Survey Gamification: Engaging Generation Z

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This paper is about the development of a gamified application tailored to Generation Z (population born between 1997 and 2012) as an alternative to the text-based LimeSurvey (formerly PHPSurveyor). The study was conducted among students from the Department of Computer Science at University College Dublin. Data were analyzed from the perspectives of college learning, personal interest, and post-COVID hindsight. Engagement with the experimental application was examined in terms of participation rates, total time spent on the survey, and experiences shared by participants. Descriptive statistics were generated using the numerical data, while the textual results were explored semantically. The implementation of the gamified survey consisted of the development of mobile-first and web-based software with 80 integrated questions divided into 5 mini games. Each of the game series used a touch screen for interactivity as a way of providing multiple types of entertainment within the gamified software.

Keywords: survey gamification; education; interactive design; motivation

Introduction and background

Gamification can be described as designing game elements for non-game settings in order to influence user behavior (Caillois, 2001; Deterding et al, 2011; De Sousa Borges et al., 2014; Sánchez-Mena & Martí-Parreño, 2016; Koivisto & Hamari, 2019). Some researchers have suggested changing the term design to gameful design, emphasizing the incorporation of engagement triggers (Deterding et al., 2011; McGonigal, 2011; Hiltunen, 2016; Bell, 2017) that are appropriate for digitally minded participants. Thus, in a game-like context, two types of motivation can occur: intrinsic motivation, which implies internal satisfaction derived from accomplishing tasks, and the enhancement of extrinsic motivation, which is based on receiving praise or rewards (Deci & Ryan, 1985; Konetes, 2010; Larchen Costuchen, 2020; Hallifax et al., 2020).
In recent decades, computer- and mobile-assisted activities have been widely integrated into education to capture the attention of the new generation of learners, Generation Z /iGen (Palley, 2012; Larchen Costuchen, 2019; Saxena & Mishra, 2021). This tech-savvy cohort, born in the late 1990s and early 2000s and raised in the 2000s, has demonstrated an early familiarity with technology, developing stronger visual (imagery) skills than receptive auditory skills (Rothman, 2016; Cilliers, 2017; Azman et al., 2021). Today, Generation Z has immediate access to information and expects to get quick, timely responses when interacting with devices, icons, and applications (Purcell et al., 2012; Wang et al., 2022). A recent iGen corpus comprising 70 million words of age-specific English language (text messages, images, videos, memes, and emojis) by Katz et al. (2021) underscores the visual component in contemporary communication. The education sector (schools and universities) has become one of the top implementers of gamification, as poor performance in this sector is related to learner boredom in the digital age (Pekrun et al., 2010; Hamari et al., 2014; Metwally et al., 2021). This has led to the search for new tools that would improve Generation Z participants’ engagement in their classroom activities and overcome obstacles related to the monotony of some training programs.

The academic literature has found gamification to provide a number of potential benefits in 21st-century education in terms of participation rates (Bailey et al., 2015; Guin et al., 2012; Cechanowicz et al., 2013; Harms et al., 2015; Aubert & Lienert, 2019), but some issues have also been reported that need to be considered, such as the effects of increased competition among participants (Hakulinen et al., 2013), difficulties in task evaluation (Domínguez et al., 2013), and performance losses (Hammed et al., 2021). Two decades before gamification, the academic literature discussed at length the design and implementation of web-based surveys intended to increase participant
response rates (Smith, 1997; Stanton, 1998; Dillman, 1998; Bosnjak & Tuten, 2001; Holtom et al., 2022). Mobile devices in conjunction with social media platforms have become another emerging potential for survey-based research in a number of fields, including education (Callegaro, 2010; Bosnjak et al., 2013; Maray, 2022). Both gamification and survey engagement use rewards (virtual or real incentives) and rely on user feedback and sense of accomplishment (level or questionnaire completion), personalization (customized design or content), and competition (leaderboards or comparisons).

In this paper, we propose that gamification can be a tool to engage participants in online surveys and thus avoid survey fatigue, positively affecting response rates in terms of quality and quantity (Turner et al., 2014; Rijshouwer & Van Zoonen, 2022). While gamification is a technique for increasing social engagement and motivation in business, commerce, medicine, sports, and other fields (Zichermann & Cunningham, 2011; Sánchez-Mena & Martí-Parreño, 2016), this paper focuses exclusively on the application of gamification in a Generation Z educational context and, specifically, on users’ experience of the experimental (gamified) survey developed by our team as a motivational alternative to traditional text-based surveys.

**Materials and method**

Adamou (2011) and Leung & Chan (2023) suggest that an entertaining human/computer or human/device interaction explored through a game-like experience helps to obtain data from respondents as they engage with the game. As suggested by Huang and Soman (2013), gamifying a task requires 5 steps (Table 1).

**Table 1. Five Steps of Gamification (adapted from Huang & Soman, 2013, p. 7)**

<table>
<thead>
<tr>
<th>Measures to be applied</th>
</tr>
</thead>
</table>

The field of online surveys often struggles with poor completion rates, low participation rates, and insufficiently representative overall samples (Puleston, 2011; Downes-Le Guin et al., 2012). Gamification toolkits aim to achieve desired psychological (i.e., motivation) and behavioral (i.e., performance) outcomes that are influenced by factors such as context, tasks, user characteristics, and affect (Puleston, 2011; Downes-Le Guin, 2012; Cechanowicz et al., 2013; Dolnicar et al., 2013; Hamari et al., 2014).

There has been active discussion in general of the impact of gamification on students’ flow experience, motivation, and enjoyment, and in particular of Csikszentmihalyi’s flow state (1997), a concept used to describe the power of motivation on people’s daily activities. Specifically, it relates to those tasks that provide a balance between the person’s ability and the challenge of the activity (Faiola et al., 2013; Oliveira et al., 2018; Oliveira et al., 2022). Scoring (Kifetew et al., 2017), receiving points, badges, and obtaining a better position on the leaderboard all depend on implementation (platform), but they can often also serve as currency (Huang & Soman, 2013) in a game. They can be used to show participants their progress, provide feedback, and highlight their rewards (Guin et al., 2012; Harms et al., 2015). Self-determination theory (SDT) attempts to explain how a person’s determination affects intrinsic motivation, i.e., people feeling more motivated to do something when they believe that their actions will have an effect on the outcome. According to Deci and
Ryan (2016), there are three main drivers: autonomy (actions based on one's own decisions), competence (the ability to complete a task), and connectedness to others (the need to feel connected to the other participants) (Trigueros et al., 2019).

The gamification project described in this paper pursued the following key objectives (KOs):

KO1: To provide a detailed proposal and implementation of a gamified application (as a motivational alternative to traditional survey mechanics).

KO2: To obtain engagement rates for both experimental and conventional surveys.

KO3: To provide a detailed outline of data collected via the experimental software.

KO4: To draw conclusions with respect to the data obtained (students’ academic challenges and personal interests).

The hypothesis of this study was that gamified software would elicit higher engagement among Generation Z participants compared to a traditional survey method. This required 80 text-based questions to be divided into 5 response categories (option-based answers, yes-or-no answers, Likert scale, free-text responses, or time-related responses). The mini games were to be designed in such a way that participants could use them on mobile touch screens.

The Mechanics-Dynamics-Aesthetics (MDA) framework (Hunicke et al., 2001; Hunicke et al., 2004; Ruhi, 2015; Moniaga et al., 2018) was used as the formal basis for the software design (survey introduction, questions and answers, user navigation between question categories, etc.). Mechanics, or game rules, were applied to player progression (points, badges, avatars, achievements, leaderboard, etc.). In the game-related context, dynamics were observed: decisions, chance, and constraints and
consequences (non-linear exploration in the game), together with players’ competition (Ruhi, 2015). Aesthetics (visual engagement) were used to create more interesting, diverse, and effective experiences for survey participants (Ruhi, 2015; Goethe, 2019). Moving between the three levels of MDA (Figure 1) allows the conceptualization of the dynamic behavior of a system, which is useful in analyzing players’ perspective and developing techniques for a more synergistic design (Hunicke et al., 2004).

The gamification-based progression was divided into three main phases: preparation of a text-based language survey; gamification of the survey for the experimental group; collection and analysis of qualitative and quantitative data. In January-February 2022, an application for a research ethics exemption was submitted to University College Dublin (ID: LS -E-22-39-Berbearu-Dev), and the study was deemed low-risk in terms of technical or ethical issues related to data sharing.

**Stages of modeling the software**

The modeling of gamified software was performed in several steps. An initial prototype of Figma (The Collaborative Interface Design Tool, n.d.) was proposed, in which touch interaction on handheld mobile devices was the main driver for survey responses. In addition, a web application suitable for desktop interaction was developed.
Next.js by Vercel (The REACT framework, n.d.) and Firebase (Google, n.d.) were used to develop the prototype, with implementation taking approximately 8 weeks. Subsequently, Clockify (n.d.) was applied to track the time spent on the process, while Gitlab (University College Dublin, n.d.) was used as the source control repository to store the software. After successful implementation, the software was deployed on Vercel's front-end cloud (Vercel, n.d.) and distributed through social media and communication channels. All data from the gamified survey were first collected in the Firebase Realtime Database (Google, n.d.a.) and then exported using Python (n.d.) for preprocessing and analysis. Results were anonymized and analyzed using SPSS 28.0 for Windows (IBM, 2021).

Proposal

Gamified¹ as an alternative to conventional²
An 80-question plain-text survey was split into 5 mini games for a gamified system development in line with the question category (Table 2).

Table 2. Mini games: question categories

<table>
<thead>
<tr>
<th>Question category</th>
<th>Proposed mini games</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Option-based answers</td>
<td>a) Match the Card</td>
</tr>
<tr>
<td>b) Yes/no answers</td>
<td>b) Thank you, Next!</td>
</tr>
<tr>
<td>c) Likert-scaled answers</td>
<td>c) Scale and Slide</td>
</tr>
<tr>
<td>d) Free-text answers</td>
<td>d) The Storyteller</td>
</tr>
<tr>
<td>e) Time-related answers</td>
<td>e) What’s the Time?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option-based answers</th>
<th>Yes/no answers</th>
<th>Likert-scaled answers</th>
<th>Free-text answers</th>
<th>Time-related answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you find prioritizing assignments?</td>
<td>Are you developing personal projects or new skills in your free time?</td>
<td>How do you find prioritizing assignments?</td>
<td>Please indicate whether you believe it is important or not to engage in extracurricular activities and why.</td>
<td>How many hours per week do you spend on a computer?</td>
</tr>
<tr>
<td>Very difficult</td>
<td>Yes</td>
<td>Very difficult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somewhat difficult</td>
<td>No</td>
<td>Somewhat difficult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
<td>Neutral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td></td>
<td>Simple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very simple</td>
<td></td>
<td>Very simple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Throughout the survey, participants could earn points by answering the questions, level up when certain predefined thresholds were reached, and decide what types of questions they wanted to address at a given time by selecting a specific mini game to play. The mini games themselves aimed to turn answering the questions into an engaging activity that used the touchscreen for interactivity. Ideas for the mini games included swiping left and right on questions with true/false or yes/no answers, using a slider to drag an answer to the question when the answer was on a scale, matching questions to answers (similar to a memory game), rolling dice to determine random assignment of questions or person’s choice (depending on loss/win), and providing an optional interactive timer for questions that asked about time spent on an activity. This mini-game series was born out of a desire for variety and multiple types of entertainment within gamified software, combined with a need to support the different types of questions the survey covered.

A plain-text version of the survey was created using LimeSurvey³ (former PHPSurveyor), which is an open-source package which allows users to develop and

publish online surveys, collect responses, generate statistics, and export the resulting data to other applications through a web interface. Unlike other similar software, LimeSurvey can export all results to an Excel spreadsheet or CSV file. To mimic the style of free exploration in the gamified tool, all questions were made accessible on one page for the experimental part. Since participants had the option to exit the survey early in the gamified version, none of the questions were marked as mandatory.

Survey gamification

An information sheet and a consent form were displayed at the entry point of the application. After consenting, the participants were automatically sent an email with a personalized link to their survey (Figure 2a). To create a username, participants were asked to select a preferred animal and color. The username was formed by combining the color and the animal chosen by the participants, i.e., for the chosen color “olive” and the chosen animal “dog” the username was “olivedog” (Figure 2b). It should be noted that while not all usernames were unique, each participant was identified by their unique API key generated during authentication, not by their username. The experimental mini games were designed to satisfy participants’ need to maintain constant engagement. As can be seen in Figure 3a, the free exploration option allowed respondents to freely navigate between the question categories represented by the minigames. The leaderboard (Figure 3b) was reset each week and was used to provide comparative feedback to participants (e.g., top five list). An additional element was used to contrast the "always winning" paradigm discussed by Guin et al. (2012). The participant could be qualified as a top 4 (on the top 5 list) if the scores obtained during the survey allowed it. A top-bar component, present throughout the survey, provided users with customized data (i.e., username and avatar, survey progress, timer, and number of points (Figure 4).
Figure 5 shows the 5 mini games (Match the Card, Thank You, Next!, Scale and Slide, The Storyteller, What’s the Time?) and a mini-game random-number generator (Throw the Dice). The latter served as a wild card to give a chance to those participants who did not know which mini game to choose. The term “mini” was used because the survey was considered an entire game. By answering the questions, participants could increase their score and advance in the game.

Table 3. Mini games plus randomizer

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mini game: Match the Card</strong></td>
</tr>
<tr>
<td>To answer the question, one of six answer cards must be selected. When an answer is clicked or touched (depending on the platform), a green frame appears on the answer box to mark the selection. To submit the answer, the participant must click “Submit”.</td>
</tr>
<tr>
<td><strong>Mini game: Thank You, Next!</strong></td>
</tr>
<tr>
<td>This part includes a swipe mechanism applied to the question card. It is supported by “yes” and “no” buttons. Moving the card to the right indicates a positive answer, while swiping left is interpreted as a negative answer.</td>
</tr>
<tr>
<td><strong>Mini game: Scale and Slide</strong></td>
</tr>
<tr>
<td>In this mini game, the answer must be given by pushing forward or backward. The answer changes depending on the position of the slider on the scale. As with Match the Card, the participant must click the “Submit” button before proceeding to the next question. The answers in this mini game are predefined and are fed into the Scale and Slide component. The answers are stored in the database in order of scale, from negative to positive, e.g., Strongly disagree, Somewhat disagree, Neutral, Somewhat agree, Strongly agree.</td>
</tr>
<tr>
<td><strong>Mini game: The Storyteller</strong></td>
</tr>
<tr>
<td>In this mini-game, participants are expected to compose text entries on the keyboard and click &quot;Send&quot; when they are finished.</td>
</tr>
<tr>
<td><strong>Mini game: What’s the Time?</strong></td>
</tr>
<tr>
<td>In this game, participants must answer using input keys for hours and minutes. The design is intended to resemble the appearance of the digits on a tilt clock. To continue, one must click the &quot;Submit&quot; button.</td>
</tr>
<tr>
<td><strong>Randomizer: Throw the Dice</strong></td>
</tr>
<tr>
<td>Participants are offered a roll of the dice where the computer randomly selects a mini game. The participants can then accept the computer's selection or play a mini game of their own choosing. This surprise is offered to make the gamified experience more attractive.</td>
</tr>
</tbody>
</table>

Participants were shown how far they had progressed in the survey, either visually with a progress bar on the question card or through a numerical ratio (Figure 6). Participants’ scores were recorded and updated in the database in the case of early
completion of the survey. All leaderboard data was retrieved through the leaderboard API endpoint and sorted in descending order of the points. An emoji card was presented at regular intervals during the survey, asking participants to provide feedback on their experiences using emojis (Figure 7). A message card was used to deliver notices to participants throughout the survey (e.g., server error, 404 error, end of survey, etc.) (Figure 8). One of the indicators of participants’ progress was the number of points that had earned. Table 4 shows the logic used to award points in the different mini games. The points awarded were calculated taking into account factors such as the size of the question category, the difficulty of answering the question, the quality of the data, and the insights that could be gained.

Table 4. Point calculation logic

<table>
<thead>
<tr>
<th>Mini game</th>
<th># Points awarded per question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match the Card</td>
<td>2 if answer is 'Other’, 4 otherwise</td>
</tr>
<tr>
<td>Thank You, Next!</td>
<td>3</td>
</tr>
<tr>
<td>Scale and Slide</td>
<td>4</td>
</tr>
<tr>
<td>The Storyteller</td>
<td>Maximum 8 awarded, with points increasing proportionally with answer size after number of words exceeds 4</td>
</tr>
<tr>
<td>What’s the Time?</td>
<td>3</td>
</tr>
</tbody>
</table>

To incentivize participants to continue and to monitor how they rated their experience at different stages of the survey, a level-up logic was implemented whereby participants went up one level each time they had answered a total number of questions divisible by 8. Also, upon reaching a higher level, they received the points corresponding to the new level (i.e., level 1 = 1 point, level 2 = 2 points, etc.) (Figure 9). Throughout the survey, the responses were stored separately to ensure that none were lost. The survey mechanism retrieved the partial, the mid-survey and end-of-survey feedback (Figure 10). Mid-survey feedback was obtained after completion of a
mini game (i.e., after successfully answering all questions belonging to a category). In this way, the application encouraged participants to suggest improvements to the specific mini game they had completed. Participants who wished to exit the survey early could do so by clicking the "Quit" button, after which the application showed them the rankings, gave them an acknowledgement, and collected the final metrics. Similar to the “Quit” feature, the “End Survey” option collected metrics and then directed participants to the feedback section at the end of the survey. The metrics collected included data on the order in which the mini games were played in free-exploration mode, total time spent on the survey, total time spent on each of the mini games, the total score in the survey, and the score for each mini game.

**Experimentation**

**Participants**

The experiment was conducted with students from the School of Computer Science at University College Dublin over a period of approximately one month in the spring of 2022. To qualify for inclusion, students had to be between 18 and 25 years old. Participants were recruited through the social platform Discord and by word of mouth. The total of 27 respondents were randomly divided into two groups, one of 15 who used the gamified application developed specifically for this study (experimental group) and another one of 12 who used the LimeSurvey version (control group). Before the gamified data could be analyzed, Python scripts were written by the software developer to export it to a user-friendly format. The information was converted from JSON to CSV and analyzed using descriptive statistics (frequencies and trends). Gamification data was thoroughly analyzed in terms of motivation and experience, with a subset of results relating to participants' opinions of the gamification solution. Detailed
comparative patterns for gender and age for both groups are not the focus of this paper, but will be examined in another, parallel study.

Results

Experimental vs LimeSurvey engagement

A total of 100% of the respondents completed the gamified version, with 86.6% of them (n=13) belonging to the targeted age group and the remaining 13.3% (n=2) belonging to the over-25 category. Of the 12 target-age participants who used the LimeSurvey questionnaire, only 58.3% (n=7) completed the survey, while 41.6% (n=5) did not. Average time spent on the survey and average completion rates were obtained for both methods. Overall, respondents spent more time on LimeSurvey than on the gamified version, with an average of 22m 54s for the experimental software and 21m 38s for the conventional (Figure 11).

Motivation in the gamified survey

Changes in participants' motivation were recorded using a Likert scale. Participants were asked the question “How motivated are you to continue with this survey?” after completion of each mini game (i.e., a maximum of 5 times). Figure 12 shows the changes in self-reported motivation recorded by 12 of the 13 participants.

The questions in the feedback at the end of the gamified survey also asked users to comment on their experience by rating the experimental software, indicating the survey experience they would be most likely to participate in again, and suggesting improvements to the overall gamified experience. Eight participants provided this feedback, five of whom confirmed that they would most likely participate in a gamified survey in the future. The question “Was this questionnaire boring?” elicited varying responses on a 5-point scale, as shown in Table 5, which shows descriptive statistics.
pertaining to the 8 participants’ evaluation of the gamified survey, with an average score of 6.3.

Table 5. Participants’ evaluation of the gamified survey

| Answer frequencies for “Which survey experience are you most likely to engage in again?” | Frequency | Percent |
| All | 1 | 12.5 |
| Gamified | 5 | 62.5 |
| Text-based | 1 | 12.5 |
| Verbal | 1 | 12.5 |
| Total | 8 | 100.0 |

| Answer frequencies for “Has this questionnaire been boring?” | Frequency | Percent |
| Strongly disagree | 2 | 25.0 |
| Somewhat disagree | 2 | 25.0 |
| Neutral | 1 | 12.5 |
| Somewhat agree | 2 | 25.0 |
| Strongly agree | 1 | 12.5 |
| Total | 8 | 100.0 |

<table>
<thead>
<tr>
<th>Descriptive statistics for “How would you rate this survey from 1 (very boring) to 9 (very entertaining)?”</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>8</td>
</tr>
<tr>
<td>Mean</td>
<td>6.3750</td>
</tr>
<tr>
<td>Median</td>
<td>6.5000</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.99553</td>
</tr>
<tr>
<td>Range</td>
<td>6.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>3.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>9.00</td>
</tr>
</tbody>
</table>

Results in mini games

The mid-survey and end-of-survey questions inquired about participants’ opinions and experiences with each of the 5 mini games. Figure 13 shows the total time spent in each mini game and on the exploration page. Participants dedicated a large portion of their time on the survey playing The Storyteller, followed by What’s the Time? One of the participants spent a significant amount of time on the exploration page, deciding which mini game to play next. Mini game rating was established based on participants’ evaluation of each mini game (Table 6).
Table 6. Mini game rating based on participants’ evaluation

<table>
<thead>
<tr>
<th>game</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Coef. Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thank You, Next!</td>
<td>11</td>
<td>6.27</td>
<td>5</td>
<td>1.56</td>
<td>5</td>
<td>9</td>
<td>24.79%</td>
</tr>
<tr>
<td>Match the Card</td>
<td>11</td>
<td>6.4</td>
<td>7</td>
<td>1.54</td>
<td>5</td>
<td>9</td>
<td>23.42%</td>
</tr>
<tr>
<td>The Storyteller</td>
<td>11</td>
<td>6.25</td>
<td>6</td>
<td>1.56</td>
<td>3</td>
<td>9</td>
<td>28.0%</td>
</tr>
<tr>
<td>What’s the Time?</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>1.75</td>
<td>2.2</td>
<td>9</td>
<td>37.27%</td>
</tr>
<tr>
<td>Scale and Slide</td>
<td>11</td>
<td>6.56</td>
<td>6</td>
<td>2.23</td>
<td>5</td>
<td>9</td>
<td>26.5%</td>
</tr>
<tr>
<td>Total rating</td>
<td></td>
<td>31.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27.04%</td>
</tr>
</tbody>
</table>

The coefficient of variation showed homogeneous data with little variability in scores, except for What’s the Time?, which had a slightly higher coefficient of variation than its counterparts. Qualitative feedback from participants confirmed that this mini game had weaknesses in question wording and in answer entry functionality. Some of the adjectives used for this game were “tedious”, “snappy” and “vague”. While the other mini games were not without flaws, they were mostly described as interesting (e.g., the use of the adjective “pleasant” for Match the Card, “entertaining” for The Storyteller, “quick” for Thank You, Next!, and “well suited” for Scale and Slide).

Participants' qualitative feedback on each mini game is shown in a word cloud (Figure 15).

**Free exploration and scoring**

Metrics related to game order were retrieved internally by software upon termination of the survey (either early or on completion). Data from 11 participants showed that 64% of respondents began the survey with the Scale and Slide mini game, followed by Thank You, Next! and Play the Card. Conclusions cannot be drawn about the success of the mini games, because the placement of the buttons may have had an impact on decision-making (access to Scale and Slide was located in the upper left corner, as shown in Figure 3). Game order is highly variable, with participants tending to skip The
*Storyteller* most often when using free-exploration mode, followed by *What’s the Time?* and *Scale and Slide*. In contrast, *Match the Card* was the game to which participants were least likely to return. Descriptive statistics were retrieved using participants’ evaluation scores. Despite the sample data’s low variability, the standard deviation value increased due to one participant’s atypically low score in comparison with the rest of the respondents. This made it necessary to use the Median Definition to summarize the data (Table 7).

**Table 7. Statistics for participants’ scores**

<table>
<thead>
<tr>
<th></th>
<th>Thank You, Next!</th>
<th>Match the Card</th>
<th>The Storyteller</th>
<th>What’s the Time?</th>
<th>Scale and Slide</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>45.8</td>
<td>50.5</td>
<td>49.9</td>
<td>63.8</td>
<td>45.5</td>
<td>294.8</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>48</td>
<td>52</td>
<td>48</td>
<td>66</td>
<td>48</td>
<td>307</td>
</tr>
<tr>
<td><strong>Std. Deviation</strong></td>
<td>4.6</td>
<td>6.2</td>
<td>8.4</td>
<td>13.6</td>
<td>7.2</td>
<td>41.9</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>32</td>
<td>32</td>
<td>38</td>
<td>24</td>
<td>24</td>
<td>171</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>48</td>
<td>56</td>
<td>69</td>
<td>75</td>
<td>48</td>
<td>316</td>
</tr>
<tr>
<td><strong>Coef. Variation</strong></td>
<td>10.2%</td>
<td>12.4%</td>
<td>16.9%</td>
<td>21.0%</td>
<td>15.8%</td>
<td>14.2%</td>
</tr>
</tbody>
</table>

**Insights obtained from the data**

The participants' responses to the survey's questions (collected via LimeSurvey and the gamified survey) provided insights on topics related to extracurricular activities, skills development, COVID-19 perspective, and time management. Regarding extracurricular activities, both survey methods yielded the same responses: when asked if they considered it important to participate in extracurricular activities, all participants agreed it was. Response categories included benefits to social life, relief from academic pressure, knowledge acquisition, and mental health (Table 8).

**Table 8. Examples of responses on extracurricular activities**

<table>
<thead>
<tr>
<th>Survey method</th>
<th>Social life</th>
<th>Relief of academic pressure</th>
<th>Knowledge acquisition</th>
<th>Mental health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### LimeSurvey

<table>
<thead>
<tr>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage in extracurricular activities</td>
<td>It’s important to engage in extracurricular activities in that such activities relieve the study pressure and augment my social network.</td>
</tr>
<tr>
<td>Do multiple things</td>
<td>Yes, it is very important. A person is well rounded if they do multiple things.</td>
</tr>
<tr>
<td>Gamified</td>
<td>Yes, good for mental and physical health to have a wide set of interests.</td>
</tr>
</tbody>
</table>

### Gamified

<table>
<thead>
<tr>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet people and learn new things</td>
<td>E.g., Yes, it is.</td>
</tr>
<tr>
<td>Broaden your general knowledge</td>
<td>Yes, as it gives a break from constantly being sat at a desk slaving over work and can clear your brain.</td>
</tr>
<tr>
<td>Rounded knowledge set and knowledge of the world</td>
<td>Yes, for a rounded knowledge set and knowledge of the world and how it works.</td>
</tr>
<tr>
<td>Gamified</td>
<td>E.g., It’s really important to engage in extracurricular activities as it helps you think better and you just feel better in general.</td>
</tr>
</tbody>
</table>

The type of extracurricular activities mentioned was also similar in both groups, with sports and music being the most preferred.

Regarding COVID-19 perspectives, the participants were asked to comment on how they were personally affected. Table 9 shows their responses to four questions, grouped into four possible classification categories. One of the limitations of the data collected was that some of the participants only answered with adverbs like “highly” or “immensely”, or phrases such as “study from home” or “I don’t like in-person exams” without adding any details indicating whether these answers should be considered positive or negative. If we apply the semantic scale, the unclassified responses could go into the category of “mixed”, “confusing” and “more negative than positive” feelings related to the COVID-19 pandemic. Overall, the majority of positive and negative responses pertaining to free-time and college-learning activities can be associated with the need for new and creative solutions.
<table>
<thead>
<tr>
<th>COVID-related questions</th>
<th>Negative opinion</th>
<th>Neutral position</th>
<th>Positive Opinion</th>
<th>Unclassified Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How has the COVID-19 pandemic influenced your personal interests?</td>
<td>E.g., Strongly. I lost interest in a lot of things I used to enjoy. E.g., Made me enjoy work from home</td>
<td>E.g., Not really E.g., Somewhat e.g., It didn’t</td>
<td>E.g., Encouraged me to travel towards the end as things re-open</td>
<td>E.g., Highly</td>
</tr>
<tr>
<td>How has the COVID-19 pandemic influenced your skill development?</td>
<td>E.g., Slowed it down E.g., Poorly, less physical application. E.g., Upscaling is more difficult E.g., It makes the development very slow. More motivation needed</td>
<td>E.g., It didn’t E.g., No E.g., Not much</td>
<td>E.g., Positively E.g., Increased my wish to learn new skills</td>
<td>E.g., Immensely E.g., N/A E.g., Unsure</td>
</tr>
<tr>
<td>How has the COVID-19 pandemic influenced your engagement with your university course?</td>
<td>E.g., Harder to engage, loss of interest for things E.g., Less motivation, less interaction, all less inspiring E.g., Terribly E.g., Pre-recorded lectures are a hassle to actually watch as you know you can watch them at any time</td>
<td>E.g., Neutral</td>
<td>E.g., I started studying a lot more E.g., Increased engagement E.g., It has increased my engagement E.g., More chances to review lecture videos</td>
<td>E.g., Studying a lot more E.g., Increased engagement E.g., It has increased my engagement E.g., More chances to review lecture videos</td>
</tr>
<tr>
<td>Please describe your perspective in relation to COVID-19 pandemic using three words.</td>
<td>E.g., An absolute mess E.g., Glad it’s over E.g., Introspective and tough</td>
<td>E.g., Break, calm, patience</td>
<td>E.g., Always say yes E.g., Opportunity, change, confusion</td>
<td>E.g., Hopeful, apprehensive, excited E.g., Unusual, hygiene, poor E.g., Wanting to start over</td>
</tr>
</tbody>
</table>
Analysis of participants' time management in relation to skill development and academic work provided interesting insights. Data obtained through the gamification survey showed that participants spent less time on skill development than on academic activities (attending college courses and studying) (Figure 16).

**Discussion of limitations**

The project encountered limitations in terms of technology, user interface, and gamification. The biggest limitation of the application concerned the use of gamification. Participants agreed that insufficient interactive tactics were used and that the game experience could be improved in the future. The most frequent improvements they suggested were emoji sliders, different colors, different incentives for earning points, and interactive, graphical, and more customizable avatars. As for the use of gamification tactics, some lack of gamification was noted in the length of the survey and in the points system. Some participants pointed out the need for an option to skip questions, a feature that had not reached the development stage. Regarding the scoring system, it should be improved by enhancing the variability and visibility of the points earned by answering a question, and by offering special incentives for playing a particular game, e.g., The Storyteller, which requires more thought and engagement. Regarding incentives, progression could also be revised so as to be tied to reaching point thresholds rather than numbers of questions answered. This would both make the survey more game-like and provide improved measuring of respondents' experience.

**Conclusion**
Traditional surveys have been criticized for their monotony, which causes participant behaviors such as lack of attention, random responding, speeding, and premature exit (Kaminska et al., 2010; Puleston, 2011; Guin et al., 2012). In contrast, gamified surveys have shown benefits in terms of user experience, engagement, and data quantity and quality (Guin et al., 2012; Cechanowicz et al., 2013; Dolnicar et al., 2013; Harms et al., 2015). Education, both at school and college level, now faces the challenge of adapting to a new digital generation, Generation Z, in order to meet its expectations and needs. Gamification of a plain-text survey is a challenging yet engaging task. Designing a gamified educational application (KO1) ideally requires collaboration between at least two developers and two education specialists so as to allow for internal reviews within the team. In terms of engagement rates (KO2), the experimental method showed 14% higher results compared to the LimeSurvey method, thereby confirming the hypothesis. However, further work needs to be done with a larger sample and data based on age and gender. The data collected using the experimental software (KO3 and KO4) was very useful, not only in terms of the information obtained (which is not the focus of this paper), but also as feedback for experimental design and implementation. Another interesting aspect to explore would be respondents’ engagement with the same question across different mini-game designs. Overall, as each successive generation becomes more digitally literate, more interactive solutions need to be designed, developed, and tested.

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**Disclosure statement** No potential conflict of interest was reported by the authors.
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List of figures:

Figure 1. MDA Framework for Game Design.

Figure 2. Email confirmation and username.

a. Email confirmation

b. Username

Figure 3. Exploration and leaderboard.
Figure 4. Progress bar.

Figure 5. Mini games plus randomizer.
Match the Card

Thank You, Next!
My assignments helped me improve skills directly related to my future career

Somewhat Agree

You answered ‘Yes’ to the question ‘I need to improve my hard skills’. Please justify your answer below:

Because I...

Submit
Figure 6. Progress bar and numerical ratio.
Figure 7. Emoji Card.

Figure 8. Message cards.
Figure 9. Level Up.

The page you requested could not be found.

Please ensure you have the correct URL and try again.

It seems like you've reached the end of this survey.

Thank you for participating!

Well done!

You reached level 3 and earned 3 points!

New Score:

143 ★
Figure 10. High-level answering mechanism.

1. retrieve answer
2. calculate timestamp
3. retrieve question, game and user identifiers
4. create object with answer, question identifier, game identifier, user identifier and timestamp
5. POST object to /api/midSurvey endpoint
6. remove answered question
7. update survey progress
8. if number of questions answered is divisible by 8
9. level up
10. if mini game is complete
11. redirect to mid-survey feedback
12. increase participant score
13. increase score earned in mini game
14. display next question

Figure 11. Gamified Method vs Conventional Method.

![Graph showing comparison between Experimental and Conventional methods]

- **Experimental**
  - Did not respond: 0%
  - Responded: 100%
  - Response rate: 72.30%
- **Conventional**
  - Did not respond: 41.60%
  - Responded: 58.40%
  - Response rate: 58.25%

Gamified n=12  LimeSurvey n=13

Figure 12. Participants’ motivation in 5 mini games.
Figure 13. Time spent in mini games and on the exploration page (in minutes).
Figure 14. Word cloud: Qualitative feedback for mini games.

Figure 15. Responses on time management.