
Choose Your Own Adventure! An empirical study on gamification of postgraduate learning on research project design

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KEYWORDS

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ABSTRACT

It is difficult to teach complex topics such as academic research to student cohorts who are widely heterogeneous in prior knowledge, learning goals, and learning preferences. Exploratory, quest-like approaches show promise for increasing engagement, personalisation, and autonomy, however, there is a lack of empirical data on which, if any, aspects of gamification can benefit learning. This paper presents analytics and qualitative responses to a Choose Your Own Adventure for postgraduate design of research projects. It focusses on non-linear navigation for self-directed personalisation, digital badges, and the role of narrative within a gamified learning tool. Results highlight high user attrition, effective personalisation of learning, high acceptance of gamification approaches, and much lower interest in some gamification elements, contributing value to the pedagogy of learning and teaching research skills.

Introduction

This article discusses the creation and evaluation of the Creative Thinking Quest, a gamified tool for scaffolding the various skills and activities required for conceptualizing and designing research and creative projects. The motivation for gamification came from a pragmatic epistemological stance in response to my critical reflections on one particular assessment within a 12-week, postgraduate course on research skills: a proposal for an academic research project in the creative disciplines. The assessment evidenced challenges for many students in high-level concepts (e.g. appropriately scoping their project so it is achievable), nuanced understanding of research methods, and detailed project planning (for example, writing concrete objectives that help to answer the research question.) Personal reflection and scholarly enquiry on submissions over a four-year period identified the need to more closely personalize learning content for the unusually diverse cohort of students on the course. The main challenges identified were the large number and diversity of the intended users and the widely acknowledged difficulties of teaching higher-order learning outcomes related to

research skills in Higher Education (cf. Hamnett & Korb, 2017; Ryan et al., 2014). Recent meta-analyses of gamification in formal education conclude that gamification has the potential to enhance aspects of all three learning domains: cognitive, affective, and behavioural outcomes (Huang et al., 2020; Ritzhaupt et al., 2021; Sailer & Homner, 2020), although the latter notes a greater effect in schools (as compared to HE) for cognitive outcomes (Sailer & Homner, 2020, p. 105), reiterating the challenges of meaningfully teaching research skills at postgraduate level.

Therefore, action research was undertaken to improve cognitive, affective, and behavioural outcomes related to the knowledge and practice of research design, using gamification to attempt to address key challenges of meaningful personalisation and scaffolding at large scale, and motivation towards learning a “dry” topic (Ryan et al., 2014). Action research as a reflective, collaborative methodology can provide a systematic approach to developing evidence-based teaching practices. It is particularly useful for allowing exploration and cyclical evaluation of innovative instructional practices as it provides a much-needed evidence-base, encouraging teachers to critically examine their own assumptions about teaching and learning and create transformative practice (Weller, 2019, pp. 292–3). This paper presents empirical evidence of a gamified approach, along with critical reflections on ways to use findings in enhancement of practice for research skills teaching.

For the avoidance of doubt, this article uses the definition of gamification proposed by Deterding et al. (2011), “the use of game design elements in non-game contexts” (Deterding et al., 2011, p. 9), which distinguishes it from both ‘playful learning’ and ‘game-based learning.’ Playful learning is defined by Whitton & Moseley (2019) as an intrinsically motivated, player-led activity and, along with others (e.g. James & Nerantzi, 2019), they note the advantages of play in adult education as it includes constructivist educational strategies, self-supported learning, strategies for engagement, and signifiers of experimentation and exploration. Within the Creative Thinking Quest tool that arose from this action research, learning content is not delivered as an integrated game but rather a quest containing game elements of choices, puzzles, and badges (for personalisation, consolidation, and motivation respectively), and activities to perform, directly relevant to a real research project design. In other words, the play elements are typically separated from the learning elements. Nevertheless, this gamification strategy shares many of the advantages of both playful and game-based learning in this context. The self-scaffolded nature of a quest format allows for high degrees of relevance and preference for students learning research design and reflects the inherent uncertainty of postgraduate research (McCulloch, 2013). Furthermore, exploratory learning formats such as quests create high learner agency, encouraging autonomy, self-direction, and meta-cognition (Blaschke, 2021) – all crucial skills for postgraduate research.

Study aims and objectives

This study's main aim was to determine if and how a gamified learning tool for research design is effective.

Sub-questions focussed on whether the tool could deliver usefully personalised learning content, the impact of narrative and achievement badges, and overall acceptance of gamified approaches for this topic.

This paper provides useful empirical data and insights that contribute to the developing pedagogy of research methods, focussing on active learning strategies (for more context see Nind & Katramadou, 2023; Saeed & Al Qunayeer, 2021), in particular, gamification.

Research Context

It is important to begin by noting that gamification as a concept has existed for centuries, and has taken on new meanings since becoming popularised as a term in the 2000s. Gamification is continually evolving and now includes a wider range of mechanics, including sophisticated digital tracking. Nevertheless, despite a wider range of gamification strategies now being used, it is still broadly understood as a layer of game mechanics and/or aesthetics being applied to a "normal activity" to encourage (or discourage) certain behaviours (Hon, 2022, p. 10). A recent meta-analysis of gamification in education (Ritzhaupt et al., 2021) states that much of the focus has been on 'pointification', i.e. points, leaderboards, badges, or a combination of all three. They note the potential for the integration of more gamification elements, mentioning specifically the key gamification elements of: quests, personalisation, non-linear navigation, and narrative (2021, pp. 2497–2499) and suggest that future empirical gamification studies and practices should explicitly consider game elements "beyond mere pointification" (2021, p. 2516). Importantly, this meta-analysis also identifies that the latter three elements are rarely seen in previous studies on gamification in education (2021, p. 2507) making this paper a valuable contribution.

The rationale for using game-like approaches for teaching research skills is clearly outlined by previous research (e.g. Kollars & Rosen, 2017 and Abbott, 2019), identifying games' advantages for motivation, reduction of anxiety, applied approaches for obvious relevance to students, and metacognition. Learning outcomes specific to research skills and research methods training need to span cognitive, affective, and behavioural domains, and are widely acknowledged as presenting challenges for pedagogical practice (Nind & Katramadou, 2023) that game-like strategies, which foreground student-centred, active and experiential learning, can fruitfully address. An online list of Research Support Games (Bray & McCutcheon, 2021) gives a good indication of existing game-like approaches to teaching research skills. Of the games listed, most address a topic related to research (e.g. copyright, Open Access, publishing) rather than the design of research projects. Three games cover the research process, either directly or tangentially, and one is focussed on research

methods. None directly address project design. My own further review identified a wide range of other examples, including games for library research (Tekluve et al., 2015), critical thinking (Gusmanson & University of Cambridge, n.d.) evaluation of sources (Walsh, 2018), and PhD induction (Watson et al., n.d.) amongst many others. Only one example identified covered the research design process in detail, where, using inspiration from previous work (Kollars & Rosen, 2017), the research design process is mapped onto a “creative and collaborative”, scaffolded murder mystery framework (McCarty, 2021, p. 624). This study had a similar goal in that developing a realistic independent research project was a core learning outcome. Both of these studies note clear advantages for student confidence and motivation.

In terms of gamification, no examples covering research design were found that went beyond superficial pointification (e.g. snakes and ladders with quiz questions). However, three examples relevant to academic skills development used non-linear narratives to present information based on user choices: Research Data Management Adventure (*Research Data Management Adventure*, n.d.); Open Axis (Brennan, 2021); and DLTE Quest (Illingworth & Abbott, 2022). Analysis of this approach notes that “Gamification can be a useful tool to explain concepts with lots of “it depends” answers. Crucially, games acknowledge that there are many different paths to success, much like scholarship” (Brennan, 2021) and that “fun”, interactive exploration of a topic is “a refreshing alternative to trawling through pages of intranet materials” (Illingworth & Abbott, 2023). Non-linear navigation is also identified by Ritzhaupt et al. (2021) as the only gamification element that has a statistically significant positive effect on behavioural outcomes, and they identify “a lack of empirical studies that explore the potential of these gamification elements in educational practice” (2021, p. 2516). This quest-like approach therefore shows promise for the development of new learning tools.

Design and Implementation of the Learning Tool

To address the challenges of teaching research project design to a very diverse cohort of students, an intervention entitled Creative Thinking Quest was developed. Figure 1 shows the development workflow. The first stage was to review existing useful materials for the intended audience, which here explicitly included people conceiving and designing a creative project as well as

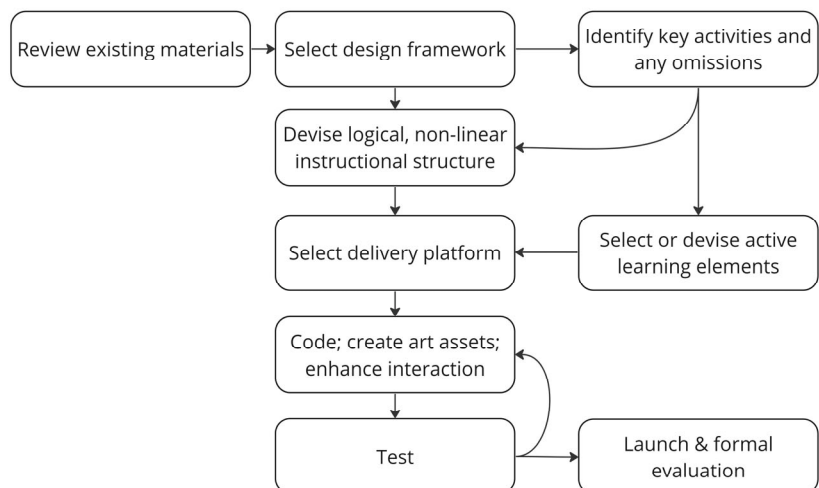


Figure 1 - Design workflow for Creative Thinking Quest

those doing more formal research project design (with a non-exclusive focus on academic settings).

Considering the full range of necessary activities from idea generation through to formal brief-writing, various tools were consulted. Due to its wide applicability across the research design process, alignment with the critical thinking learning outcomes, and availability under a Creative Commons BY-NC licence, the Creative Thinking Card Deck by School of Thought (*Creative Thinking Cards Deck*, n.d.) was selected as the main resource, with other useful tools or games also informing the design process and/or being later incorporated as 'prizes' (e.g. *Smudge Skittle*, n.d.)

The next steps were to selectively choose the key activities from the Creative Thinking Deck, undertake analytical structuring for well-scaffolded instructional design, and identify learning outcomes that were important for the context of this tool but missing from the Creative Thinking Cards (e.g. consideration of ethics, writing project objectives, data management). A logical structure was then devised that allowed for personalisation by offering choices between digging deeply into a particular set of activities or skipping them, and offering alternative formats for activities (for example, visual vs. textual brainstorming). Based on these requirements, the instructional design coalesced into a non-linear Choose Your Own Adventure (CYOA) format, including elements from classical quests such as a mentor, a series of trials, enemies to fight, and periodic recapitulation/revision of the project idea. CYOAs are just one example of interactive, or personalised pathways through material, where the user takes on the role of the protagonist in a story whose choices (to a greater or lesser extent) determine the plot and outcomes. Therefore, they usefully share characteristics with the concept of learner journeys in education (Abbott, 2020). Non-linear content, including CYOAs, tend to fall into a set of recurring patterns that affect how users engage with them. For example, a binary choice at each node will branch out into many completely divergent but relatively short paths, suitable for multiple playthroughs, whereas a largely linear path with quickly rejoining side branches leads to a relatively consistent experience where users will see most of the content. As can be discerned from Figure 2, the Creative Thinking Quest combines elements of the 'branch and bottleneck' and 'quest' structures (as defined by Ashwell, 2015), which allow a high degree of personalisation and deep exploration within conceptually clustered nodes, whilst simultaneously directing learners towards the most important and universally useful learning content.

The following simultaneous stages were to consider when and how activities could be made more active with the inclusion of short playful interventions (as opposed to text instructions), including some gated content that requires users to demonstrate knowledge to access; and to consider a platform that could deliver the functionality required. A range of interactive web tools (e.g. *Flippity*, n.d.; *Scratch*, n.d.; *ThingLink*, n.d.) were used to aim to increase engagement and active learning, and the open-source, interactive narrative platform Twine (*Twine*, n.d.) was selected for its relative ease of use and ability to export to a single html file into which

the other web-based tools could be embedded.

Next followed a series of short, iterative prototyping and testing phases where the 'chunked' learning content was encoded into a non-linear quest format, all active learning enhancements were designed and embedded, and the quest was given a simple 'skin' inspired by retro digital text-based adventures. Images were created where appropriate (typically by original creation or sourcing and restyling existing Creative Commons images) and a simple narrative based on a fantasy-themed journey was written. Feedback from initial testing phases with small groups led to additional content being added for users developing projects in groups (presented as a 'side quest'), additional games, achievement badges, and a change in art style. The Creative Thinking Quest was launched and disseminated to the general public in October 2021 through the Itch.io game hosting website (Itch.io, n.d.). Figure 2 shows all 82 linked nodes of the final quest within the Twine software and has been annotated with overlaid shapes and text to show conceptual stages, formulated as chapters within the overall narrative.

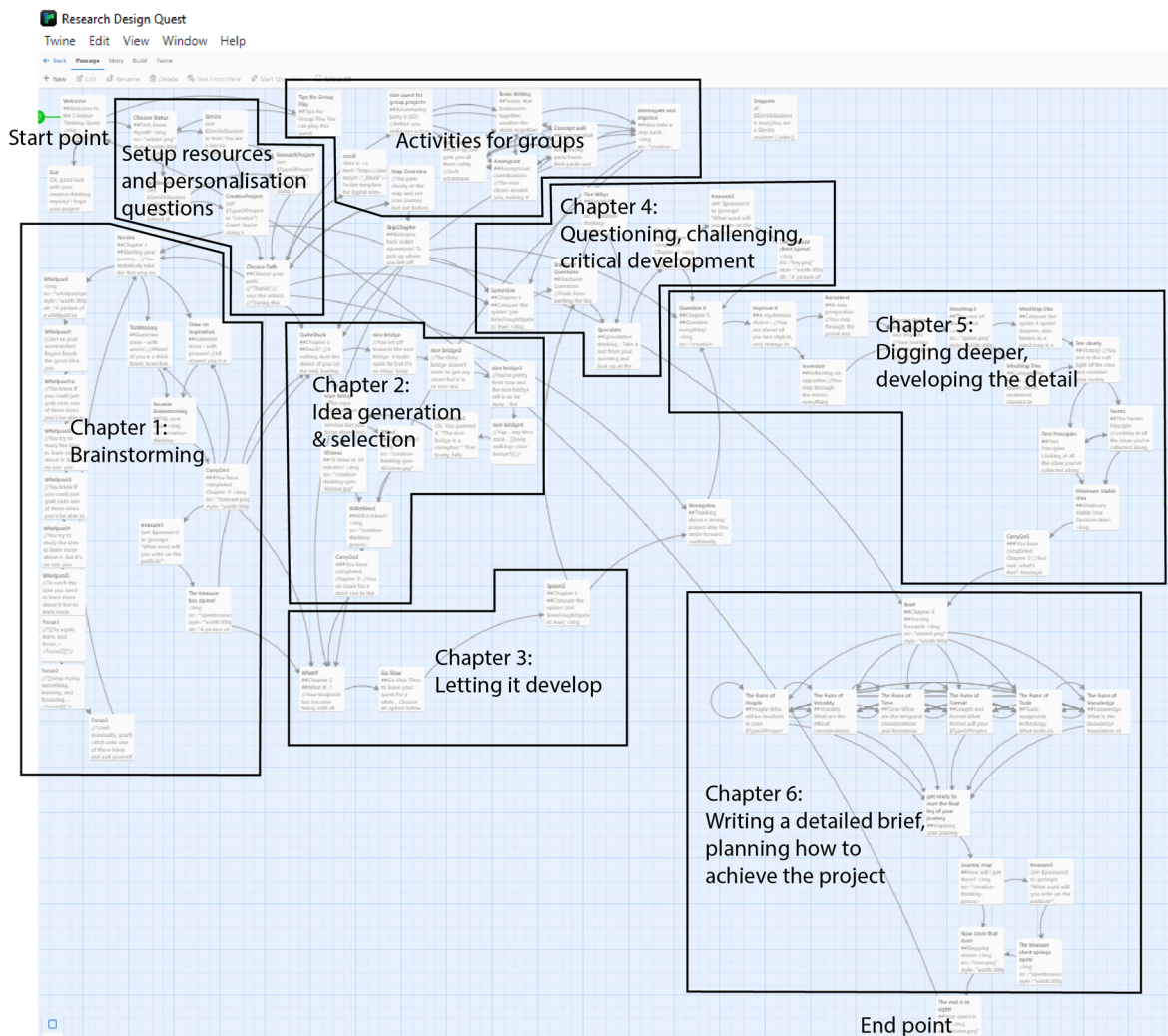


Figure 2 - Structure of the Creative Thinking Quest in Twine with annotations to show conceptual themes of each chapter

Evaluation Methods

Empirical data was gathered using three complementary methods in order to capture a mixture of large-scale quantitative data on the use of the tool, and qualitative data to inform interpretation of the quantitative data and provide deeper insight into users' attitudes towards different aspects of the content and delivery.

Triangulation of evaluation methods for game-based approaches is noted as important (Mayer et al., 2014) and qualitative data are specifically mentioned as both crucial to achieve a complete evaluation of a game-based approach, and as a research gap for games in Higher Education (Boughzala et al., 2013). Therefore, this mixed-method approach combines simple automated game analytics, a post-play survey, and a focus group with expert practitioners to gain further insights. All data collection was completely anonymous and voluntary.

Where the evaluation was made available to students it was emphasised that participation in both the quest itself and the evaluation was entirely optional and had no way of being linked to individuals and no bearing on assessments. Ethical clearance was granted by The Glasgow School of Art.

Automated game analytics

Web analytics can provide large-scale, systematic, but high-level use data. Itch.io provides overall use statistics as views (of the game landing page) and plays (clicking Run in the game window.) It also provides referring URLs. In order to collect more detailed analytics from within the game itself to enable interpretation of game use, javascript snippets* were embedded within the quest pages which, when visited, capture simple anonymous data including choices made by the player such as type of project (research or creative), the path(s) selected through the quest learning content, and time spent between individual pages. Automated game analytics such as these are particularly suitable for capturing behavioural measures of learning (e.g. time on task, access to particular content) (cf. Ritzhaupt et al., 2021) and the non-personal demographic data gathered allows for greater insight into who is using the tool. The variables captured were written to a Google spreadsheet using Google Extension Apps Script† and later optimized to identify individual game sessions. As all users are completely anonymous, analysis was at the level of individual play sessions (rather than unique

* Javascript is an object-oriented computer programming language commonly used to create interactive effects within web browsers.

† Apps Scripts integrate with and automate tasks to extend the functionality of Google products, in this case automating the writing of variables into a new row in a Google Sheet to collect data about user sessions.

users.) Data was captured periodically at key points during the quest (for example, at the end of chapters) so is not a perfect map of user activity, nor does it distinguish between time a user is actively on task vs. simply having the page open in a browser window. Nevertheless, despite its limitations, this session-level data is very useful to establish overall use patterns for the tool. Consent for data gathering is acquired at the start of the game. For the purposes of this paper, data from 18 January 2022 – 31 October 2023 is used.

Survey

This method aimed to capture data on users' roles (e.g. undergraduate or postgraduate student, staff, creative practitioner), prior development of a particular project idea, and affective outcomes (motivation, perceptions of learning, and attitudes on digital badges, narrative, and personalized learning.) A link within the quest itself takes users to a detailed participant information sheet and consent form, followed by a short survey combining fixed options with free text responses to elaborate. This non-automated method allows direct, structured qualitative and quantitative data from users to be collected to enhance interpretation. Over the evaluation period, 26 valid responses were collected.

Focus group

In order to gather expert views, a focus group with around 20 participants took place at a conference focused on playful learning. Participants were shown the Creative Thinking Quest and preliminary evaluation data, and asked to respond to a series of provocations (aligned with the particular educational issues explored in the survey) through discussion and making anonymous notes. These notes have been used to inform the analysis.

Results & Discussion

In the two years after the quest was launched (October 2021-2023) the game page on Itch.io had 7,365 views, of which 3,446 (48%) translated into clicking into and playing the game. Referring URLs identify that, as well as a range of referrals from the UK Higher Education learning and teaching and research development communities, the quest has been linked from virtual learning environments (VLEs) at 13 universities, with seven of these (two from outside the UK) showing evidence of sustained and meaningful use (i.e. more than 20 referrals).

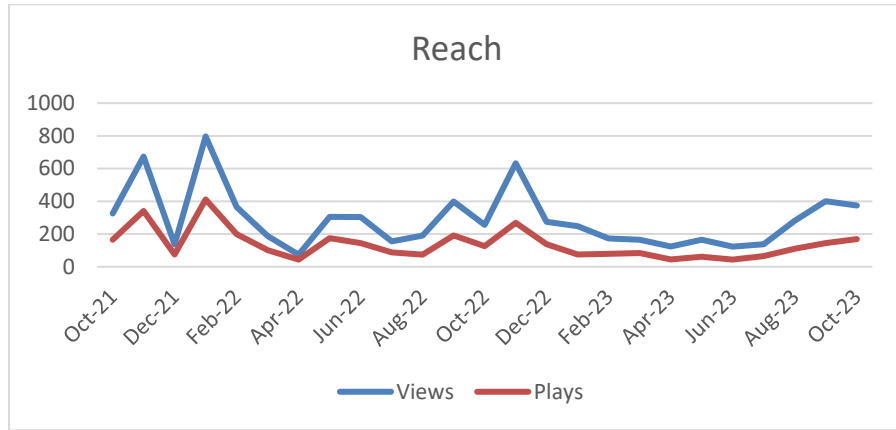


Figure 3: Page views and plays of the Creative Thinking Quest:

The following results data uses view, plays, and analytics from the slightly shorter period the detailed game analytics were implemented, i.e. 18 Jan 2022 - 31 Oct 2023.

User information and overall impressions

The evaluation survey (n=26) that was released alongside the quest aimed to find out more detail about users, their roles, and preferences. Figure 4 shows user roles with most being the target group of postgraduates in HE, with a high proportion too of HE staff members. These non-mutually exclusive categories also show an even split between those who identify as researchers and creative practitioners. Of the total number of play sessions, 13.4% came from my own students for whom the quest had initially been designed.

1 Are you (tick all that apply)

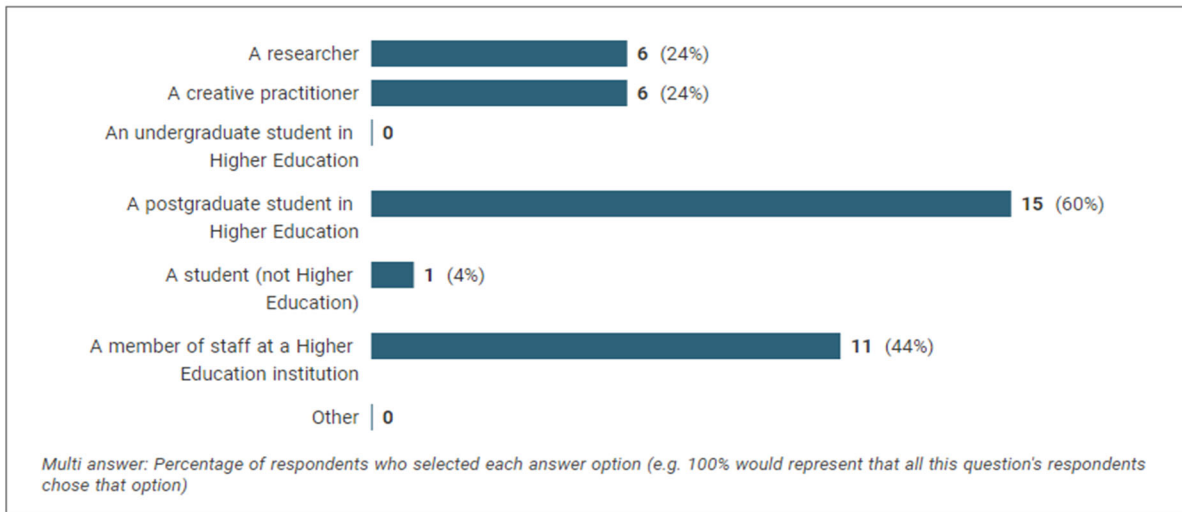


Figure 4: Survey Question 1 - User roles

5 Which of the following best describes your use of the quest?

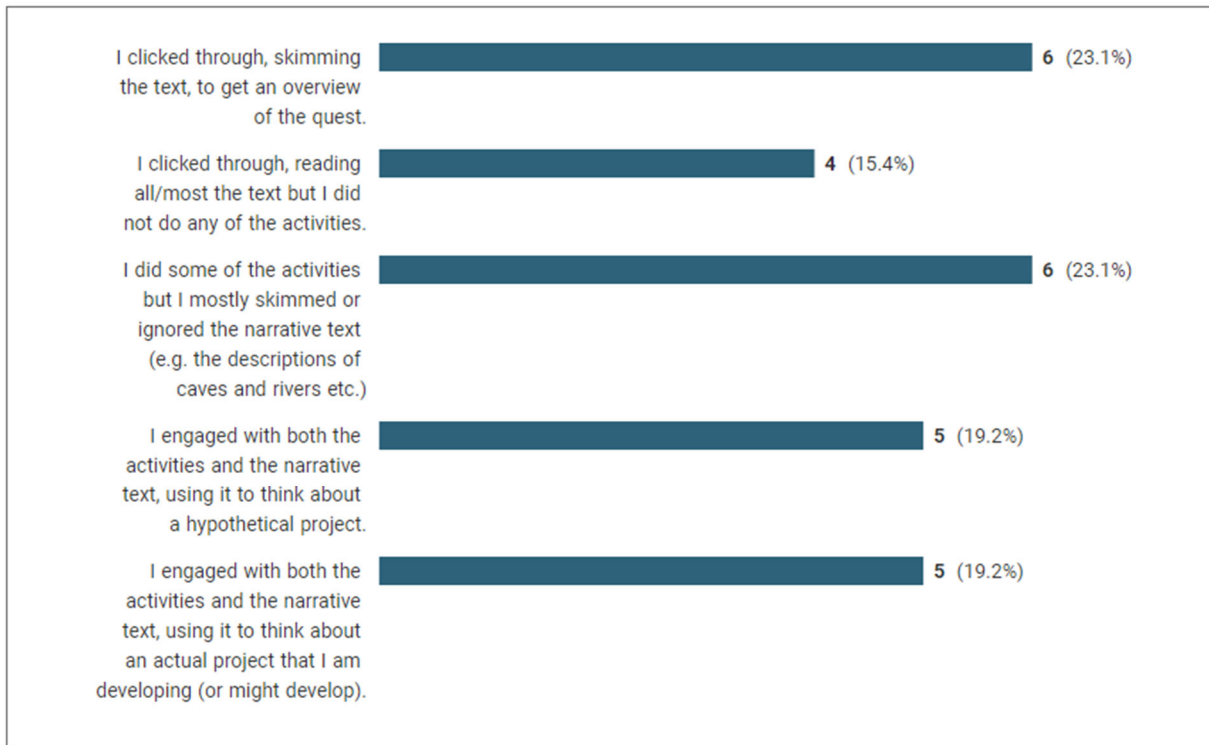


Figure 5 Survey Question 5 - Ways of using the quest

As can be seen from Figure 5, uses varied from those who just wanted to have a quick look at the quest (qualitative responses show that HE staff wanted to check if it was suitable for their own students) to those who engaged with parts, or all, of the content, to varying levels of depth. The difference between these use cases is analysed in detail in the Using or Perusing section, below.

13 How useful did you find the Creative Thinking Quest overall?

13.1 Overall, I found the quest:

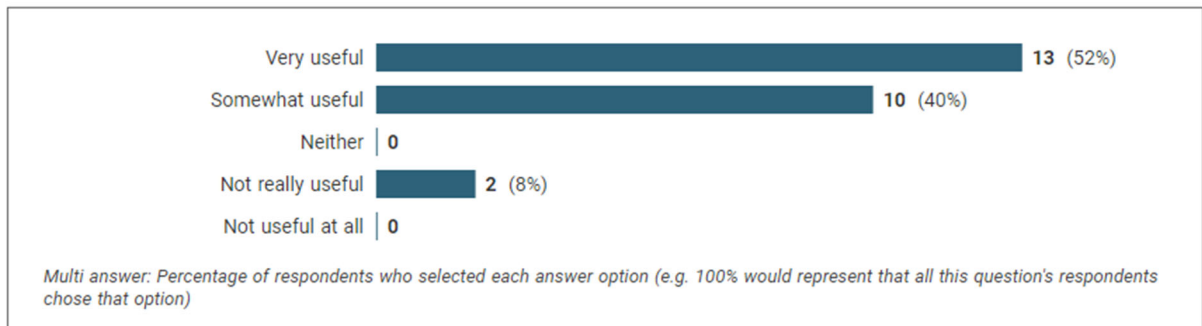


Figure 6: Survey Question 13 - Overall usefulness of the quest

Overall satisfaction with the quest was high. Figure 6 shows that all but two of the respondents found the quest useful and Figure 7 shows that 14 out of 24 (58%) would probably or definitely use the quest again. Qualitative responses highlighted that the quest was “engaging”, “memorable” and, in particular, that the way the content was chunked and structured was excellent. Comments included: “I liked that it made each stage equally as important, breaking it into bite-size pieces and forcing you to work through it methodically and not miss anything out. Some tasks resulted in unexpectedly helpful answers. I liked that I could stop and return later”, and “A far more engaging tool than written websites or info a tutor could describe to a student”. 10 academics also emailed directly with extremely positive feedback. When talking about if/how the quest would be re-used, respondents identified that they would come back to it at dissertation time, or use it with their own students.

17 Do you think you will use this Quest again in the future?

17.1 I will vs use this quest again.

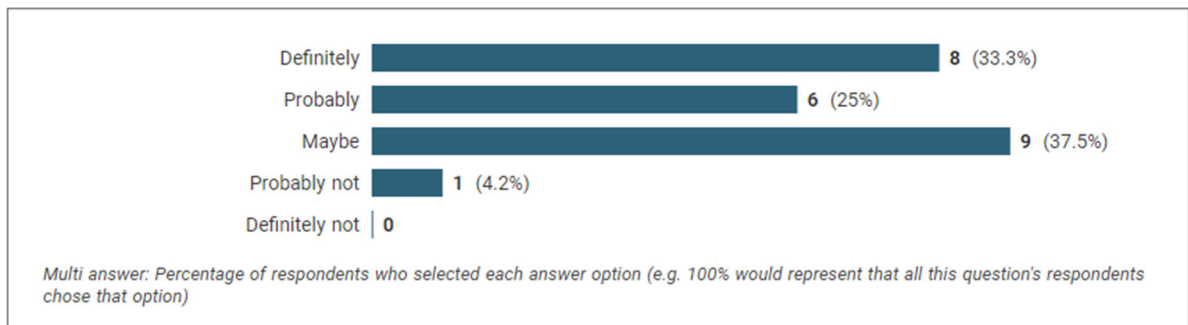


Figure 7: Survey Question 17 - Reuse of the Quest

Personalisation of learning

In its initial stage, the Creative Thinking Quest asks users to choose from a series of options designed to both ease them into the material, and personalise the learning content which is then delivered. A binary choice between Creative Project or Research Project does not affect the quest path itself but is instead written to a state-tracking variable which is used to tailor content more specifically at some points, especially for more procedural learning content. For example, ethical approval from your university is emphasised for ‘research project’ but ethical considerations for arts is presented more generally if the user chose ‘creative’. The main personalisation comes from question and response choice between four options based on how well-developed the user’s project idea already is. The paths through the quest are summarised in Table 1 and Figure 9. There is also a side quest for users who will be working on projects in groups.

Table 1: initial responses to the question "Tell me, how much of an idea for a project do you already have?" and how content is personalized.

Initial path choice text	Jumps to	Types of learning activities in this chapter
Absolutely no idea whatsoever!	Chapter 1	Idea generation, brainstorming, scoping
I'm quite stuck for an idea.	Chapter 2	Brainstorming, scoping, and decision-making
-	Chapter 3	(Advocating leaving the tool and taking time to reflect.)
I have some ideas...	Chapter 4	Investigating ideas in more depth, refining, and improving
I already have a clear idea of my research project (path 1)	Chapter 5	Refining and improving ideas through specific questioning, selecting an (in scope) final idea
I already have a clear idea of my research project (path 2)	Chapter 6	Working on the fine detail of project design and writing a project brief

Figure 8 shows the frequency of project type from everyone who started using the tool. 59% chose research project with 41% choosing creative project. This is an expected split given the context that the Creative Thinking Quest was designed for and disseminated into. Analytics closely match the data from the user survey (where the research-creative split was 58% and 46%, respectively.)

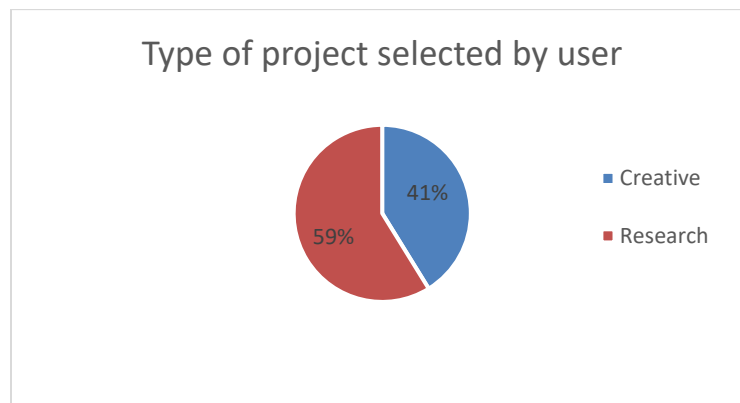


Figure 8: Project type chosen at start of quest

Figure 9 shows the pathways taken by users through the quest. Just over half chose No Idea (51%), Quite Stuck or Some Ideas were 21% and 24%, respectively, and only 4% stated they have a Strong Idea (therefore being taken to Chapter 5 or 6.) It should be reiterated that Figure 9 tracks play sessions, not unique users. Therefore, it is highly likely that some users chose No Idea at first, before returning to the quest for one or more play sessions where they subsequently chose a more advanced pathway. As can be seen from Figure 2 and Figure 9, there are also nodes that allow users to move within and between chapters based on their choices, and these nodes summarise more briefly the learning content of chapters that are skipped.

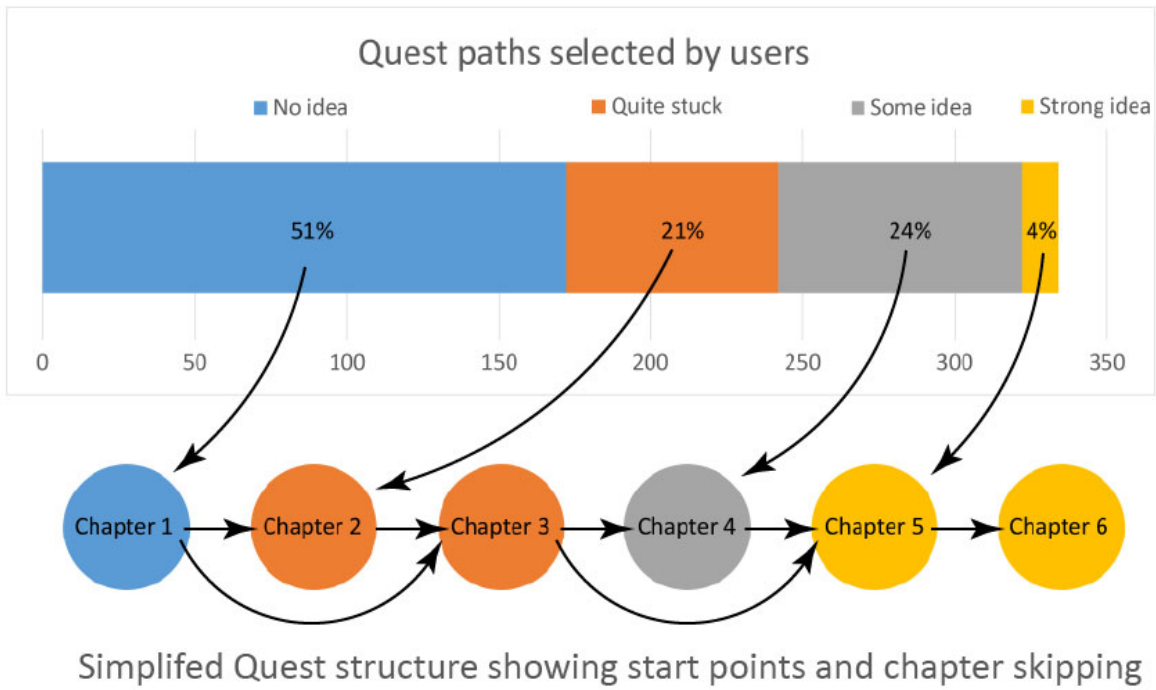


Figure 9: Users’ estimation of how well-developed their project idea was when starting the quest

The evaluation survey gleaned more detail about use and attitudes towards personalised content. 84.6% of users found these activities useful or very useful (Figure 10). One response stated: “Loved the choose-your-own-adventure element of the activities. Thought they were well described, with just enough information to ensure you could do the critical thinking properly”. Users were also asked if they preferred text-based prompts for learning activities (36% preferred) or using embedded apps with more interactivity (64% preferred). This non-decisive split also highlights the advantages of offering different pathways through material so that learners can select their preferred approach.

7 If you worked through some of the idea development activities, please answer Question 7 below. How useful did you find the idea development activities overall?

7.1 I found the activities:

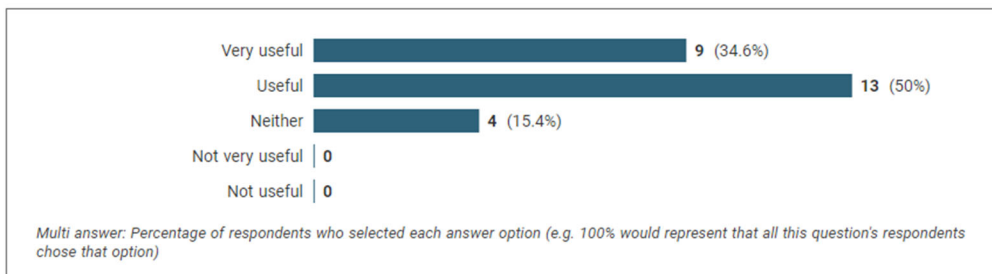


Figure 10: Survey Question 7.1 - Usefulness of learning activities

72% of users felt that the quest was somewhat or very personalised to their individual needs (Figure 11). However, qualitative responses highlighted that with such a broad scope it is important to ensure that some content is seen by everyone (“The personalization makes it engaging, but since there are specific tips that everyone needs, personalization is less important”) and that “It clearly worked for my needs but with such a broad scope to address, it’s understandable that not every part meets needs like the last and so on”.

9 Did you feel that the quest was personalised to your needs?

9.1 The quest was: vs for my needs.

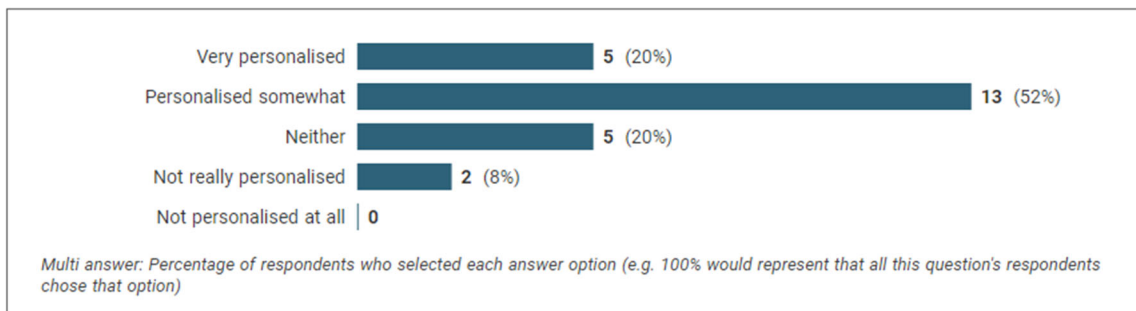


Figure 11: Survey Question 9.1 - How personalized did the quest feel

10 How important do you think that personalisation is for people engaging with this sort of learning content?

10.1 Personalisation is:

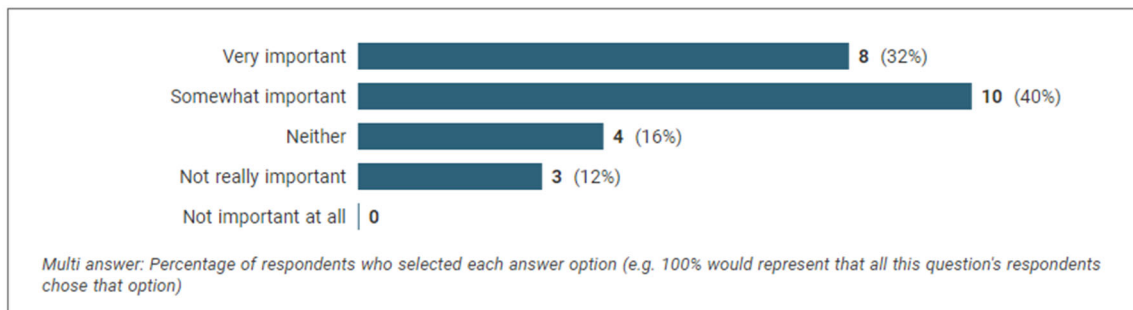


Figure 12: Attitudes towards importance of personalisation of learning content

Figure 12 shows that 72% of respondents felt that personalisation (in general) is somewhat or very important, but that “It depends on the openness of the user or the learning situation” and their emotional connection to the material and/or narrative. Interestingly, 12% of respondents felt that personalisation was Not really important. Ritzhaupt et al. found a small negative effect from adaptivity/personalisation on outcomes (2021, p. 2510). They are however keen to emphasise the very small sample size and question this finding, stating that “non-linear navigation displayed higher effect sizes [on affective outcomes] when present, and

quests/missions/modules had very similar effect sizes with and without it" (2021, p. 2516).

Experts from the focus group speculated on the nature of exploratory learning and how it would suit some students (very self-directed learners) more than others, so clear guidance toward core topics is needed. They also reflected on the relationship of personalisation to the somewhat "transactional" nature of postgraduate HE and how playful and exploratory approaches can change the relationships between student and teacher. Play is described as "the *process* that smooths out the reductive, transactional striations of [...] formal education" making "research methods teaching ripe for gamification" (James & Nerantzi, 2019, pp. 25, 285) and play explicitly supports constructivist learning (crucial for postgraduates.) Furthermore, creative or game-like approaches by their very nature move students into the role of creator, reinforcing their autonomy and agency over their own learning, and reconstructing relationships with both the learning material and their teachers (cf. James & Nerantzi, 2019, pp. 285, 322).

Therefore, although its impact on outcomes is currently unclear, personalisation is acknowledged as particularly important in the postgraduate context where learners are characteristically more self-directed and have a wider range of learner goals. The quest was broadly successful at providing this through both non-linear pathways and choices between activities. Nevertheless, careful scaffolding is still required when designing structures for quest-like content.

Using or Perusing?

The total overall views of the quest were compared to the number of unique play sessions, and data from in-game analytics were used to distinguish between users who were simply having a quick look at the quest ("perusers", with a total view time under five minutes), and those who engaged more meaningfully ("meaningful users" whose play sessions either lasted 5+ minutes or included correctly answering one of the in-game quizzes). It should be noted that in-game analytics are only captured when a player reaches the end of a chapter, therefore if a play session resulted in meaningful engagement but for whatever reason the user did not progress to the end of the chapter, this data is omitted from these results. The definitions used for different use cases is summarised in Table 2, which also indicates the proportion of each use case for the evaluation period.

Table 2: Definition of use types for the Creative Thinking Quest

Use case	Use type	Proportion
Visited the game page but did not start the game	Viewed	100%
Visited the game page, started the game, but never arrived at the final page of any chapter	Started	48.0%
Played the game and finished a chapter but with a play time of <5 minutes	Perused	5.0%
Played the game for 5+ minutes, or completed >0 in-game quizzes	Meaningful Use	2.4%

Acknowledging the limitations on data collection, it can be seen that just under half of page viewers started the

quest, only around 1/10 of those perused enough to reach the end of a chapter, and only half of those (2.4% overall) engaged meaningfully with the learning content.

The quest is largely composed of learning content that prompts players to undertake thinking or analogue activity alongside the quest itself (for example, making notes on a piece of paper) so it is impossible to ascertain whether an activity was actually completed. Instead this information is inferred from time spent on each section. The 'time on task' was captured by comparing the time difference between visiting the first page of each chapter and the last page of each chapter. In several cases, this time spanned more than one day, indicating that a browser tab had remained open, but it is very unlikely that this is true 'time on task'. Therefore, during analysis, a cap of 120 minutes was applied as an attempt to balance capturing longer-term working sessions without introducing extensive confounding data, as it is unlikely that time over 120 minutes represents true engagement. Every chapter except Chapter 6 had session time outliers. These have been excluded from Figure 14 in order to show the more relevant median session times more clearly.

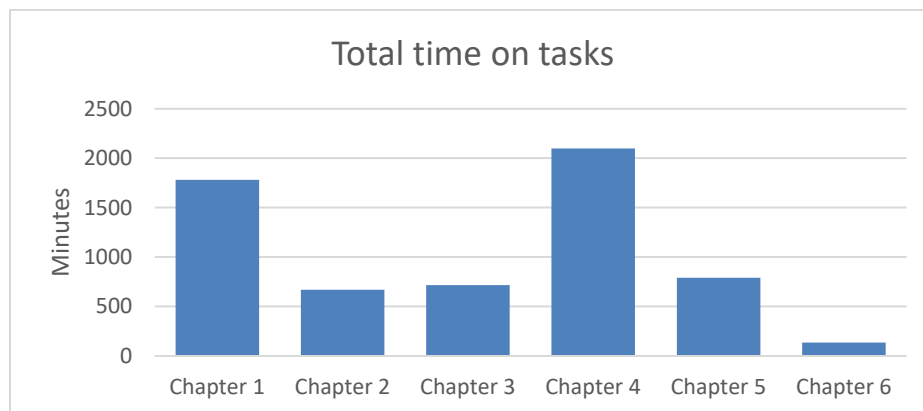


Figure 13: Cumulative time on task for each chapter in the quest

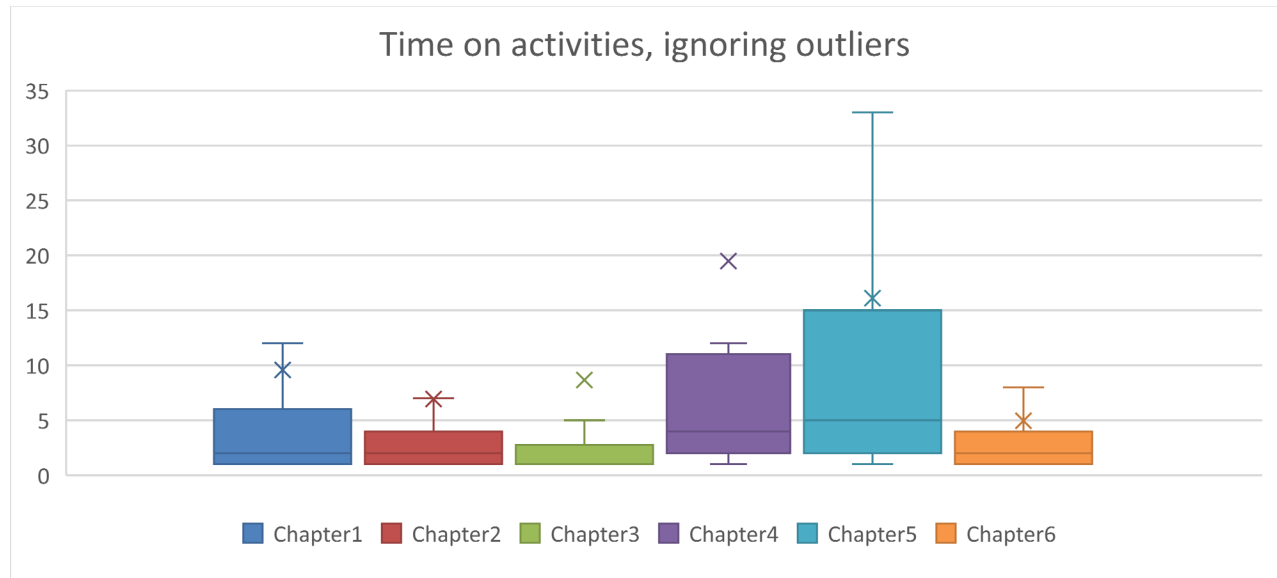


Figure 14: Detailed time on task data showing quartiles, mean, and median

It can be seen from Figure 14 that Chapters 1 and 4 have the longest cumulative session times, at around 1,750 minutes and over 2,000 minutes, respectively. These chapters are the two main entry points for players choosing the “I have no idea” and “I have some idea” quest paths. However, the way in which the learning content was used appears to differ. Examining Figure 14 and the session-level data shows that Chapter 1 of the quest had a much higher proportion of perusers (as might be expected, people having a quick look before deciding if the quest is suitable for their/their students’ needs), whereas engagement with later chapters shows fewer sessions but higher average ‘time on task’ (both mean and median.) Chapter 1 data shows that 75% of sessions lasted around six minutes or less, whereas the variation is much higher for Chapters 4 and 5 with the 75th centile at around 11 and 15 minutes respectively. Triangulating these analytics with the self-reported time spent using the tool from the survey (see Figure 15) shows a clear pattern of lots of short gameplay sessions, with a long tail of people engaging very deeply with the quest over a longer period. The expert focus group suggested, during discussion of this issue, that it is quite typical for any one intervention to have low use rates and that similar patterns are seen in videogame culture and other online learning tools. However, they noted that this is not necessarily a bad thing: “It might be about choice and that the users can choose their own time and level of participation, and if they want this or another thing to address their learning needs”. Certainly, whilst there are very few other similar gamified tools on this topic, there are hundreds of books, course materials, and blogs helping students to develop advanced research skills. Again, the heterogeneity of students was emphasised, with the success (or not) of gamified approaches being dependent on both the goals of the course and on individuals’ identities.

4 Roughly how long did you spend interacting with the quest, altogether?

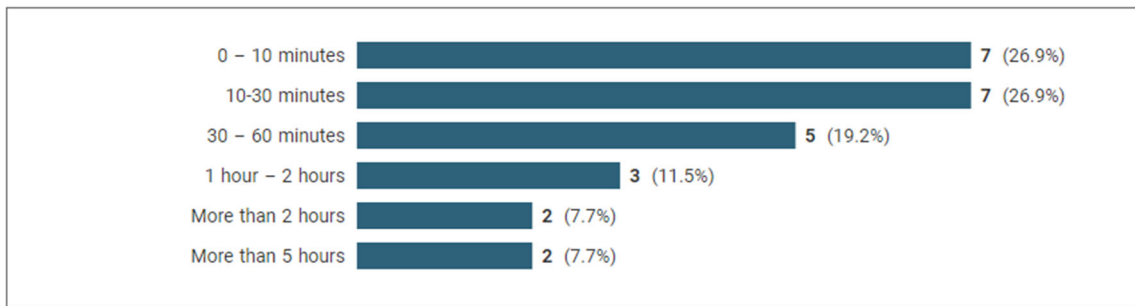


Figure 15: Survey Question 4 - Time spent using the tool

In three cases, the quest prompted users to engage in active learning to unlock “treasures” – a small quiz designed to consolidate understanding led to content that was locked behind a password. These were possible to track using in-game analytics. Engagement with the (explicitly optional) treasure chests is summarised in Figure 16 and shows that the proportion of Meaningful Use game sessions that resulted in finding at least one ‘treasure’ is around a third of the total.

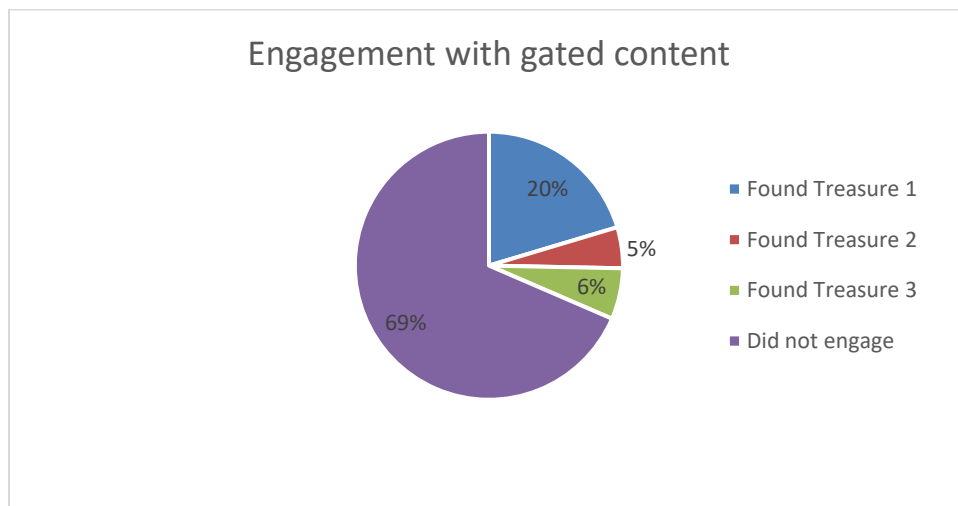


Figure 16: Percentage of engaged users who unlocked each treasure

This analysis of personalisation and use of the quest emphasises the need for explicit learning experience design (LXD), which foregrounds learners as individuals with differing preferences and desired outcomes. This can be challenging for novice designers (Chang & Kuwata, 2020), however, despite the challenges in designing them, gamified and game-based approaches suit LXD and personalized learning very well (Abbott, 2020). It is clear from the high proportion of superficial users that this particular topic, presented in this particular way, did not result in extended, deep learning for most. Nevertheless, the extremely positive feedback from those

who did engage deeply shows significant impact on those it suited (e.g. “It made me think in different ways”, “a really nice combination of content, depth and fun in this!”) and the potential for new use cases (e.g. “I know I won't 'really' use it myself, even if I think it is a good idea, but I might use it collaboratively”).

Digital Achievement Badges

Throughout the quest, players can earn ‘badges’ in the form of digital images, which they are encouraged to save alongside their research development notes. Much of the literature analysing badges and their impact notes that they are amongst the most commonly used gamification elements, but have mixed or no differences on both outcomes and motivation (Huang et al., 2020; Kyewski & Krämer, 2018; Ritzhaupt et al., 2021). This is borne out in this study with only five (22%) respondents stating they had saved their badges, and 48% reporting that they found badges somewhat or very motivating. My own students were also offered the chance to display their badges on a class leaderboard – an opportunity with a 0% take-up! This finding contributes further evidence that ‘badgification’ is not necessarily a productive approach; or at least public display of badges is not generally desirable. The expert focus group discussed the differences between digital and physical badges, suggesting that physical badges could be more motivating, and that “badges for the sake of badges” was likely to be a less effective gamification element than achievements with a function (e.g. those that open up a new section of a map, or give the player a new ability). Reflecting the literature, they also noted that badges may even have a negative effect on intrinsic motivation (cf. Kyewski & Krämer, 2018). Nevertheless, the badges were enjoyed by several respondents: “While I didn't save the badges, they made me smile when I got one!”.

12 How motivating did you find the digital badges (achievements)?

12.1 I found the digital badges:

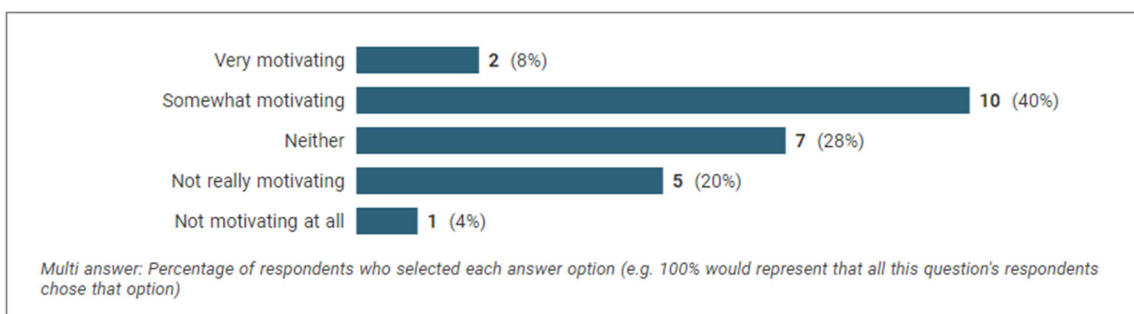


Figure 17: Survey Question 12 - Are badges motivating?

Narrative

The Creative Thinking Quest had a deliberately light-touch narrative which acted more as a fantasy ‘flavouring’ for the player’s journey than a story in itself. The survey indicated a generally positive response to narrative elements, with 68% stating that it had enhanced their experience to some extent (Figure 18). However, it did not enhance the experience for around one-third of respondents, and as Figure 5 also shows, more than 20% who were engaged in learning content ignored the narrative elements.

8 Did the narrative content (e.g. the pixelated images and the descriptions of caves and rivers etc.) enhance your experience of using this tool?

8.1 The narrative content:

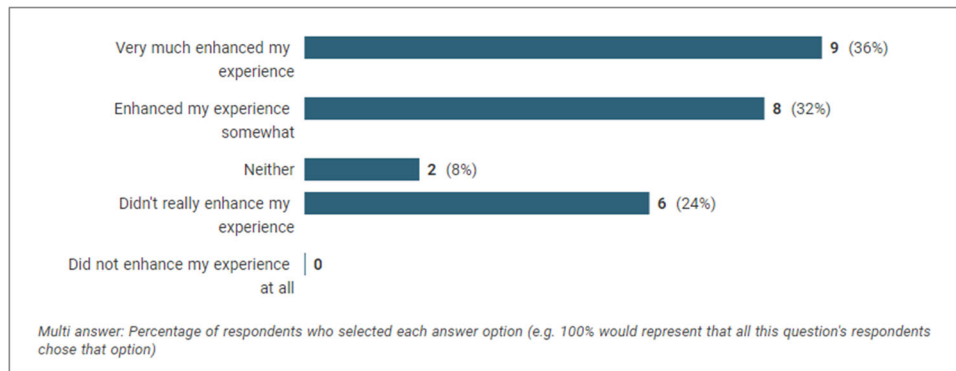


Figure 18: Survey Question 8 - Narrative enhancement of the experience

One meta-analysis shows that game narratives can have significant positive effects for behavioural outcomes, and analyses reasons why the effect for cognitive and motivational outcomes was non-significant (Sailer & Homner, 2020, pp. 102–103). A notable point raised is that quality can be a confounding factor, highlighting specifically the relevance of narrative at key points in the learning journey, whether it meaningfully develops, and the authorial skill of the creator. “Most learning designers who apply and investigate gamification in the context of learning are not trained as writers and are probably, on average, not successful at applying game fiction effectively” (2020, p. 102). This is certainly true for me! The expert focus group also reinforced this point, emphasising that, in order to be useful, narratives need to be deep, authentic, and (again) approached thoughtfully with due consideration given to LXD. Therefore, whilst a well-designed narrative can certainly contribute to effective gamified learning, a shallow ‘skin’ is more likely to be ineffective or even distracting. (For a great example of simple learning content elevated by a compelling narrative, see *Lost at the forever mine*, Field Day Learning Games, n.d.). Therefore narratives that simply seek to add ‘flavour’ to an experience may be enjoyable but are not recommended.

Conclusion

The webpage analytics provided crucial usage data but had clear limitations, in that some users (who did not reach the final page of each chapter) will have been omitted from the dataset and that a browser tab remaining open in the background could create confounding time data. The analytics give a good overview of parts of the quest, but were far from perfect due to the time and technical burden of implementing them comprehensively across all 82 nodes. They also could not capture qualitative user data, and so were complemented by the user survey and the focus group with playful learning experts. This triangulation demonstrated consistency in general, although unsurprisingly, there is a bias towards 'deep' users in the respondents to the questionnaire. Consequently, the questionnaire results skew towards positive engagement compared to the 7,000+ users curious enough to visit the quest's landing page.

The main finding from this empirical research is that the Creative Thinking Quest was meaningfully used by a tiny proportion of the people who visited it. Few people finished the quest, or undertook the (optional) treasure chest quizzes. Nevertheless, this still resulted in hundreds of meaningful uses, its incorporation into university VLEs across the world, and feedback from the long tail of 'deep' users was extremely positive.

Personalisation was generally successful and users commented on the effective structuring and high quality of the content. Several respondents noted the need for 'core' content and its associated scaffolding.

Personalisation through non-linear navigation was thought to be particularly valuable for self-directed learners and the postgraduate context.

Badges and narrative were gamification elements that were less successfully applied in this study, with badges being of little interest other than a novelty, and the narrative providing some flavour but not reaching the quality or depth to create real emotional or behavioural impact.

Overall the Creative Thinking Quest was very well received and provides an alternative approach to learning about academic research design. The main ideas for improvements were an interactive map to navigate the content, and a progress bar to help players' expectations and sense of achievement. Both of these would be helpful but would also need careful consideration before implementation to retain the sense of a learner constructing their own personal journey through the material.

This tool was created as a direct intervention for a problem identified through critical reflection on teaching practice. Further reflection-in-action is useful to best inform future practice. My main consideration is the apparent contradiction between the exceptionally positive reception to the Creative Thinking Quest and the (relatively) low numbers of meaningful uses, especially within my own cohort for who the tool was specifically designed. In fact, this reinforces Learner Experience Design literature (and indeed the different lenses of critical reflection (Brookfield, 2017)) in demonstrating that, even if teachers think quest-based approaches work well,

students are highly heterogenous. Whilst some will be delighted by, and highly engaged with, gamified learning, others will be indifferent at best. That said, for those whom this approach worked at all, evidence supports it seeming to work very well. Acknowledging that there is no “one size fits all” solution to pedagogical challenges is the first step in creating truly personalised learner journeys.

Recommendations for other creators

- Do not underestimate the time necessary to create a well-structured and visually engaging learning quest. A design that is robust enough to provide most users with interactive yet relevant learner journeys takes substantial time to develop and test.
- Capturing usage analytics is technically demanding, and either extremely labour-intensive in the analysis stage or likely to miss some information. Rather than take the self-coded approach used for this study, it is instead recommended that those who need gameplay analytics for research purposes collaborate with existing organisations such as Open Game Data (*Open Game Data*, n.d.).
- Narrative should be relevant, meaningful, and well-designed. If the learning designer using gamification does not themselves have strong creative writing skills, collaborate with a writer who does.
- Before committing to ‘pointification’, perform scoping research to establish if this type of gamification will motivate your users or increase learning outcomes.

Many aspects of gamification have inconclusive results about their impact and efficacy for a range of learning outcomes and learning behaviours. This study provides additional evidence for a non-linear, quest-based approach focussed on delivering personalised learner journeys. It also provides insights that could encourage further investigations into which gamification techniques are most likely to be well-received and effective for different learners, or how classroom teaching might be informed by similar (complementary, optional, deliberately non-universal) gamified interventions.

The Creative Thinking Quest is available free online at <https://daisyabbottitchio.itch.io/creative-thinking-quest>.

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