Virtual play and real connections: unpacking the impact of rice farming simulation video games

Takeshi Nishimura[1]*, Junko Taguchi[2], Terukazu Kumazawa[3] and Kengo Hayashi[4]

[1]Graduate School of Agriculture, Ehime University, Matsuyama, Japan, [2]Faculty of Urban Science, Meijo University, Nagoya, Japan, [3]Faculty of International Co-Creativity and Innovation, Osaka University of Economics, Osaka, Japan, [4]Institute of Industrial Science, The University of Tokyo, Tokyo, Japan

This study investigates how the rice farming simulation video game *Sakuna: Of Rice and Ruin* affects interest in real-world agriculture and the inclination to start farming amidst Japan's declining farming population. We surveyed 428 Japanese residents, including not only game players but also those who watch the game live or are merely aware of its existence. We also interviewed an individual who started rice farming after playing the game. The findings indicate that the game successfully stimulates greater interest in agriculture and somewhat motivates players to consider farming, more than just viewers or those who are aware of it. Moreover, individuals with real-life connections to agriculture, such as farming experience or professional connections, were optimistic about the transition from game to reality. The study suggests that rice farming simulation games can foster expectations of developing an interest in agriculture and potentially embarking on farming careers, demonstrating the game's significant impact beyond entertainment.

KEYWORDS

expectation, interpersonal connection, new farmer, rice farming, video game

1 Introduction

The rice farming simulation video game *Sakuna: Of Rice and Ruin* (hereinafter referred to as *Sakuna*), released in 2020, has achieved global sales surpassing one million units and captured significant attention on social media platforms.[1] This trend went beyond the gaming industry and affected real-life agriculture. For instance, not only did game players refer to

---

1   *Sakuna*, a hybrid of rice farming simulation and action gameplay, launched globally in November 2020 for the Nintendo Switch, PlayStation 4, and PC via Steam. By 2021, it had achieved over one million units in cumulative global shipments, significantly enhancing profits for its publisher, Marvelous Co., Ltd. (2021a,b). Within the game, players engage in detailed rice cultivation tasks from planting to harvest. An interesting feature allows players to assign farming duties to a character named Tauemon, streamlining the process but at the expense of rice quality. Despite the option for simplification, many players expressed a strong preference for producing high-quality rice, underscoring the game's immersive and compelling nature (Famitsu, 2021). This dedication to the agricultural component has not only garnered attention from agricultural organizations but also attracted an audience beyond traditional gamers, highlighting its broad appeal.
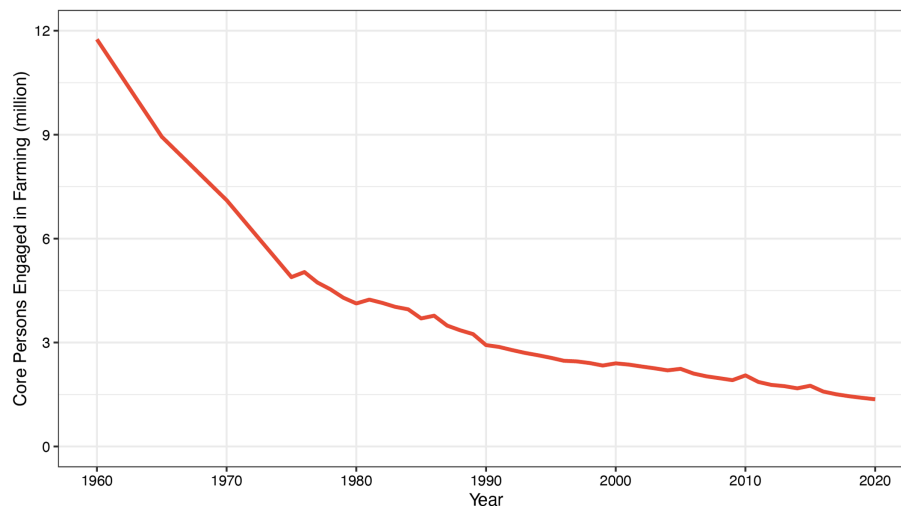
FIGURE 1
Farming population in Japan. The "core persons engaged in farming" as defined by the MAFF in Japan refer to individuals who are engaged in agriculture as a profession. Source: MAFF, *Census of Agriculture and Forestry* and MAFF, *Current Survey of Agricultural Structure*.

existing information on agriculture, but the National Federation of Agricultural Cooperative Associations (Zen-Noh) in Japan promoted *Sakuna* via social media, including distributing a PDF booklet on actual rice farming.[2] This indicates that an agricultural organization is making a coordinated effort to cultivate interest in farming among young people. This initiative is driven by a decrease in the farming population and a looming crisis in the sustainability of the agricultural sector.

Japan is known for having one of the world's most rapidly aging societies (Cutler et al., 1990; Anderson and Hussey, 2000), which poses significant challenges across various sectors, especially agriculture (Jöhr, 2012). The agricultural sector vividly reflects this demographic shift, with a marked reduction in the farming population over the last six decades (Figure 1). As of 2020, a staggering 79.9% of this population was 65 years or older, with only a small fraction, 4.9%, being under 40. On the other hand, while the influx of new farmers in Japan includes older individuals transitioning post-retirement, a noteworthy proportion also includes younger people (Figure 2). Therefore, increasing the younger generation's interest in agriculture is essential to strengthen this trend.

Amidst these challenges, video games have emerged as unconventional yet promising educational and motivational tools, potentially attracting new entrants to agriculture and facilitating the acquisition of foundational knowledge in the field (Nagasawa et al., 2006; Yoo and Kim, 2014; Ali et al., 2017; de la Vega et al., 2022). The actions of Zen-Noh mentioned above can be seen as resulting from the expectation of similar effects from *Sakuna*. However, to what extent does experiencing agriculture in the game contribute to an interest in and the initiation of farming?

Games have been discussed as a means of guiding desired behavior in the real world (McGonigal, 2011). Therefore, the role of

serious games and video games in influencing societal behaviors and career choices is gaining recognition (Carvalho et al., 2018; Crespo-Martinez et al., 2023; Keller et al., 2023; Wallinheimo et al., 2023). For instance, prosocial video games have been shown to increase prosocial outcomes, suggesting that online play may positively impact players' real-world social relationships (Greitemeyer and Mügge, 2014; Perry et al., 2018). Additionally, studies have indicated that children who play video games often mimic the behaviors of characters they have interacted with in the games (Schutte et al., 1988).

Despite this, the impact of serious games on actual behavioral change, particularly in environmental contexts, still needs to be studied more. Georgiou et al. (2023) reviewed behavior change games, finding that while they promote pro-environmental knowledge and attitudes, their influence on behaviors has yet to be definitively proven. The contentious relationship between first-person shooter games and real-world violence further illustrates the complex effects of video games on behavior, necessitating more research on how attitudinal shifts lead to action (Ferguson, 2008; Anderson et al., 2010; Markey et al., 2015).

Engaging with games is about more than just playing them. In recent years, live gaming through YouTube and Twitch has become popular. Twitch, a live gaming and e-sports streaming platform, has over 2.4 million monthly active users (TwitchTracker, 2024). It has been indicated that there are differences between game viewers and game players in the way they experience games (Kätsyri et al., 2013; Juvrud et al., 2022). Furthermore, Polman et al. (2008) demonstrated that players are more likely to behave aggressively in the real world after playing than viewers of violent video games. However, this tendency was observed only among boys, revealing the significance of the attributes of the players and viewers. Therefore, the effects of games must be examined, considering how individuals interact with games and their attributes.

To examine the impact of games on the real world, it is desirable to quantitatively analyze popular games that are widely recognized by

2 https://twitter.com/zennoh_food/status/1326755869053214721

FIGURE 2
New farmers in Japan. Source: MAFF, *Survey of New Farmers*.
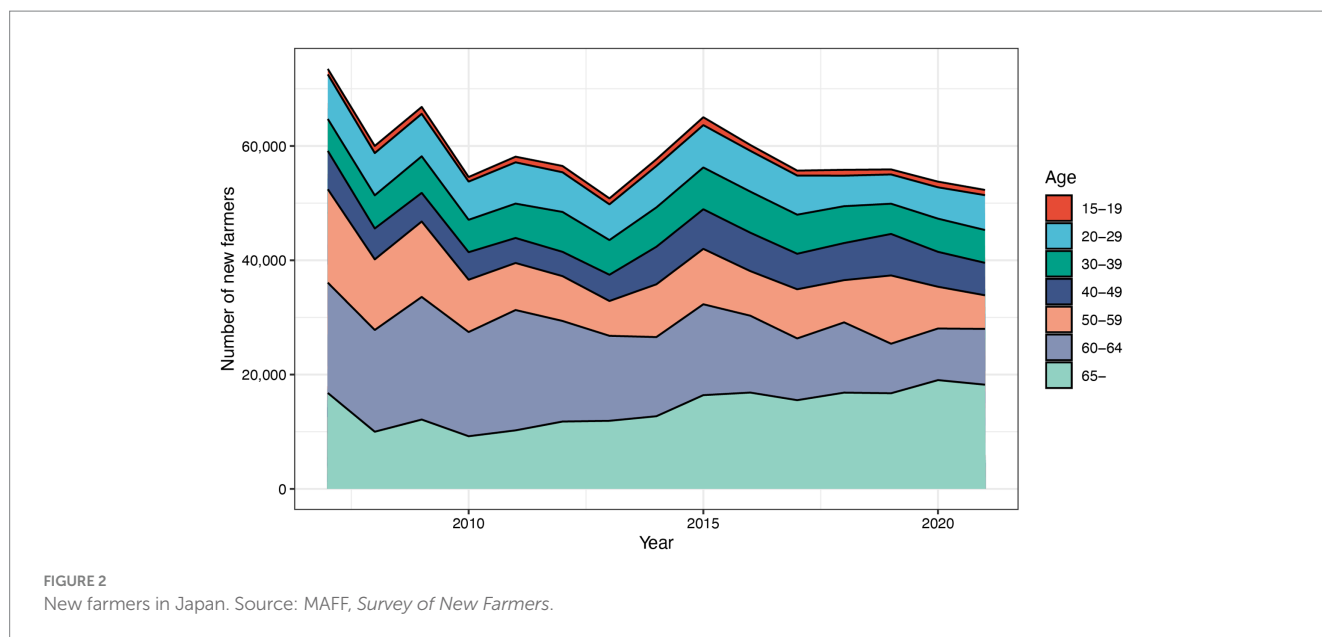
a broad audience and have already demonstrated explicit connections between the game and the real world for some players. *Sakuna*, with its realistic agricultural simulation, has sparked significant interest and engagement, including promotion by Zen-Noh via social media. This tangible connection between the game and real-world agriculture suggests that insights from investigating *Sakuna* can illuminate both the impact of gameplay on real-world activities and the influence of real-world connections on players' agricultural interests.

This study investigates the potential of the rice farming simulation game *Sakuna* to stimulate interest in agriculture. This inquiry is particularly pertinent given the ongoing decline in the farming population. The study quantitatively examines the effect of the game on interest in agriculture, considering not only game players but also those who are merely viewers or aware of its existence, irrespective of their prior agricultural experience. To this end, we will adopt an exploratory approach, comparing the attitudes and perceptions of individuals who are aware of *Sakuna*, distinguishing between those who have played the game and those who have not.

Our preliminary research (see Supplementary material) indicates that other games like *Story of Seasons* and *Hay Day* also possess the potential to generate interest in agriculture. Notably, the *Story of Seasons* series, launched in 1996, has already inspired some enthusiasts to engage in real-world dairy farming (Matsumura, 2023). Addressing the question of whether a commercial game, accessible to a broad audience, can increase interest in agriculture and expand the pool of potential new farmers is critical for securing young entrants into the agricultural sector. Despite *Sakuna* having been released only a few years ago, there are individuals who have started farming as a result of playing the game. We conducted an interview survey with one such individual and qualitatively analyzed the effects of both game-related and non-game-related factors that motivated them to start farming.

By focusing on widely accessible commercial video games, this research evaluates their role in promoting agriculture as a career choice and examines the agricultural community's views on these games' impact. This effort aims to rejuvenate Japan's agricultural workforce and explore the broader utility of video games in career exploration and raising agricultural awareness. While *Sakuna* includes action elements, our primary focus is on the agricultural simulation. Although our study concentrates on *Sakuna*, the findings could be applicable to other farming simulation games as well.

2 Methods

To understand whether playing *Sakuna* promotes awareness and behavioral changes in people in the real world, we conducted an online questionnaire survey in March 2021. The survey was outsourced to Macromill, Inc., an Internet research company. We targeted Japanese residents aged 16–60 years who were at least familiar with the name of the game. To ensure that respondents who had never played the game would be included in the sample, we screened potential respondents so that the number of respondents who had never played the game would be about one-quarter of all the respondents.

The survey comprised 25 questions, focusing on how respondents experienced the game (whether they played it, viewed someone else play, etc.) and the changes they perceived in themselves as a result of this engagement. The questions were designed to be answered by selecting from a set of choices, ensuring clarity and ease of response. Several questions in the survey required respondents to input numerical values directly. The estimated time to complete the survey was approximately 5 min, making it convenient for respondents to provide their insights without significant time commitment (for the full survey, see Supplementary material).

The respondents were categorized into three groups: respondents who had played the game (Player group), respondents who had never played the game but had watched others play the game (Viewer group), and respondents who knew the game but had never watched the gameplay screen (Non-player/viewer group). In psychophysiology, interactive game players exhibit unique levels of arousal and engagement compared to passive viewers, which may influence

TABLE 1 Three groups: characteristics.

Group	Player group	Viewer group	Non-player/ viewer group
Sample size	313	68	47
Average age	26.79	25.78	29.09
Gender (Percentage of females)	44.09	47.06	59.57

TABLE 2 Agricultural group vs. Non-agricultural group: characteristics.

Group	Agricultural group	Non-agricultural group
Sample size	119	309
Average age	26.30	27.11
Gender (Percentage of females)	40.34	48.54

behavior (Juvrud et al., 2022). We aimed to examine differences among these groups regarding their perceptions of whether the game could influence players' awareness and behavior. Specifically, we inquired if engagement with the game (through playing, viewing, or knowing about it) influenced their interest in agriculture and their inclination toward starting farming. Additionally, we asked respondents to estimate what percentage of game players, in their opinion, might change their awareness and behavior due to playing the game.

In addition to the initial grouping, we further divided respondents based on their existing involvement in agriculture, including those who were farmers or engaged in agriculture-related work. This allowed us to compare the Agricultural group (those involved in agriculture) with the Non-agricultural group (those not involved in agriculture) to determine if the former had greater expectations from the game than the latter.

Moreover, to explore the connections between the gaming and real-worlds experiences, we focused on the players' interpersonal relationships with actual farmers. In the real world, advice from friends and acquaintances who are knowledgeable about rice farming is invaluable. This contrasts with the game environment, where such interpersonal connections are not necessary to progress or obtain information. Although initially targeting younger audiences, notably junior high and high school students, *Sakuna* unexpectedly appealed to a wider demographic, including actual farmers, surpassing developer expectations.[3] Feedback from agricultural experts, indicating omissions in the game's depiction of rice farming, underscored the balance between authenticity and entertainment (Famitsu, 2021). This feedback suggests that the game's portrayal of rice farming mirrors real-life practices to a significant degree. We hypothesized that real-world connections might influence players' expectations and experiences with the game. Therefore, we categorized players based on the source of their farming information: those who relied on in-game resources versus those who sought advice outside the game. This categorization aimed to assess whether different

information sources led to varying expectations about the game's impact.

The sample size for our study was 428, representing residents from all prefectures in Japan. The sample was collected from respondents who participated in an online survey, without any intentional selection to represent the broader gaming population. This included 313 respondents who had played the game and 115 who had not. The age range of respondents was 16–52 years, with an average of 26.9 years. The gender distribution was relatively balanced, with 230 males and 198 females, though males were slightly more represented. The respondents' occupations varied, with the largest groups being office workers (187), followed by students (118), part-time workers (44), civil servants (21), and self-employed (13). The average daily gaming time was 2.6 h, with a median of 2.0 h. On average, respondents purchased 7.1 games in the past year, with a median of 3.0 games. Regarding monthly spending on games, 42.8% of respondents did not spend any money, 37.6% spent less than 4,000 yen, 13.6% spent between 4,000 and 8,000 yen, and 6.1% spent more than 8,000 yen. Comparing these figures with the findings of Mitsubishi UFJ Research and Consulting (2022) suggests that our sample consists of typical Japanese game players rather than individuals with excessive gaming habits.

The respondents were categorized into three groups based on whether they had played the game. The Player, Viewer, and Non-player/viewer groups comprised 313, 68, and 47 respondents, respectively. Table 1 presents the comparisons between these groups. The Player group consisted of young people, and its respondents were predominantly male.

One hundred and nineteen respondents were classified into the Agricultural group, and the rest into the Non-agricultural group. Of the agricultural group, 77 were rice farmers, 66 were non-rice farmers, and 27 were agriculture-related workers; this was determined based on their multiple-choice responses regarding their status. In Japan, it is possible to work as a farmer while working for a company because many farmers are dual-income workers. Table 2 presents the comparisons between these groups. The Agricultural group was more likely to be male than the Non-agricultural group.

In a fortunate development, alongside our planned survey, we had the opportunity to interview an individual who began farming after playing *Sakuna*. This person gained attention after tweeting about concerns over typhoon damage to their rice plants, a tweet that was quote-retweeted by the game's developer and received widespread recognition.[4] This case highlighted a real-world instance of the game influencing someone to start farming. We conducted an interview with this individual in October 2022, after reaching out via Twitter. We believed that this interview would provide valuable insights to interpret our survey results. Given that our questionnaire required respondents to provide hypothetical answers, the reliability of these responses could be questioned. Thus, the interview with someone who transitioned into agriculture influenced by the game was anticipated to lend additional credibility and depth to our findings. Hereafter, we refer to this interviewee as the practitioner.

It is important to note that we did not select this practitioner from among multiple candidates; rather, this opportunity arose

---

3 https://www.facebook.com/maffgohan/posts/3089040124530060

4 https://twitter.com/nal_ew/status/1571681399907971072

serendipitously. While long-term observational studies would provide more comprehensive insights, they are not feasible at this stage. However, the fact that we were able to access and interview someone who began farming within the short period since the release of *Sakuna* is a significant achievement. This interview provides a unique and valuable perspective on the game's potential impact on real-world agricultural practices.

3 Results

3.1 Sources of information on rice farming in the game

Only the game players were asked to indicate, using a multiple-answer format, what they consulted to obtain the information they needed to farm rice in the game.

The results showed that 53.7% of the respondents chose "Live game streaming on Twitch, YouTube, etc.," and 47.3% chose "Posts on social media." Many respondents referred to how other players played the game, just as they did with other games. These responses were followed by "Website of the Ministry of Agriculture, Forestry, and Fisheries (MAFF)" (34.5%), "Website of the Zen-Noh" (30.0%), and "Strategy sites or strategy books for the game" (28.8%). Some players referred to the previously mentioned Zen-Noh PDF booklet and other sources. Furthermore, 26.8% of the respondents chose "Information available in the game," 25.2% chose "Advice from friends and acquaintances who are playing the same game," 12.5% chose "Advice from friends and acquaintances who are engaged in rice farming," and 9.6% chose "My own experience and daily life." Of the respondents, 12.5% sought advice from real farmers to advance their rice farming during the game.

3.2 Changes in the respondents themselves and the expectations of other players

In our survey, we asked the respondents if their engagement with the game (playing, viewing, or knowing about it) had changed their interest in agriculture.

For the group-specific analysis, the statistics estimated by the bootstrap method were used to test for significance, as well as to visualize the results through graphing. Specifically, group comparisons were conducted in accordance with Ho et al. (2019). This method involves generating 5,000 bootstrap resamples to derive the mean and 95% confidence interval for the mean difference distribution between groups, providing a clearer picture of the differences between the Player, Viewer, and Non-player/viewer groups. For this purpose, we employed the "dabestr" package in R 4.2.2 (R Core Team, 2023).

Of the total respondents, 17.8% indicated an increased interest in agriculture. Breaking this down by group, 18.5% of the Player group, 17.6% of the Viewer group, and 12.8% of the Non-player/viewer group reported a heightened interest in agriculture. However, these differences were not statistically significant. In terms of wanting to start farming, 9.3% of all respondents expressed this desire. Specifically, 10.9% in the Player group, 7.4% in the Viewer group, and 2.1% in the Non-player/viewer group expressed a desire to start

farming, with a significant inclination in the Player group compared to the Non-player/viewer group.

Respondents were also asked to estimate the percentage of players who might become interested in agriculture after playing the game. Answers could range from 0 to 100, with the overall average being 50.2%. By group, the Player group estimated 53.9%, the Viewer group 44.4%, and the Non-player/viewer group 34.4%. Figure 3A illustrates that both the Player and Viewer groups had higher expectations about players developing an interest in agriculture compared to the Non-player/viewer group.

We explored whether respondents who developed an interest in agriculture after playing the game anticipated that other players would also become similarly interested. Our findings, as depicted in Figure 3B, indicate that respondents influenced by the game had higher expectations for other players to develop an interest in agriculture compared to those who were not influenced.

Additionally, respondents were asked to estimate the percentage of players they believed would want to start farming after playing the game, with answers ranging from 0 to 100. The overall average was 28.7%. By group, 34.4% of the Player group, 13.2% of the Viewer group, and 12.9% of the Non-player/viewer group believed players would be inclined to start farming. Figure 4A shows that the Player group expected a higher percentage of players to start farming compared to the Non-player/viewer group. However, the Viewer group's expectations did not significantly differ from the Non-player/viewer group.

We also investigated if respondents who expressed a desire to start farming anticipated that other players would share this aspiration. Surprisingly, those who wanted to start farming were no more likely than others to expect that other players would also want to start farming, as shown in Figure 4B.

In terms of interest in agriculture, the average expectation among respondents was that 50.2% of players would develop an interest in agriculture after engaging with the game (playing, viewing, or knowing about it). This percentage is notably higher than the 17.8% of respondents who reported a personal increase in interest. Similarly, for starting farming, respondents estimated that 28.7% of players would be motivated to start farming, a figure higher than the 9.3% of respondents who personally expressed this desire.

We also compared the expectations of the Agricultural and Non-agricultural groups. The Agricultural group anticipated higher levels of interest in agriculture and a greater inclination to start farming among players than the Non-agricultural group, as illustrated in Figure 5.

We examined the connection between gaming and real-world experiences by categorizing respondents based on their sources of information for improving rice farming in the game. The sources were: (1) advice from friends and acquaintances engaged in rice farming (Rice Farmer group), (2) advice from friends and acquaintances playing the same game (Game Farmer group), and (3) information available within the game itself (In-Game group).

Figure 6 shows that there were no significant differences in the estimations of the percentage of players who would become interested in agriculture between the Rice Farmer and Non-rice Farmer groups, the Game Farmer and Non-game Farmer groups, and the In-Game and Non-in-game groups. However, as depicted in

FIGURE 3
Estimation of the percentage of game players developing an interest in farming. **(A)** Comparison of interest in farming. Bootstrap analysis revealed the unpaired mean difference between the Viewer group (*n* = 68) and the Non-player/Viewer group (*n* = 47) to be 9.95, with a confidence interval of [0.618, 19.6]. In contrast, the mean difference between the Player group (*n* = 313) and the Non-player/Viewer group (*n* = 47) was 19.5, with a confidence interval of [11.6, 27.2]. **(B)** Difference in agricultural interest between respondents who became interested while playing and all other respondents. Group 1 consists of respondents who developed an interest in agriculture while playing the game (*n* = 76), and Group 0 includes all other respondents (*n* = 352). Bootstrap estimation and analysis indicated that the unpaired mean difference between Group 1 and Group 0 was 16.8, with a confidence interval of [10.5, 23.1].

FIGURE 4
Estimation of the percentage of game players who would start farming. **(A)** Comparison of farming start-up intentions. Bootstrap analysis revealed that the unpaired mean difference between the viewer group (n = 68) and the Non-player/Viewer group (n = 47) was 0.276, with a confidence interval of [−7.59, 7.4]. For the Player group (*n* = 313) versus the non-player/viewer group (*n* = 47), the mean difference was 21.5, with a confidence interval of [13.9, 28.1]. **(B)** Difference in farming start-up intentions between players who wanted to start farming and all other respondents. Group 1 comprises respondents who expressed a desire to start farming while playing the game (*n* = 40), and Group 0 includes all other respondents (*n* = 388). Bootstrap estimation and analysis indicated that the unpaired mean difference between Group 1 and Group 0 was 9.5, with a confidence interval of [−0.464, 20.1].
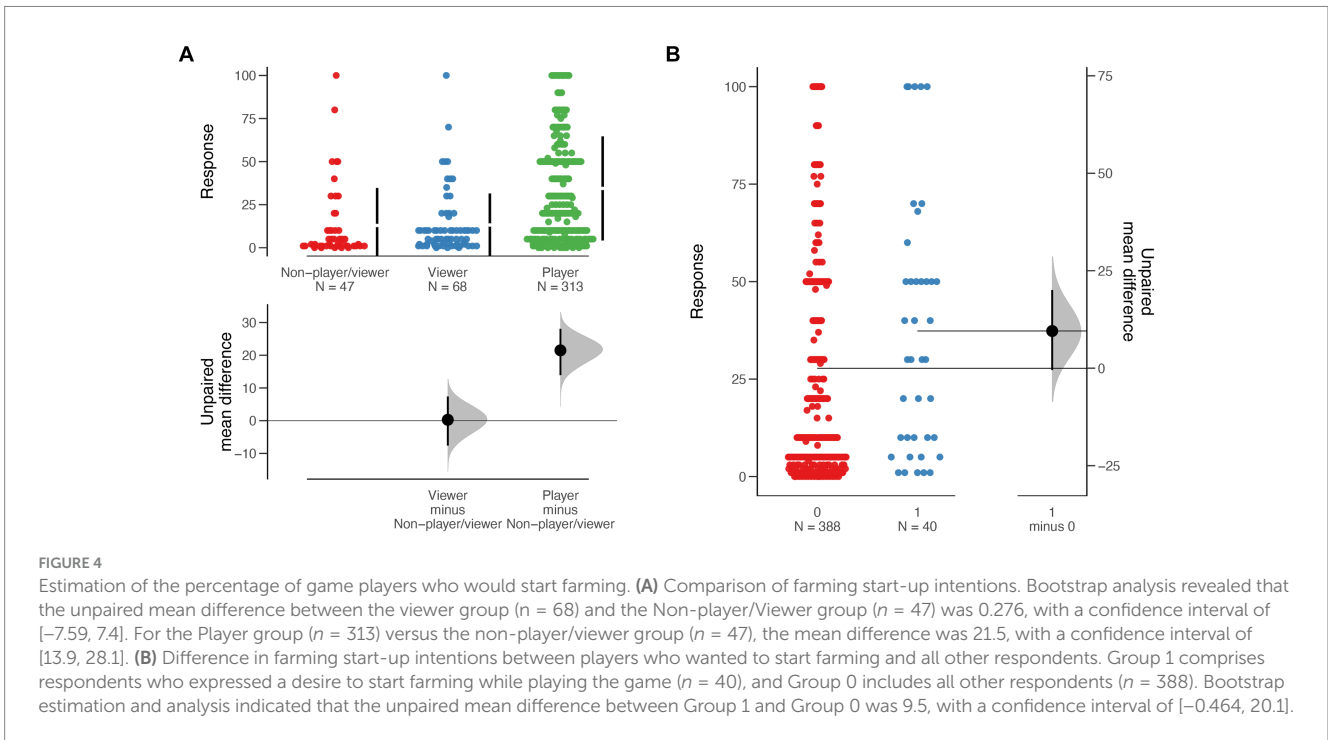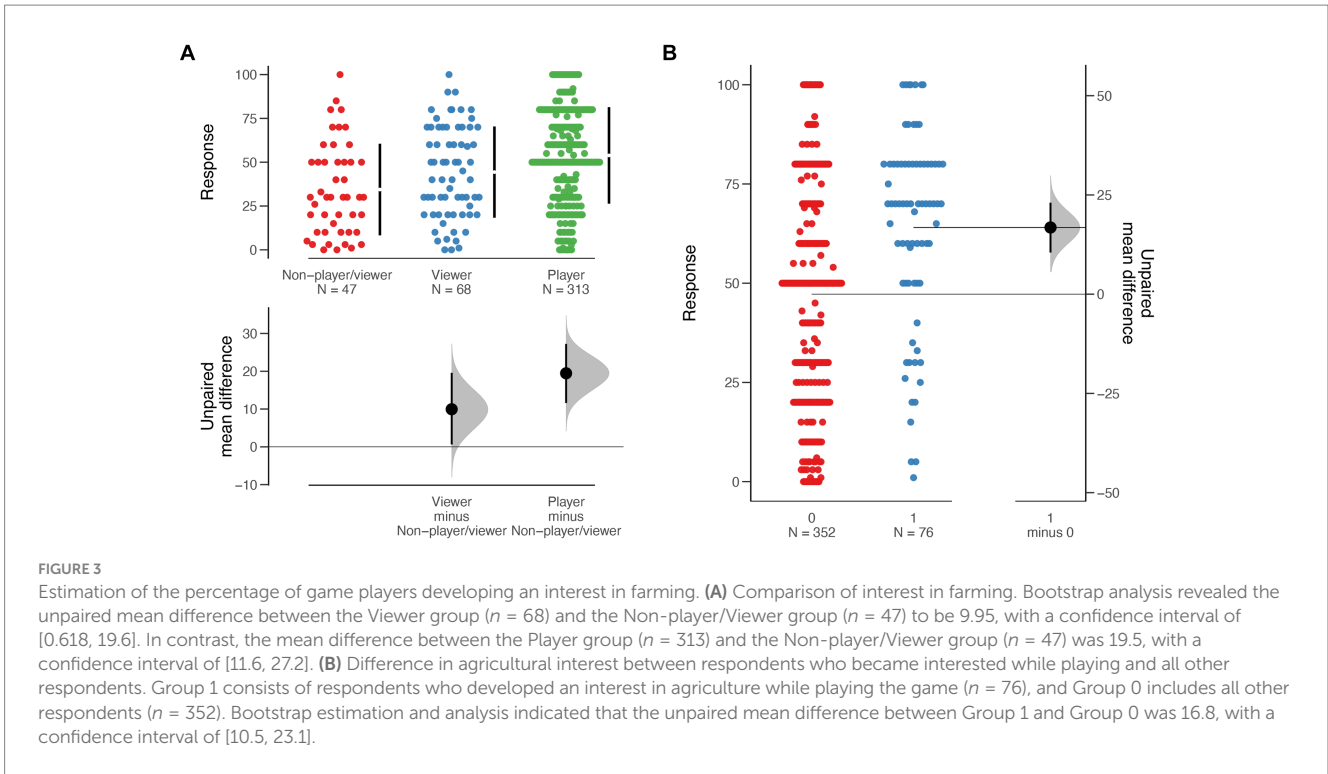
Figure 7, the Rice Farmer group estimated a higher percentage of players would start farming compared to the Non-rice Farmer group. In contrast, the In-Game group estimated fewer players would start farming compared to the Non-in-game group. No significant difference was observed between the Game Farmer and Non-game Farmer groups.

4 Discussion

4.1 Impact of video game play

Our analysis explored the influence of video game engagement on participants' motivation to pursue farming. Notably, 9.3% of
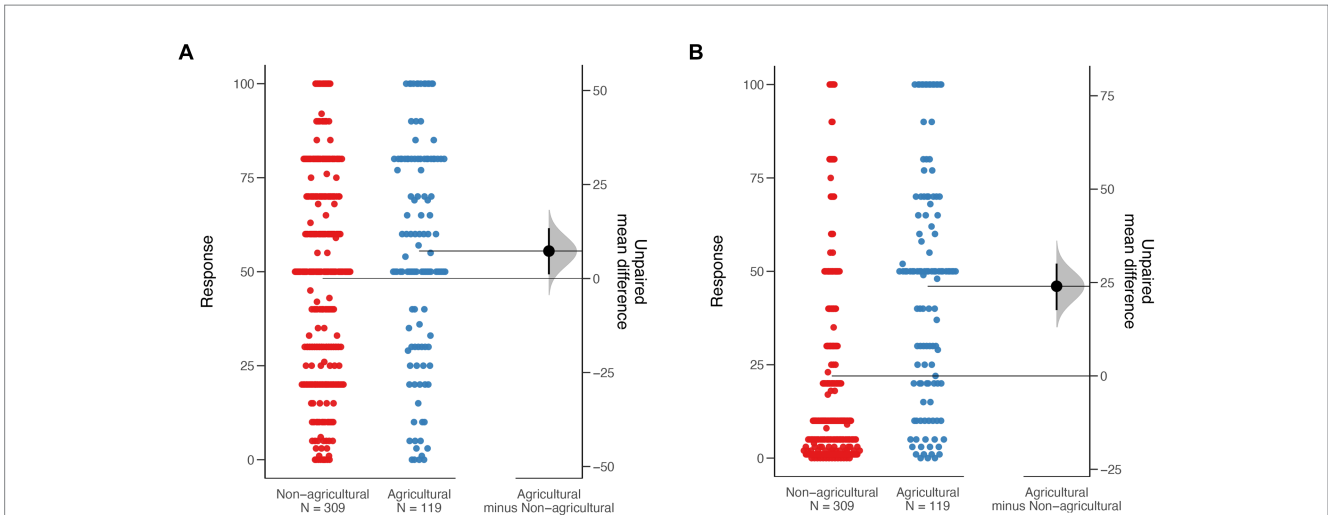
FIGURE 5
Comparison of expectations between agricultural and non-agricultural groups. **(A)** Expectations on the percentage of players developing interest in agriculture. This panel compares expectations regarding what percentage of players will develop an interest in agriculture. Bootstrap analysis revealed that the unpaired mean difference between the agricultural group (*n* = 119) and the Non-agricultural group (*n* = 309) was 7.3, with a confidence interval of [1.12, 13.4]. **(B)** Expectations on the percentage of players starting farming. This panel compares expectations regarding what percentage of players will start farming. Further bootstrap analysis indicated that the unpaired mean difference between the Agricultural group (*n* = 119) and the Non-agricultural group (*n* = 309) was 24, with a confidence interval of [17.6, 30.1].
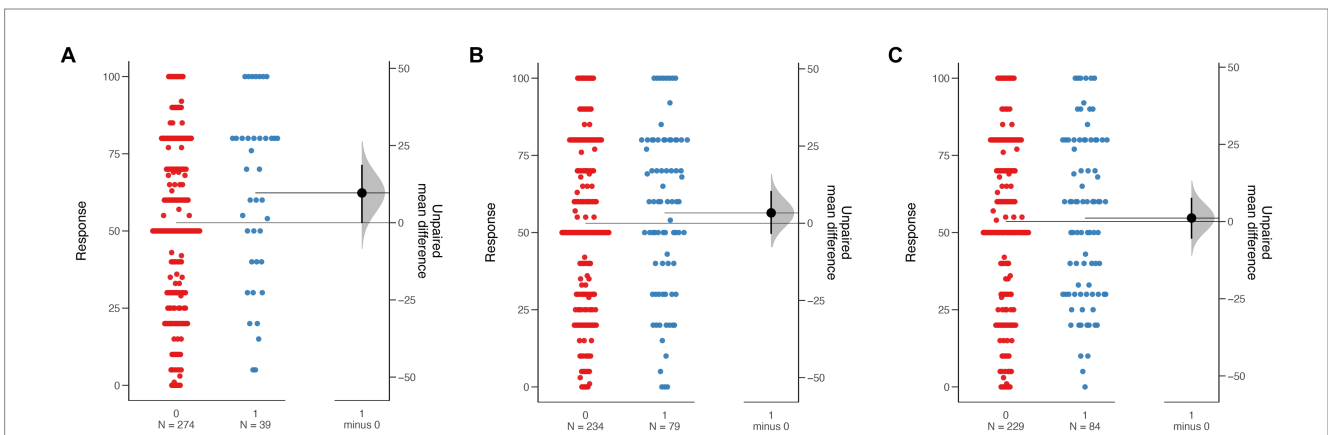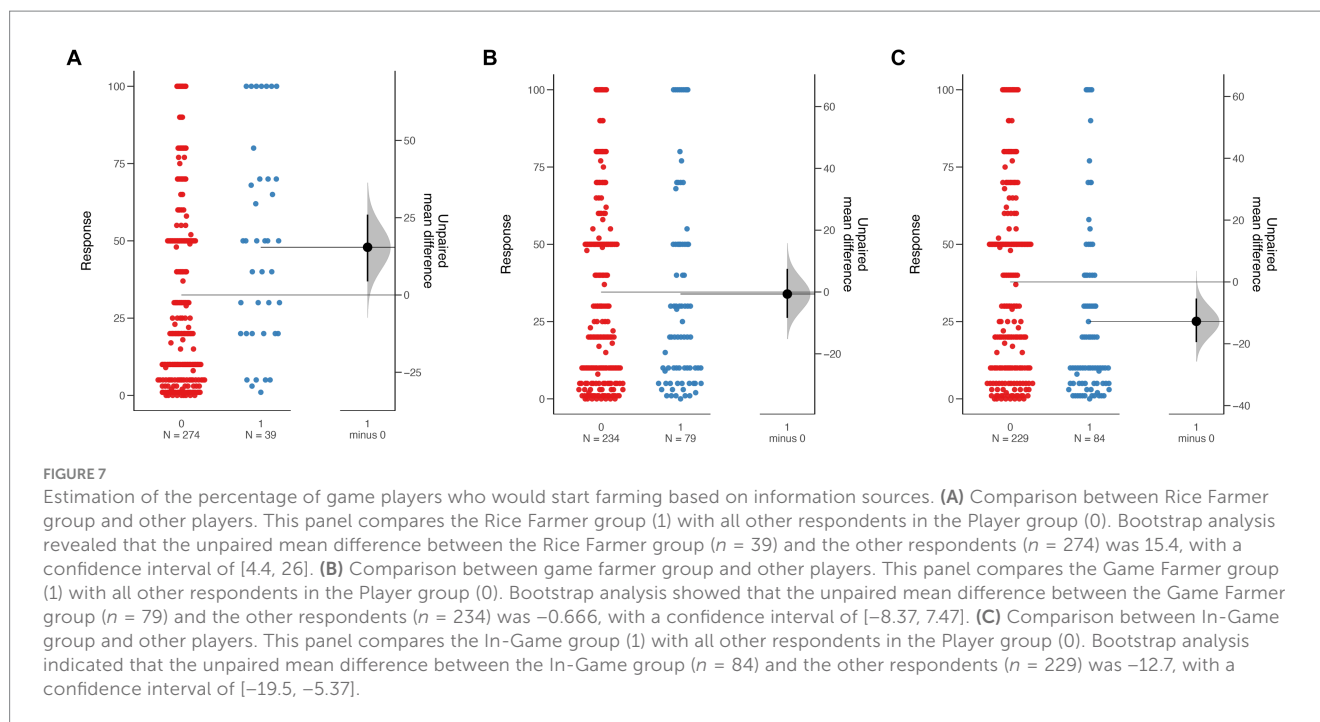

FIGURE 6
Estimation of the percentage of game players developing an interest in farming based on information sources. **(A)** Comparison between rice farmer group and other players. This panel compares the Rice Farmer group (1) with all other respondents in the Player group (0). Bootstrap analysis revealed that the unpaired mean difference between the Rice Farmer group (*n* = 39) and the other respondents (*n* = 274) was 9.64, with a confidence interval of [−0.122, 18.7]. **(B)** Comparison between Game Farmer Group and other players. This panel compares the Game Farmer group (1) with all other respondents in the Player group (0). Bootstrap analysis showed that the unpaired mean difference between the Game Farmer group (*n* = 79) and the other respondents (*n* = 234) was 3.35, with a confidence interval of [−3.45, 10.4]. **(C)** Comparison between In-Game group and other players. Additionally, the In-Game group (1) is compared with all other respondents in the Player group (0). The analysis indicated that the unpaired mean difference between the In-Game group (*n* = 84) and the other respondents (*n* = 229) was 1.14, with a confidence interval of [−5.55, 7.7].

respondents who played, viewed, or knew about the game expressed a desire to start farming, reflecting a measurable impact. However, this figure falls short of the 17.8% who experienced a heightened interest in agriculture, underscoring the notion that transitioning from interest to action—specifically, embarking on farming—entails more substantial challenges. This led to the conclusion reached by Georgiou et al. (2023) regarding the behavior change games: our findings suggest that, although the commercial game *Sakuna* promoted pro-agricultural attitudes, its effect on behavior remained unproven.

Differences in the impact of playing, viewing, or knowing about the game on fostering agricultural interest were not statistically significant. Yet, individuals in the Player group exhibited a stronger inclination toward starting farming than those in the Non-player/viewer group. This distinction is consistent with previous discussions of differences in the way interactive game players and passive viewers experience games (Kätsyri et al., 2013; Juvrud et al., 2022; Polman et al., 2008), and we extended this discussion with the finding that there are differences in behavior change expectations across the groups. Our study results suggested that while passive engagement

FIGURE 7
Estimation of the percentage of game players who would start farming based on information sources. **(A)** Comparison between Rice Farmer group and other players. This panel compares the Rice Farmer group (1) with all other respondents in the Player group (0). Bootstrap analysis revealed that the unpaired mean difference between the Rice Farmer group (*n* = 39) and the other respondents (*n* = 274) was 15.4, with a confidence interval of [4.4, 26]. **(B)** Comparison between game farmer group and other players. This panel compares the Game Farmer group (1) with all other respondents in the Player group (0). Bootstrap analysis showed that the unpaired mean difference between the Game Farmer group (*n* = 79) and the other respondents (*n* = 234) was −0.666, with a confidence interval of [−8.37, 7.47]. **(C)** Comparison between In-Game group and other players. This panel compares the In-Game group (1) with all other respondents in the Player group (0). Bootstrap analysis indicated that the unpaired mean difference between the In-Game group (*n* = 84) and the other respondents (*n* = 229) was −12.7, with a confidence interval of [−19.5, −5.37].

with the game through viewing or knowing may kindle interest, active participation through gameplay more effectively inspires individuals to consider farming as a viable endeavor.

Expectations regarding the game's potential to encourage farming adoption were more pronounced among players than non-players (Figure 4A). This observation indicates that immersive experiences of agricultural tasks within the game might diminish perceived entry barriers to the field. The game's realistic depiction of farming tasks highlights the capacity of virtual experiences to mitigate perceived obstacles to entering agriculture.

In this study, we focused not on educational games used specifically for training new farmers, but on a commercial game. This approach revealed that the rice farming simulation game not only motivates players to consider starting farming but also has the potential to spark interest in agriculture among those who previously had no connection to the field. This suggests that the game can serve as a gateway for individuals unrelated to agriculture to develop an interest in farming. Moreover, even merely viewing gameplay can provide an initial spark of curiosity.

The role of game streaming and social media in disseminating information about the game is significant. Agricultural stakeholders leveraging these platforms to share such content could potentially reach and engage a broader audience with latent interest in farming. While this study cannot definitively state the full extent of these platforms' influence, it highlights an important area for future research. Further analysis is needed to determine how game streaming and social media can effectively enhance interest and positive behavior toward agriculture.

4.2 The connection between gaming and the real world

One interesting aspect of playing this game is the emergence of connections to real-world agriculture. 34.5% of users consulted the

MAFF's website, and 30.0% turned to Zen-Noh's website for gaming strategies. On the other hand, agricultural experts also had high expectations for this game. As the introduction mentions, agricultural organizations have taken up the game as a social media discussion topic. Our comparative analysis of the expectations between Agricultural and Non-agricultural groups revealed that agricultural professionals may hold optimistic views regarding the game's ability to draw potential new farmers.

Additionally, 12.5% of players enhanced their in-game agricultural skills through advice from real-world experts, such as farmers. Analysis based on information sources revealed that those interacting with real-world experts harbored greater expectations for engaging in actual farming compared to solo players. This indicates that direct connections with experts may lower perceived barriers to farming, suggesting a significant role for expert advice in transitioning from virtual to real-world agricultural activities. In the real world, newcomers, especially those with non-agricultural backgrounds, face significant barriers to starting farming due to a lack of interpersonal networks, particularly connections with local farmers (Mailfert, 2007; Carlisle et al., 2019; Zollet and Maharjan, 2021). Leveraging these interpersonal networks can significantly aid in the transition from virtual to real-world farming. Expert advice and connections with real-world farmers can lower the perceived barriers to farming, providing game players with the necessary confidence and knowledge to pursue agricultural careers. Our findings suggest that these networks serve as crucial catalysts for agricultural career development, echoing the conclusions of Zollet and Maharjan (2021).

These interpersonal connections can be realized through proactive actions by game players or by coincidental acquaintance with farmers. However, agricultural stakeholders can also intentionally build connections between players and farmers. Organizing online or onsite events where game players can showcase their in-game skills and strategies might be a practical approach. Participation in such agricultural-related events and workshops can

strengthen their ties with actual agricultural communities, facilitating direct interactions with individuals possessing agricultural expertise and deepening the players' understanding of real-world farming activities. Drawing inspiration from other fields, such as Nissan's successful cultivation of professional race car drivers through the racing game *Gran Turismo* (Lefebvre et al., 2024), the rice farming simulation game holds promise for developing new farmers. By leveraging the educational and engaging aspects of the game, agricultural stakeholders could provide a pathway for players to transition from virtual farming to actual agricultural careers.

4.3 One practitioner's experience

The results presented above are based on respondents' self-evaluations to hypothetical questions and do not necessarily reflect actual changes in players' awareness or behavior. Additionally, our survey did not inquire whether respondents started farming after beginning the game. Therefore, the interest in agriculture or the motivation to start farming as a result of gameplay remains hypothetical, and claiming that such changes in awareness or behavior will lead to actual action might be somewhat exaggerated. To clarify this ambiguity, we examined the interview results with a practitioner who started farming due to the game.

The practitioner was 35 years old and began rice farming in Saitama Prefecture, a peri-urban area in Japan, in December 2021; he had been playing *Sakuna* since December 2020. He worked at a post office and had no farming experience. His friend's uncle had quit farming four or five years ago, and he could rent a piece of abandoned farmland for free. Therefore, he decided to start farming during holidays with four friends, including the friends mentioned above. While the four who had never played the game had started growing vegetables, he wanted to start rice farming because of the game's influence. He started by preparing soil for a paddy field stretching across 200 square meters (2 ares) of farmland.

In April 2022, he germinated seed rice and grew the seedlings. He insisted on starting rice farming from seed rice, whereas most rice farmers in Japan buy rice seedlings from agricultural cooperatives and plant them in the paddy fields using their rice transplanters. The game influenced his obsession with seed rice. After searching the internet for seed rice, which was difficult to find in retail stores, he obtained it from a seed and agricultural materials sales company in Kyoto, Japan. Using a bucket, he disinfected the seed rice, selected seeds using salt water, and germinated them. Although he understood the overall procedure because of his experience with the game, he obtained information on the detailed techniques by searching the internet. For example, in the game, salt and mud were used for seed selection, but in reality, ammonium sulfate is easier to use. Therefore, he tried to obtain ammonium sulfate. However, because it was difficult to obtain ammonium sulfate, he decided to use salt, which is readily available in supermarkets. Thus, the rice farming techniques used in the game could actually be dated to a time before the early Showa Era (about 100 years ago or more); because more efficient modern agricultural techniques could be adopted quickly, he tried them. While rice planting in the game had to be performed manually by using a hoe, he used a tractor that was stored on the rented farmland. He used a rice transplanter for planting rice, but the threshing machine was too

expensive; therefore, he used the services of a company in a neighboring prefecture that could thresh the rice for him. He now enjoys rice farming as a hobby to such an extent that he can do it by himself.

Regarding knowledge about rice farming, he not only used the internet as a source of information but also tried to obtain advice from acquaintances who grew rice. During his work as a mail carrier, he came in contact with several rice growers. Prior to engaging in the game, he had never discussed rice farming with them. He consulted them when he decided to begin farming rice. They advised him that rice farming would be a battle against weeds and told him that it would be difficult to pursue it seriously. Manually removing the marsh dewflower was the most arduous rice-growing task that he experienced. Weeding had been one of the most crucial tasks in the game as well. However, as advised by rice farmers, he found actual weeding much more arduous than the weeding in the game. He also asked them for advice whenever he had any trouble with rice farming. As he had progressed in his in-game rice farming, he had paid closer attention to the conditions of the surrounding rice paddies, which he had never paid attention to before, and his view of the scenery in his daily life changed.

In our discussions, we explored his expectations regarding the game's influence on fostering an interest in agriculture, as in our above-discussed survey. He anticipated that 75% of players would develop an interest in agriculture through the game, while 50% might consider initiating farming practices. When queried about the feasibility of the latter percentage, he acknowledged the substantial barriers to starting a farm, such as the necessity for land and water. However, he posited that if home gardening or hobby farming were considered, half of the players might engage in some form of agricultural activity. This perspective broadens the conventional view of farming from a professional endeavor to include agricultural pursuits as a hobby.

Furthermore, the respondent highlighted the value of consulting with experienced rice farmers in overcoming various obstacles to farming, such as accessing resources and technologies. He shared his personal experience of entering farming, noting that while he managed to lease farmland, his agricultural venture would not have been feasible without the support of a friend's uncle, who provided essential guidance and resources. This underscores the significant role of community and personal networks in facilitating entry into agriculture, whether as a profession or a hobby.

In summary, the interview with the practitioner who started rice farming due to the game revealed not only the initiation of rice farming but also the influence of the game on practices like focusing on seed rice and perspectives on rice paddy landscapes. He also added that people influenced by games or anime, or those desiring to acquire things similar to what they see in these media, likely exist in significant numbers. However, he adapted to real-world farming by incorporating modern techniques, recognizing the greater difficulty of actual farming compared to the game. The ability to adapt to these differences between the game and reality could be a barrier to starting and continuing farming. On the other hand, considering that consulting with rice farmers contributed to lowering the barriers to starting farming, the interview confirmed the importance of interpersonal connections in beginning agriculture.

Given the limited existing research on the impact of commercial farming simulation games on real-world agricultural behavior, we approached this study as an exploratory investigation. This approach allowed us to derive meaningful insights and establish a foundational understanding of how such games can influence

agricultural interest and behavior. The combination of quantitative survey data and qualitative interviews enriched our analysis, providing deeper insights into the personal experiences and motivations of individuals who transitioned to farming after playing the game. While our study only included one interviewee who changed their behavior due to the game, future research should include more case studies to increase the robustness of the findings. This mixed-methods approach strengthened the reliability of our findings and offered valuable insights into the broader implications of farming simulation games.

5 Conclusion

This study utilized results from an online questionnaire survey to investigate whether playing a rice farming simulation video game, *Sakuna: Of Rice and Ruin*, could stimulate interest in agriculture and motivate players to start farming in the real world. Our analysis indicated that the game indeed sparked interest in agriculture and, to some extent, encouraged players to consider farming. We also observed that individuals involved in agriculture held optimistic views about the game's potential impact. Moreover, respondents with connections to both the gaming and real worlds anticipated a higher likelihood of players starting farming compared to those engaged solely in the gaming world. An interview with a practitioner who started farming influenced by the game suggested that such connections could reduce barriers to entering agriculture.

While it would be premature to conclude that encouraging young people to play farming simulation games is a definitive solution to reversing the decline in Japan's farming population and achieving sustainable agriculture, this study highlights the existing expectations that such games can foster agricultural interest and potentially lead to farming. The next step involves identifying necessary environmental improvements and support mechanisms to make these expectations more realistic. If future developments align with these expectations, raising awareness through such games could contribute to addressing the decline in the agricultural workforce.

Future research should focus on longitudinal observation to determine whether game players actually take up farming, distinguishing between farming as a profession and as a hobby or lifestyle. Specifically, following up with respondents at regular intervals, such as annually, could provide valuable insights into their actual engagement in farming activities. Methods such as repeated surveys, in-depth interviews, and participatory observation could be employed to gather comprehensive data on how virtual farming experiences translate into real-world agricultural practices. This approach would offer a more robust understanding of the long-term effects of farming simulation games on real-world farming motivation, attitude, and behavior. This research will be crucial in tracking actual behavioral changes and understanding the long-term impact of gaming on agricultural engagement.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements for online surveys. On the other hand, the interviewee has provided written consent for their real names to be mentioned in the acknowledgments of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomp.2024.1392862/full#supplementary-material

References

Ali, A., Paliktzoglou, V., Gatzoulis, C., and Abedallat, O. A. (2017). Raising awareness on hydroponics via an educational video game using an indirect teaching method. 2017 9th IEEE-GCC Conference and Exhibition (GCCCE), Manama, Bahrain, 1–6. doi: 10.1109/IEEEGCC.2017.8448136

Anderson, G. F., and Hussey, P. S. (2000). Population aging: a comparison among industrialized countries. *Health Aff.* 19, 191–203. doi: 10.1377/hlthaff.19.3.191

Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., et al. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and Western countries: a meta-analytic review. *Psychol. Bull.* 136, 151–173. doi: 10.1037/a0018251

Carlisle, L., de Wit, M. M., DeLonge, M. S., Calo, A., Getz, C., Ory, J., et al. (2019). Securing the future of US agriculture: the case for investing in new entry sustainable farmers. *Elementa* 7:17. doi: 10.1525/elementa.356

Carvalho, C. V., Rodríguez, M. C., Nistal, M., Hromin, M., Bianchi, A., Heidmann, O., et al. (2018). Using video games to promote engineering careers. *Int. J. Eng. Educ.* 34, 388–399.

Crespo-Martinez, E., Bueno, S., and Gallego, M. D. (2023). A video game for entrepreneurship learning in Ecuador: development study. *JMIR Formative Res.* 7:e49263. doi: 10.2196/49263

Cutler, D. M., Poterba, J. M., Sheiner, L. M., Summers, L. H., and Akerlof, G. A. (1990). An aging society: opportunity or challenge? *Brook. Pap. Econ. Act.* 1990, 1–73. doi: 10.2307/2534525

de la Vega, G. J., Falconaro, A. C., Soria, L., and Corley, J. C. (2022). Integrated Pest management education: a video-game to improve management of Drosophila suzukii, Soft-Skin Fruit Pest. *Neotropical Entomol.* 51, 801–807. doi: 10.1007/s13744-022-00977-4

Famitsu. (2021). Special interview: the making of *Sakuna: of Rice and ruin*, a thoroughly pursued real rice farming. Shukan Famitsu, Kadokawa Game Linkage, 30–35.

Ferguson, C. J. (2008). The school shooting/violent video game link: causal relationship or moral panic? *J. Investig. Psychol. Offender Profiling* 5, 25–37. doi: 10.1002/jip.76

Georgiou, Y., Hadjichambis, A. C., Paraskeva-Hadjichambi, D., and Adamou, A. (2023). "From gamers into environmental citizens": a systematic literature review of empirical research on behavior change games for environmental citizenship. *Multimodal Technol. Interact.* 7:8. doi: 10.3390/mti7080080

Greitemeyer, T., and Mügge, D. O. (2014). Video games do affect social outcomes: a Meta-analytic review of the effects of violent and prosocial video game play. *Personal. Soc. Psychol. Bull.* 40, 578–589. doi: 10.1177/0146167213520459

Ho, J., Tumkaya, T., Aryal, S., Choi, H., and Claridge-Chang, A. (2019). Moving beyond P values: data analysis with estimation graphics. *Nat. Methods* 16, 565–566. doi: 10.1038/s41592-019-0470-3

Jöhr, H. (2012). Where are the future farmers to grow our food? *Int. Food Agribusi. Manag. Rev.* 15, 9–11. doi: 10.22004/ag.econ.129168

Juvrud, J., Ansgariusson, G., Selleby, P., and Johansson, M. (2022). Game or watch: the effect of interactivity on arousal and engagement in video game media. *IEEE Transact. Games* 14, 308–317. doi: 10.1109/TG.2021.3073084

Kätsyri, J., Hari, R., Ravaja, N., and Nummenmaa, L. (2013). Just watching the game ain't enough: striatal fMRI reward responses to successes and failures in a video game during active and vicarious playing. *Front. Hum. Neurosci.* 7, 1–13. doi: 10.3389/fnhum.2013.00278

Keller, C., Makarova, E., and Döring, A. K. (2023). Career choice with the serious game Like2be. *Int. J. Game-Based Learn.* 13, 1–18. doi: 10.4018/IJGBL.327788

Lefebvre, F., Malinen, V., and Karhulahti, V.-M. (2024). Sociohistorical development of Sim racing in European and Asia-Pacific esports: a cross-cultural qualitative study. *Convergence*. doi: 10.1177/13548565231222172

Mailfert, K. (2007). New farmers and networks: how beginning farmers build social connections in France. *Tijdschr. Econ. Soc. Geogr.* 98, 21–31. doi: 10.1111/j.1467-9663.2007.00373.x

Markey, P. M., Markey, C. N., and French, J. E. (2015). Violent video games and real-world violence: rhetoric versus data. *Psychol. Pop. Media Cult.* 4, 277–295. doi: 10.1037/ppm0000030

Marvelous Co., Ltd.. (2021a). Business report for the fiscal year ending. Available at: https://corp.marv.jp/library/img/jigyohokoku4q2021.pdf (Accessed February 28, 2024).

Marvelous Co., Ltd. (2021b). Interim business report for the fiscal year ending March 2022. Available at: https://corp.marv.jp/library/img/jigyohokoku2q2022.pdf (Accessed February 28, 2024).

Matsumura, N. (2023). My *Story of Seasons* began: enchanted by the game, I became a dairy farmer in Betsukai, Hokkaido. Nihon Nogyo Shinbun. Available at: https://www.agrinews.co.jp/society/index/200568 (Accessed February 28, 2024).

McGonigal, J. (2011). Reality is broken: Why games make us better and how they can change the world. New York: Penguin Press.

Mitsubishi UFJ Research and Consulting (2022). Trends in online gaming. Available at: https://www.caa.go.jp/policies/policy/consumer_policy/caution/internet/assets/consumer_policy_cms106_220630_08.pdf (Accessed June 1, 2024).

Nagasawa, M., Nanseki, T., and Machida, T. (2006). Development of a game for entrants into farming and farm village life. Agricultural. *Inf. Res.* 15, 349–358. doi: 10.3173/air.15.349

Perry, R., Drachen, A., Kearney, A., Kriglstein, S., Nacke, L. E., Sifa, R., et al. (2018). Online-only friends, real-life friends or strangers? Differential associations with passion and social capital in video game play. *Comput. Hum. Behav.* 79, 202–210. doi: 10.1016/j.chb.2017.10.032

Polman, H., de Castro, B. O., and van Aken, M. A. G. (2008). Experimental study of the differential effects of playing versus watching violent video games on Children's aggressive behavior. *Aggress. Behav.* 34, 256–264. doi: 10.1002/ab.20245

R Core Team (2023). R: A language and environment for statistical computing. R foundation for statistical computing. Vienna, Austria. Available at: https://cran.r-project.org/web/packages/report/vignettes/cite_packages.html.

Schutte, N. S., Malouff, J. M., Post-Gorden, J. C., and Rodasta, A. L. (1988). Effects of playing videogames on Children's aggressive and other behaviors. *J. Appl. Soc. Psychol.* 18, 454–460. doi: 10.1111/j.1559-1816.1988.tb00028.x

TwitchTracker. (2024). Twitch statistics & charts. Available at: https://twitchtracker.com/statistics (Accessed February 28, 2024).

Wallinheimo, A.-S., Hosein, A., Barrie, D., Chernyavskiy, A., Agafonova, I., and Williams, P. (2023). How online gaming could enhance your career prospects. *Simul. Gaming* 54, 28–44. doi: 10.1177/10468781221137361

Yoo, H.-S., and Kim, S.-W. (2014). Virtual farmers training: realistic simulation with amusements using historic simulation and game storyline. *Int. J. Multimedia Ubiquitous Eng.* 9, 121–130. doi: 10.14257/ijmue.2014.9.5.11

Zollet, S., and Maharjan, K. L. (2021). Overcoming the barriers to entry of newcomer sustainable farmers: insights from the emergence of organic clusters in Japan. *Sustain. For.* 13:866. doi: 10.3390/su13020866