fig 3 illustrates a histogram distribution showcasing the number of participants who attained various OKRs scales, with the majority falling within the 0.3 to 0.7 range. Notably, three participants fell below the commit level. A one-sample t-test was

employed to examine the disparity between personal OKRs results and the commit level set at 0.3. The results revealed a significant difference between the commit value (M=0.3) and the mean of personal scores (M=0.56, SD=0.28), t(23)=4.59, p=0.00. Twenty-two out of 24 participants successfully surpassed the commit level at 0.3. Furthermore, a significant difference was observed between the target level (M=0.7) and the mean of personal scores (M=0.56, SD=0.28), t(23)=-2.49, p=0.02, indicating that, on average, subjects' scores were lower than the target level, with only 8 out of 24 subjects achieving it. On average, participants set up two key results (M=1.83, SD=0.48), with only three subjects choosing for three key results.

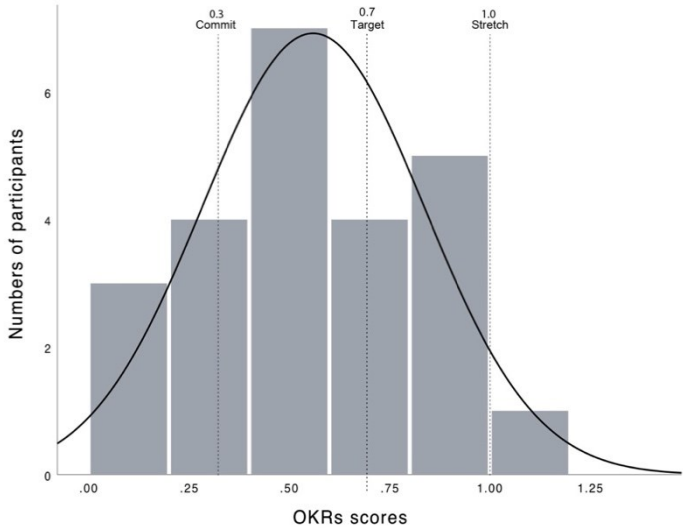

Fig 3. Histogram distribution on commit, target and stretch levels.

Among the 24 subjects, 10 mentioned that SMART guidelines provided specific goals. One recommendation proposes, “I believe that the SMART guidelines assist me in establishing both the goal and key results. This approach helps us clearly define our goals and understand what we want to achieve. It plays a crucial role in facilitating effective planning and time management. The key results are measurable, allowing for thorough evaluation. Essentially, SMART criteria keep us focused and aligned with our goals, ensuring a cohesive connection with the overarching objective.” A statistical examination utilizing the Mann-Whitney test indicated no significant difference between the OKRs scores of the Upskill group (*Mdn*=14.29) and the Reskill group (*Mdn*=10.71). Conversely, a notable distinction was found in the Grit scores assessed on a Likert 5-level scale. The Kruskal-Wallis H test revealed a statistically significant difference in Grit scores between the Upskill Group (*Mdn*=16.92) and Reskill Group (*Mdn*=8.08), with $\chi^2(1)=9.45$, p=0.004. There are two groups that provided different ratings for their grit scores. The group that rated a lower score expressed the following sentiments: *"I might have set the goal too challenging, and I*

didn't have enough time. While I consider myself a diligent person, I prefer not to focus on a task for an extended period." On the contrary, participants who rated their grit score high shared the following thoughts: *"I am committed to my goals and don't give up easily (Participant R5). Consistently performing a task every day turns it into a habit for me. Additionally, I excel in problem-solving and generating new ideas. I don't abandon old tasks, and I'm not someone who works excessively hard or procrastinates. I prefer prioritizing important work, and if something distracts me, I may lose some minor attention (Participant U11)."*

3.2 Examining the appropriateness of Matric levels

When asked about the appropriateness of the commitment level at 0.3 to their abilities, the majority of participants provided a high score (*M*=3.75, *SD*=1.33). Many mentioned that the commit level was perceived as achievable, not too difficult, and not too easy. Participants who found it challenging often admitted underestimating the task due to incorrectly setting the unit of key results. Regarding the target level at 0.7, participants rated it very high (M=4.54, SD=0.88), expressing agreement that the target level posed a significant challenge. Participant U3 remarked, "I need to manage time and control myself. After working on it for a while, it becomes really difficult. If I don't manage time for this task every day, it might fall to a lower commit level." Several participants indicated a preference for devising their own key result scores as opposed to adhering strictly to the commit and target levels, with the mean response falling in the medium range (M=3.04, SD=1.45) as can be seen in Fig 4. One participant explained, *"I prefer creating my own metrics, but having a reference metric would be helpful, or I'd like to start with an initial attempt and adjust the key results based on my capabilities. (Participant U9)"*. Conversely, others expressed a desire to utilize the system. One participant noted, *"I struggle with targeting measurable key results because I lack knowledge of benchmark values (Participant R3). Additionally, there's a concern about bias when setting my own key results (Participant R7)"*

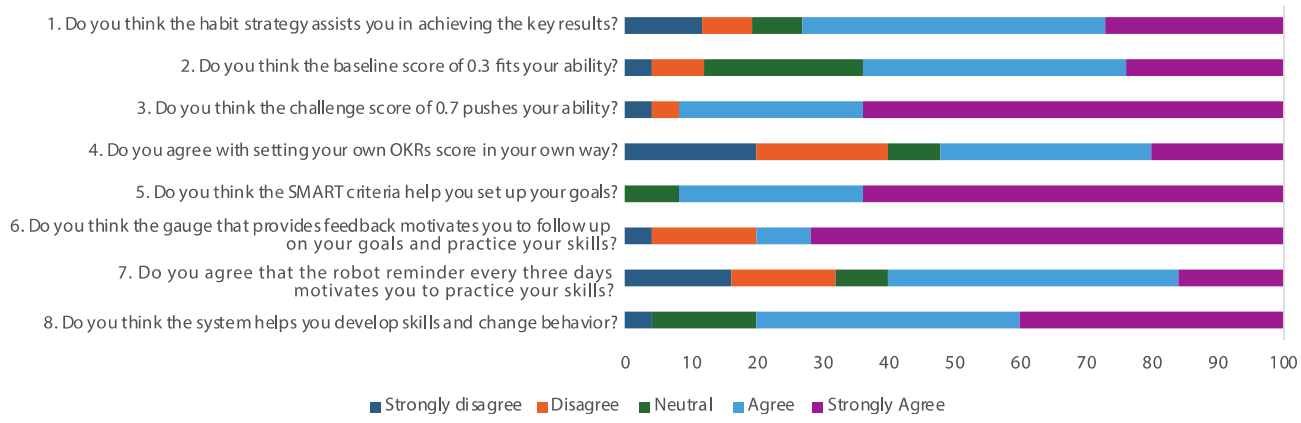

Fig 4. Rating scale on habit strategy, metric level, personalize OKRs, SMART, reminder and changing behaviour

3.3 Examining the effectiveness of habit strategies on subjects' goal achievement and identifying the most effective strategy.

The study examined the effectiveness of habit strategies for achieving goals, as well as the use of a gauge as feedback to track progress. The habit strategy was found to be effective, with many subjects reporting satisfaction with the strategy (*M*=3.7, *SD*=1.3). The time blocking strategy was the most used by both the 'Upskill' and 'Reskill' groups (66%), followed by repeating the habit for 21 days (31%) and improving 1% each day (3%). One participant emphasized the effectiveness of the habit strategy by stating, *"The habit strategy transforms daily practice into a habit, making it a consistent part of our routine rather than a sporadic event. It compels us to follow through with our intentions, and missing a day induces a sense of guilt. Establishing habits by starting with small actions and repeating them is crucial for achieving overarching goals. Personally, I allocate a minimum of 20 minutes daily for self-learning, although initially, I struggled with time management. Over time, I learned to concentrate on one task at a time instead of switching between tasks (Participant U3)."*

However, some participants who faced challenges in building habits expressed their perspectives, with one participant mentioning, *"I need to assess the situation before committing to the habit. If there are no other pressing tasks, I can engage in self-learning. However, I prioritize my company's work first, as the fear of blame for not completing company tasks is a deterrent. I also seek support from friends for collaborative learning (Participant U4)."*

When questioned about the intrinsic or extrinsic motivation that aids their regular practice, approximately 72% of the respondents indicated that intrinsic motivation is the primary driving force. One participant expressed, *"The challenge itself motivates me as it provides an opportunity to prove to myself that I am capable. I take pride in learning something new every day, and this process is closely tied to responsibility, time management, and personal development (Participant R7)."* Conversely, individuals choosing for extrinsic motivation express their interest in potential rewards, such as learning certifications or a portfolio for job applications.

3.4 Effectiveness of VUI system login frequency on objective attainment

Examining the login activity over the course of one month reveals a greater decline in the Reskill group compared to the Upskill group. This diminishing interest is visually apparent in the plotted figure depicting the number of logins across the observed days. The decline in login frequency follows a discernible linear pattern represented by the equation y = -0.37x + 17.

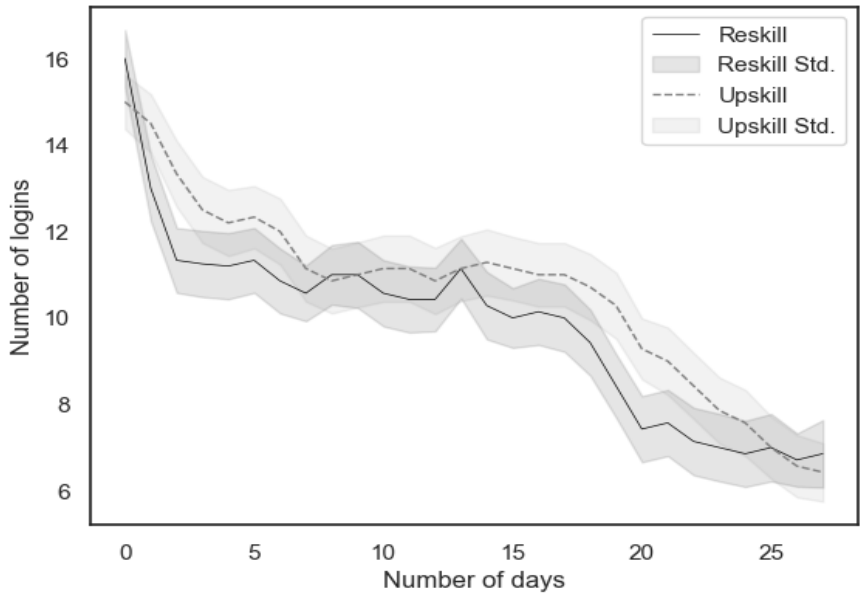

Fig 5. Time series analysis of the login activity within the OKRs system for both the 'Reskill' and 'Upskill' groups.

Initially, there was a noteworthy surge in login frequency, peaking at a maximum of 21 logins in total. However, as time advanced, the frequency of logins experienced a consistent decrease, reaching a minimum of only 3 logins at the Day 28 (See Fig. 5). An intriguing observation emerges as participants with a commitment score below 0.3 tended to log in during the initial week. In contrast, those who attained a stretch level of 1.0 sustained their login activity between days 14 and 28. This implies a connection between the frequency of logins and the likelihood of success. It suggests that a higher login frequency is linked with an increased chance of success compared to fewer logins frequency.

3.5 Assessing the contribution of system reminders to goal achievement and habit development

The inclusion of the gauge proved to be advantageous, eliciting positive responses from participants who were motivated by its visual progress indicator (*M*=4.37, *SD*=1.2). They said that: *"The gauge visually signifies the red, orange, and green zones, revealing our progress towards the goal (Participant U6, U8, R5, R9). I don't feel pressure when using it, especially in combination with the calendar checklist (Participant U12). Its substantial size makes tracking easy. I prefer the gauge over numerical representations. (Participant U2)."*

The reminders feature of the bot, sending reminders every three days, received less favour among participants (*M*=3.25, *SD*=1.39) who deemed it unnecessary in light of the gauge. One participant expressed discomfort with the bot's warning sound, stating, *"In my experience, I felt a sense of guilt with the warning sound of the bot (Participant R4). It would be more motivating if it were changed to a human sound, maybe from a relative or friend (Participant R3, R9, U7, U10).*

The bot's reminders, though, was beneficial as it informed me when I hadn't logged into the system (Participant U2, U3, U6, U12, U13, U14, R5, R6, R10)".

The system was seen as effective in helping subjects develop their skills and change their behaviour (*M*=4.08, *SD*=0.97). Participants highlighted, *"The system should automatically collect data and integrate with other apps like smartwatches (Participant U9). The positive aspect of this system is that it generates a plan for us to follow, reflecting our habits (Participant U3, U4, U6, U12, U14, R3, R4, R6, R9, R10). Previously, I would buy numerous books without reading them, but using this system motivated me to engage with my reading list. It also establishes a sense of continuous learning; without it, I might have discontinued my learning journey (Participant U13). This system could be particularly effective for students seeking monitoring and feedback. Another advantage is the system's numerical feedback, compelling us to adjust our behaviour to align with our goals. It operates like habit-forming, requiring self-discipline. I often forget to log in; having an automatic login upon task completion would improve the experience. Additionally, it surpasses the solitary learning of MOOCs because the system has the potential to reshape our behaviour."*

4. DISCUSSION

Participants demonstrated proficiency in meeting the commit level but encountered difficulties in reaching the target level. The effectiveness of OKR scores, following Niven's perspective[20], hinges on the necessity for substantial effort to surpass the target level, ensuring that goals are not easily attained. On the other hand, participants who achieved higher scores could be at an excellent level.

Participants prominently favoured the time-blocking habit strategy, highlighting its practicality in daily life. This underscores the significance of crafting habit strategies that are both practical and easily implementable. In contrast, strategies like improving 1% each day and a 21-day repetition, although effective, were not widely chosen. These strategies, while beneficial, should be adapted to suit individuals' lifestyles.

The SMART goal proves effective in helping participants establish clear and measurable objectives and key results. This is like other studies[9,21] Nevertheless, participants require time to learn how to accurately estimate the right key result. Introducing best practices in the future is essential to guide users of the OKR system in effectively setting up goals and key results.

In the time series analysis, it was observed that many participants completed their tasks before 28 days, while those with lower OKR scores tended to give up their tasks and did not log in within a week, resulting in a goal disengagement—a pattern consistent with other studies[22]. Participants with fewer logins tend to demonstrate less perseverance in their tasks, aligning with findings from other studies on habit formation in exercise behaviour[23]. One assumption underlying this trend is related to instinctive motivation, as proposed by Rompho[24], who associates Personal OKRs with instinctive motivation. This experiment confirmed the prevalence of instinctive motivation among participants. Regarding grit, the Upskill group exhibited higher grit scores and more frequent logins than the Reskill group, indicating greater ambition and perseverance in the former[25,26]. The challenges faced by the Reskill group in learning, particularly due to the transition to a new career, were noteworthy.

The OKRs system demonstrated effective interaction with Voice User Interface (VUI) for data input, guidance, and reminders. The future user interface's emphasis on simplicity, avoiding technical terms, is crucial. Participants invested time in comprehending the terminology associated with OKRs, and they expressed a preference for succinct communication in Voice User Interface (VUI) interactions[27]. There is a suggestion that VUI could evolve into a coaching tool, akin to Generative Artificial Intelligence, addressing problems and facilitating self-learning.

The data in Fig 4 demonstrates the effectiveness of the OKRs system in helping participants set their key results and goals. It includes both baseline and challenge metric levels. Participants acknowledged that the SMART criteria assist them in setting clear goals. Additionally, the visual gauge motivates participants to stay on track with their goals. Many participants also noted that the system has the potential to change their behaviour.

The study recognizes the limitation of a restricted number of participants due to reluctance in engaging with the time-consuming longitudinal program. Future research is recommended to explore embedded systems in daily activities, such as the Internet of Things, for streamlined data collection. Integration of Personal OKRs with analytics and planning strategies is suggested to optimize learning outcomes and goal achievement by recognizing practice patterns and incorporating deliberate practice.

5. CONCLUSION

The OKRs system proves beneficial in facilitating goal setting, particularly when users can input their data through a voice interface. Additionally, the Voice User Interface (VUI) can assist in guiding participants through the goal-setting process, as well as monitoring and tracking the outcomes. While some participants may struggle to reach the target level of 0.7, there exists an opportunity

to enhance their habit-forming strategies. The system underscores the importance of regular login as a key element in ensuring goal achievement success, a crucial aspect of habit formation. Future developments aim to establish predefined patterns for key results and leverage machine learning to predict the likelihood of success throughout the journey.

ACKNOWLEDGMENTS

This research project is supported by Thailand Science Research and Innovation (TSRI). Basic Research Fund: Fiscal year 2022 under project number FRB650048/0164

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