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Abstract: The need for self-directed learning for professional development drives an increase in the delivery of easy to use 'just-in-time' resources that respond to the often-dynamic workplace and work culture. Micro-learning has gained traction in online training, which focuses on delivering brevity through bite-sized learning units or short-term learning activities. Learning content in this case can take many forms, from text to interactive multimedia. These contents are often created on demand, which can sometimes be less contextualised and pedagogically informed. Based on a case study of the need for training on cultural risks in multi-cultural organisations, this paper focuses on the design of mini-games as playful learning resources for supporting an online learning platform that has been developed as a response to this training need. Fifteen mini-games have been developed to complement eight main topics related to cultural risks and to promote reflection, practice and the self-assessment of knowledge acquired through the platform. The main eight topics represent the risk areas identified that include cultural awareness, communication, learning styles, hierarchy, team-working, and stereotypes through a survey carried out with personnel (n=154) from large multi-cultural organisations across five countries - Cyprus, Italy, Latvia, Poland, and the UK. The discussions include unpacking the mapping of pedagogical and gameful design considerations based on Arnab et al 's (2015) Learning Mechanics-Game Mechanics Mapping (LMGM) model. The paper also discusses the findings from the testing of the platform with 71 students. The insights provided will be valuable to researchers, practitioners, designers and developers of micro-learning resources.

Keywords: game-based learning, mini-games, micro-learning, cultural risks, e-learning

1. Introduction

'Just-in-time' resources are often used to deliver brevity to the way learners or employees are engaged with professional development that is deemed useful for productivity, awareness of specific regulations, and also wellbeing. Brevity through bite-sized learning (Hug, 2005) or training units is the main premise for micro-learning, which has gained traction in online training. Micro-learning has been used to support today's fast-paced world with abundant access to a myriad of resources and tools, making it challenging for learners to meaningfully absorb educational material and remain focused on a topic for hours on end (Shail, 2019).

Micro-learning contents are often created on demand and in a more passive form, where learners would simply consume content, such as short videos viewed in sequence or accessing content delivered in the form of simple infographics. Equipping learners with materials in different formats engages learners more effectively in their development towards strengthening their knowledge base (Shail, 2019). Interactive media such as mini-games (also called micro-games) have been increasingly delivered as micro-learning content. A more dynamic interaction with digital content such as mini-games could increase learners' self-efficacy (Alqurashi, 2017b).

Kapp and Defelice (2019) emphasise that like any other learning programmes, micro-learning should include careful design. Alqurashi (2017a) argues that considerations on contents, pedagogy, and technology influence the design of micro-learning environments. When games are used as instruments for facilitating this type of learning, like any other game-based learning initiatives, designers need to consider the balance between learning and gameplay from pre-production through to post-production of interactive content (Arnab and Clarke, 2017), which includes activities, such as identifying expected outcomes, choosing appropriate methods, and evaluating the developed resources.

Based on a case study of the need for training about cultural risks in multi-cultural organisations, this paper focuses on the use of digital mini-gaming activities as interactive learning resources for complementing an online learning platform that has been developed as a response to this training need. Eight topics that represent the risk areas, including cultural awareness, communication, learning styles, hierarchy, and stereotypes, were determined through the use of a survey carried out with personnel (n=154) of large multi-cultural organisations across five countries - Cyprus, Italy, Latvia, Poland, and the UK as part of an Erasmus+ project. Fifteen mini-games have been developed to complement the eight topics to promote reflection, practice, and the self-assessment of knowledge acquired through the online training platform. The paper discusses the design considerations and findings from the testing of the mini-games with (n=71) students.

The following section describes the background, followed by the methodology and analysis of the findings from the testing of the platform and the mini-games.

2. Micro-learning and mini-games

There has recently been an increased interest in the use of micro-learning as a learning strategy, even though the concept itself has been around for decades (see Hierdeis, 2007). There are various definitions of micro-learning and what it should be. Kapp and Defilice (2019) define micro-learning as "an instructional unit that provides a short engagement in an activity intentionally designed to elicit a specific outcome from the participant."

Short bursts of learning content and activities enabled by the micro-learning approach allow learners to access learning at their own pace and in a more modular manner, where mental fatigue can be caused by longer lessons (Shail, 2019). Individuals learn and perform better when they can engage with short and engaging content at their own pace, instead of vast amounts of complex information in one session (Mayer et al., 1999). Wang (2017) found that when used as part of a course, smaller chunks of content in the form of short videos viewed in sequence helped students to better retain information and better perform in end-of-course tests.

Micro-learning can be part of a larger learning system, where resources may take many different forms, not limited to one particular medium. Short engagement in this case refers to engagement in condensed learning activities that will usually take between 1 to 10 minutes, designed for skill-based training, learning and education (Shail, 2019). Online learning platforms that are currently exploiting micro-learning resources include Khan Academy™, Udemy™, and Coursera™.

Engagement with micro-learning content has been proven to impact learning outcomes (Wang, 2017; Girgiu, 2017). A more active interaction with such content can often increase learners' self-efficacy, where it can develop and boost learners' confidence in their capabilities to study the content in a digital environment (Alqurashi, 2017b). Activities in the form of interactive games for instance, allow learners to actively participate instead of passively consuming content as it is supplied. Tesco, a large supermarket chain, uses mini-games to train employees in compliance. Ten mini-games are delivered to ensure learners are not overloaded with the content, with testing on a particular aspect integrated within each game. The various scenarios place the learners in different challenging situations, making the online learning engaging and interactive. 'Broken Co-worker' is another example of micro-learning that engages learners through various interactive scenarios with a mix of comic and video styles. The interactive video aspect allows learners to make decisions as they traverse various scenarios. Rosmalen et al. (2014) implemented mini-games to teach research methods. They found that the challenge lies in creating a well-balanced design for both the short nature of a mini-game and the level of complexity of deliverable content, in order to gain any learning effect.

Kap and Defilice (2019) emphasise that micro-learning is not just a quick and easy way to jazz up a boring learning program, as it can take just as long to design, develop and implement. Alqurashi (2017) argues that to create effective micro-learning environments, we need to pay close attention to design considerations related to content, pedagogy, and technology. When mini-games are used to support micro-learning, we will face the same challenge in balancing learning and play.

3. Methodology

This paper explores the use of mini-games as micro-learning resources based on an Erasmus+ project on the development of training materials for addressing cultural risks associated to multi-cultural organisations.

Aligning with the identified need to ensure that we balance both learning and gaming aspects in the design process, the methods include the synthesis of the subject matter that has informed the content of the online training platform, and the use of Learning Mechanics and Game Mechanics mapping (Arnab et al., 2015) for informing the design of the complementary mini-games as micro-learning resources.

3.1 From topic identification to the development of open educational resources

The development process included a three-step methodology. Firstly, an in-depth literature review was carried out to identify and understand the possible risks that can occur in multi-cultural organisations. Secondly, based on the synthesis of the risks identified through literatures, personnel from multi-cultural organisations including managers and employees were consulted towards identifying key competences that are necessary in order to work effectively in multi-cultural organisations. Altogether, there were 154 questionnaires collected in the five countries of the project partners: Cyprus, Italy, Latvia, Poland, and the UK.

The third phase involved designing and developing an open online educational platform with access to interactive educational resources, such as mini-games in various forms, which also include comic-book games and interactive video scenarios. The design process includes the mapping of learning mechanics against game mechanics (see Arnab et al., 2015) to align the resources to the specific learning objectives that they were designed for. The mini-games are endogenous to the topics they are complementing, and can also be used as separate stand-alone resources to engage learners.

3.2 Testing of the interactive mini-game resources

The aim is to gain feedback on the interactive resources that complement the online educational platform. 71 participants were consulted, including students at the Private University in Radom, Poland, who were undertaking a module on 'Social aspects of the integration process in Europe'. The resources from the online training platform were used in formal teaching and learning as a response to the Covid-19 pandemic. The students completed an online questionnaire specifically targeting the mini-game elements after one month of online learning via the training platform. The questions included:
- How engaging are the interactive media, such as mini-games?
- Do these mini-games support the specific learning objectives and topics?
- Do you think that they can be used separately as a learning resource?
- Which are the top three mini-games that are both engaging and educational?

4. The Cultural Risks (Cult_Risk) Open Educational Platform

4.1 Cultural risks as a subject matter - the identified topics

The number of questionnaires collected in every country are as follows: 34 questionnaires in Cyprus, 33 in Italy, 30 in Latvia, 30 in Poland, and 27 in the UK. 31% of all interviewees were managerial staff in a multi-cultural organisation, 49% were employees working at a lower level in a multi-cultural organisation, and 20% were individuals interested in the topic of cultural risk. 79% of interviewees are working in a multi-cultural organisation at this moment, 13% have worked in such an organisation before, and 8% have never worked in a multi-cultural organisation. 54% of interviewees are working in private enterprises, 20% in NGOs, 9% in universities or colleges. 6% were working in government organisations, 2% in municipality organisations, and 9% had another status. The survey ran between October 2018 – February 2019.

Based on the results collected, both from the literature review and interviews with the target groups, it can be concluded that there is a great need for cultural education in these organisations. In the era of globalisation, the number of employees who are culturally diverse increases each year. Most medium and large companies operate in an international environment. This is due to the expansion of international enterprises with branches in various countries, that requires cooperation with foreign clients and the employment of foreign nationals in these companies. Employers and employees face challenges associated to cultural differences, which may introduce risks that impact their respective organisations (Anglim et al., 2019; Ashkanasy et al., 2002; Masulis et al., 2012; Scarborough et al., 2019; Segal, 2019).

All the organisations participating in the research agree that cultural risks occur in multi-cultural organisations in their countries. Based on data gathered, it can be concluded that in the vast majority the risks occurring are similar. Primarily, the risks may be caused by a different approach to culture-related working styles: individualism vs. collectivism or low-power distance vs. high-power distance. Communication risk is a large part,

but communication is a very broad concept that includes linguistic (e.g. language barrier, misunderstandings resulting from the use of idioms) and non-linguistic issues (e.g. low/high-context culture). The indicated risks are associated with work culture and productivity as well as the social aspects such as risk of social exclusion in the work environment. Those related to the social aspects may cause the creation of subgroups, excluding people from other cultures. This exclusion may be due to underlying prejudices, discomfort, or unfamiliarity with other ethnic groups, or displeasure with changing policies and procedures. Comparatively, prejudices and lack of knowledge about other cultures may cause self-isolation of the culturally-different employee. Exclusion is closely linked to the work efficiency, because an excluded person (whether excluded by the group or through self-isolation) may lose the desire and commitment to work, feel uncomfortable, and experience a decrease in efficiency. From the analysis, managerial staff of the organisation should be culturally aware and place emphasis on stronger inclusion of people at risk of social exclusion at work.

Synthesis of the findings led to the identification of eight main topics that are considered, which include (1) an introduction to cross-cultural awareness, (2) understanding different cultures, (3) working with stereotypes, (4) communication skills, (5) teamwork and social integration, (6) leadership and hierarchy, (7) learning styles, and (8) qualities in the workplace.

4.2   The Online Educational Platform

The content of each topic (8 topics into 8 separate modules) was developed by the project partners in consultation with subject experts. With the aim to enable resources within each topic to be used as a collective or as individual stand-alone resources, the presentation of both content and activities is highly modular (see Figure 1). Educators and learners can pick and choose resources that are relevant to their teaching and learning. Specific resources, such as visually attractive Microsoft Power Point slides, videos, and mini-games can also be delivered to learners as required to allow access to small bites of learning contents and activities.
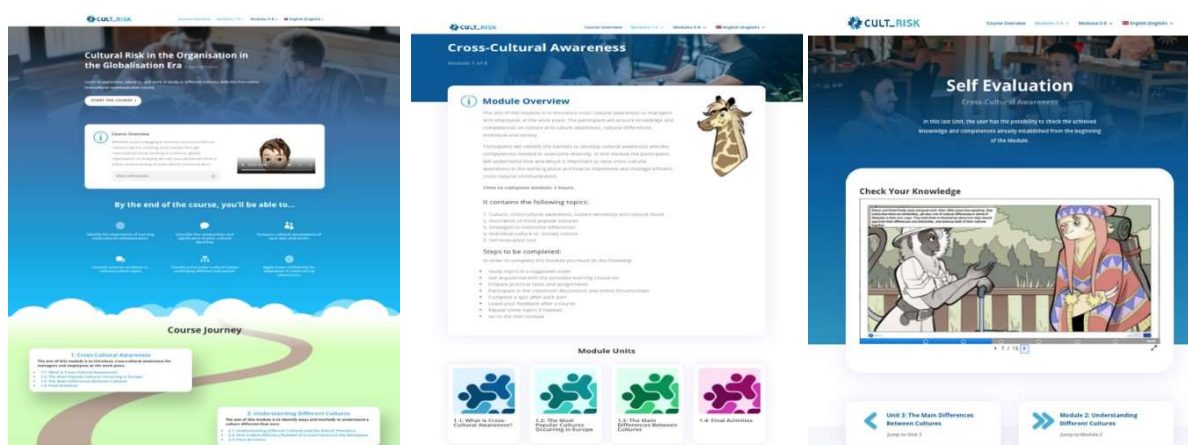

Figure 1: The online platform (http://cultrisk.dmll.org.uk[1]) with modular resources including mini-games.

4.3   Interactive mini-games

Design of the micro-learning contents is influenced by pedagogy and technology. The browser-based educational platform requires micro-learning resources, including the mini-games, to be compatible with any web-browser. Mini-game development thus adopted existing authoring tools, such as Beaconing[2] and H5P[3], to enable quick development of interactive mini-game activities aligned with specific requirements of the different modules.

Four core aesthetics representations based on the Mechanics-Dynamic-Aesthetics (MDA) Model (Hunnicke et al, 2004) were selected to model the game experience. They are (1) Challenge – Game as an obstacle course, (2) Discovery – Game as uncharted territory, (3) Fantasy – Game as make believe, and (4) Expression – Game as self-discovery. These experiences were drawn into the selection of the five main mini-game types for delivering micro-learning contents in an engaging way: (1) 'MCQ' quizzes provide a challenge in the form of multiple-choice questions with time pressure; (2) 'Drag-and-drop' quizzes fall under the challenge experience, where time

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[1] The url may change but this will redirect to the future web location
[2] http://beaconing.eu/results
[3] https://h5p.org/

pressure and the drag-and-drop action act as the obstacle course; (3) The animated target-and-swipe games also fall under the challenge experience, where players need to swipe the planets with the correct answers under a time constraint, (4) 'comic book' games provide a sense of fantasy with engaging scenarios played out by imaginary characters; and (5) 'video scenario' games provide scenarios played out by actors, where the player's response to questions posed in the narrative determines the ensuing narrative as players traverse the game, demonstrating experiences related to fantasy and expression.

Figure 2 shows examples of the different types of mini-game activities developed. There are 15 mini-games in total, comprised of two 'drag-and-drop' actions for filling in blank quizzes, one 'drag-and-drop' for word clustering quizzes, two 'MCQ quizzes', two 'animated target-and-swipe', six 'comic-based scenarios', and two 'video-based scenarios'.
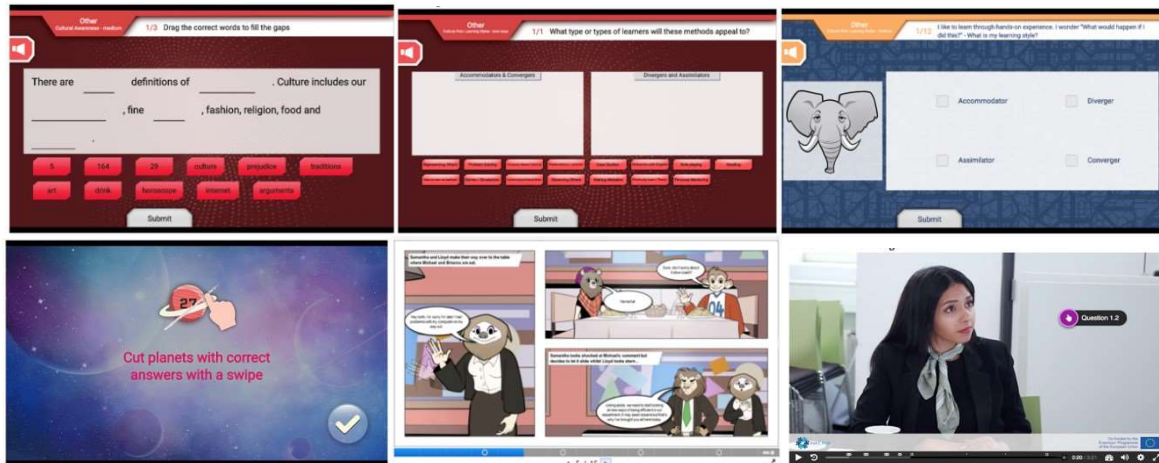

Figure 2: Mini-game types (left to right, top down): drag-and-drop (fill in the blank), drag-and-drop (word cluster), MCQ quiz, animated target-and-swipe, comic book, and video scenario.

Examples of a summary of learning mechanics-game mechanics (LM-GM) mapping of 3 of the 15 mini-games are described below.

Planet Ninja (see Figure 3) is an Animated Target-and-swipe game featured within Unit 2 of Module 1 that aims to allow learners to quickly self-evaluate and assess what they have learnt from this unit's content within the online course. The topics explored in this game cover Cultural Sensitivity in an organisation, where the game takes learners through 4 rounds that require them to identify the correct keywords that relate to statements displayed to them before each round begins. It counts the number of correct and incorrect answers and provides learners with an overall feedback on their scores. The simple LM-GM mapping is summarised in table 1.

Figure 3: Snapshots of the Planet Ninja game authored using Beaconing

Table 1: Simple LM-GM mapping of Planet Ninja

Learning objective	Learning Mechanics	Game Mechanics	Implementation
To identify components and attributes associated to statements on cultural sensitivity.	Identify Discovery	Selecting	Through swiping action – cutting the planets with the correct answer
	Repetition	Repetition	The same mechanics are repeated in four rounds.
	Feedback Assessment	Scores/Penalties Visual feedback	Correct and incorrect answers will produce visual feedback (explosion for wrong answers and colourful confetti for correct answers) Statistics on correct and incorrect answers are provided as feedback at the end.
	Competition Challenge	Time pressure	Time in seconds are shown. The swiping has to be done within the time limit.

The second example is the Check Your Knowledge game (see Figure 4) in Unit 3 of Module 3. This takes the form of a Comic Book quiz that assesses the learner's knowledge on cultural stereotypes and generalisations. Here, the comic-based narrative explores examples of scenarios that can occur within an office. Examples of stereotypical comments made towards an employee at an organisation highlight the impact that prejudices and cultural biases can have on everyone – not just the individual. Learners are asked to read through the comic book and answer questions that cover the topics of cultural stereotype factors and related risks, influences of cultural stereotypes in multi-cultural organisations and possible cultural biases, and different types of cultural stereotypes. The simple LM-GM mapping is summarised in table 2.
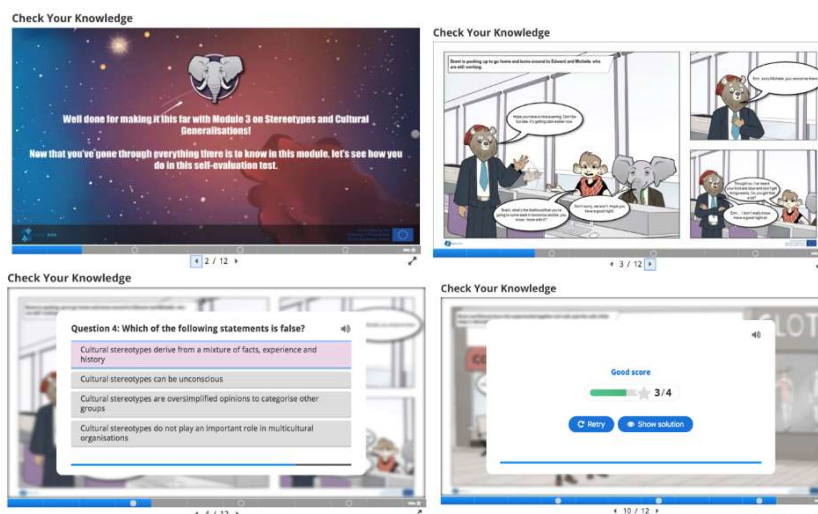

Figure 4: Snapshots of the Comic Book quiz game authored using H5P

Table 2: Simple LM-GM mapping of a Comic Book quiz game

Learning Objective	Learning Mechanics	Game Mechanics	Implementation
To reflect on knowledge of cultural stereotypes and generalisations	Hypothesis Reflect	Narrative/Story Endogenous fantasy	Use of comic book style and dialogues to present the story and to allow learner to hypothesise and reflect on the scenario
	Question and Answer Identify	Selecting Quiz	Embedded questions related to the story, where learners have to select the correct answer.
	Feedback Reflection	Scores Feedback	Text, visual and audio feedback has been used to indicate correct/incorrect answers and also summary scores Solutions to the questions are shown, allowing players to reflect

The third example is an interactive video (see Figure 5) in Unit 4 of Module 5. This introduces learners to a scenario showing a multi-cultural team hosting a meeting to discuss rapid changes on a project. During the team meeting, managers and employees encounter cultural differences and display certain emotions towards them. Learners attempt to problem solve through the final activity in which they must navigate through the branching narrative and answer questions correctly, if they are to achieve a high score and a positive outcome for the scenario's team. The topics covered within this final activity demonstrate the role of emotions, the changes that may be needed in a multi-cultural team, and problem solving in multi-cultural organisations. The simple LM-GM mapping is summarised in table 3.
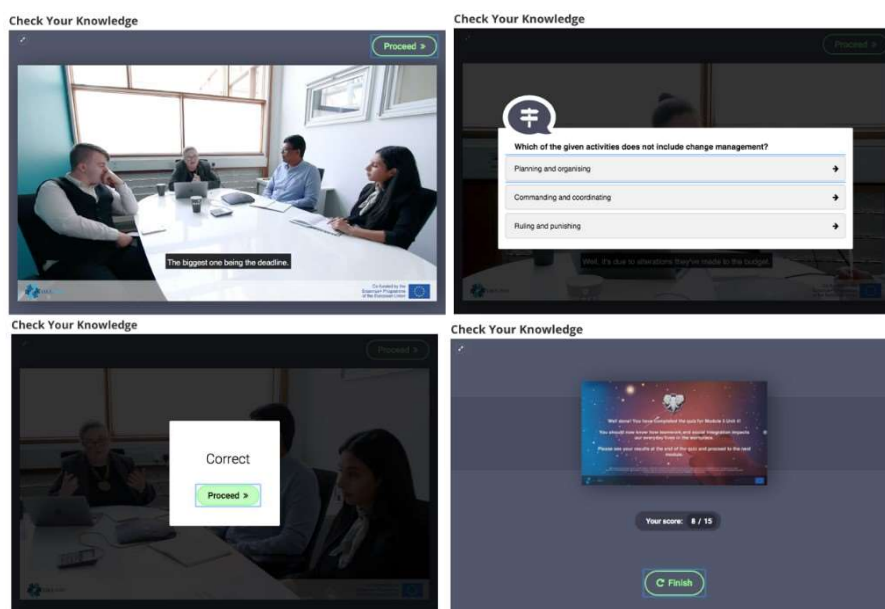

Figure 5: Snapshots of the Video Scenario game authored using H5P

Table 3: Simple LM-GM mapping of a Video-Scenario game

Learning Objective	Learning Mechanics	Game Mechanics	Implementation
To explore the roles of emotions and changes needed in a multi-cultural team	Hypothesis

Reflect | Narrative/Story

Endogenous fantasy | Use of video scenarios and dialogues to present the story and to allow the learner to hypothesise and reflect on the scenario |
| | Question and Answer

Identify

Decision making | Selecting

Quiz

Branching narrative | Embedded questions related to the story, where learners will have to select the correct answer.

Players navigate through the branching narrative of the scenario to answer questions correctly |
| | Feedback

Reflection | Scores

Feedback | Text, visual and audio feedback has been used to indicate correct/incorrect answers and summary scores

Display of solutions to the questions allows players to reflect |

5. Findings from the testing of the mini-games

Out of the 71 students who engaged with the resources of the online platform and especially the interactive mini-game activities, 96% found the interactive media to be highly engaging, all students (100%) found the games to be connected to the learning objectives, where 41% rated them highly. 93% of the students stated that the mini-games can be used separately as stand-alone learning resources, which indicates the versatility of the modular approach in populating the online platform with micro- learning activities.

The mini-games were also ranked by the students for the top 3 that were considered to be both engaging and educational. The frequency is summarised in Table 4.

Table 4: Relative frequency of times mini-games are ranked in top 3

Mini-game types	Frequency (number of times)	Relative Frequency (%)
Drag-and-drop Quiz	80	38
Animated target-and-swipe	66	31
Comic Book	43	20
MCQ Quiz	24	11
Video-based	0	0

The 'drag-and-drop quiz' games include the self-evaluation game on 'what is culture' in Module 1 that was ranked in the top 3 by 48% of the 71 students, with 24 students rating it as first. 44% and 21% of the students ranked Module 7's 'identifying learner's behaviour' and 'learning methods' games in the top 3 respectively. The 'animated target-and-swipe' games include Module 1's self-evaluation game on 'cultural sensitivity' that was selected by 59% by the students, though this game was only ranked either as a second or third favourite. Module 7's game on 'recognising learning style' was ranked in the top 3 by 34 % of students. Module 7's 'teaching methods for learning styles' game, which is an 'MCQ quiz' game, was ranked in the top 3 by 34% of students and a huge 60% of students ranked the 'comic-scenario' game that was used as a self-evaluation game at the end of Module 8.

The 'drag-and-drop' and the 'animated target-and-swipe' mini-games have simpler yet intuitive and interactive mechanics that may have achieved better engagement overall. The 'MCQ quiz' is a common format for micro-resources, which was also ranked highly. These mini-games serve smaller chunks of content per game scene. The 'comic book' game has the third highest frequency and one of the six games of this type received the highest number of votes compared to the other games i.e. preferred by 60% of students, which may be due to the design of the comic characters and also the fictional scenarios that enhance the quizzes. The mix of humour in the content may have engaged learners better.

Even though there are 6 'comic book' games (the highest number of games of a single type) on the platform, only one game was ranked in the top 3. The assumption is that overall impact of length and complexity of materials presented as mini-games for micro--learning is critical in design considerations. None of the two 'video-scenario' games for instance were ranked in the top three, which could also be due to the length and the more serious content of the video scenarios. The mechanics may also be deemed less 'fun' and playful compared to the simpler drag-and-drop and target-and-swipe games. This is an interesting observation as, on reflection, the video-scenario games were the most complicated to design and develop, which may perhaps not be as practical for delivering quick micro-learning materials to learners. This has provided the design team with insights into improvements that can be considered in future.

6. Conclusions

To support learners within a work-based environment, especially when related to professional development, or development of skills and aptitudes that would increase productivity and improve wellbeing, we need to enable quick and easy access to knowledge and contents that will support this development. Micro-learning has increased in popularity in delivering short bursts of content, which has also proven beneficial for increasing both engagement and learning outcomes. There has been an increase in the use of interactive media for encouraging more active participation in the engagement with content. This includes the use of mini or micro games for complementing and supporting specific learning objectives. Pedagogically informed development of such mini resources is essential and the balancing of learning and gameplay in the design process requires well thought-out considerations.

This paper describes examples of how such considerations can be included in the design of the interactive content associated with the mini-games, where the mechanics of learning (the activities related to the learning process) were mapped against the game mechanics (the interactions associated to gameplay). Based on the feedback from alpha testing, all learners found that the games are somewhat connected to the learning objectives. The high rating is slightly low, only 41% rated them highly. This could be due to the games being used mostly as self-evaluation instruments, where the link to specific learning may not be as explicit.

The use of an ethnicity/cultural agnostic approach in the comic-based games was featured to avoid any potential biases or stereotypes. The comic-based game received the most votes compared to the other games. However, as a game type, only one of the 6 comic book games was selected by the participants, and it is second in ranking behind the 'drag-and-drop' game in Module 1, which was voted as first choice. The comic-based game allows a more narrative-based approach for learners to put their learning into context. Narrative and scenarios are also used in the interactive video-based games, which did not appear in the top 3. The interactive videos are longer in nature due to scenarios being acted out by actors and to the branching nature of the game. There will be additional studies in the future to gain more comprehensive insights on these types of games within a micro-learning context and to further understand these in terms of time and content complexity.

The mini-game types that are simpler in content representations (e.g. quiz, word cluster) and yet more interactive in nature (e.g. drag-and-drop, target-and-swipe with visual and audio feedback) seem to be an overall favourite with the highest frequency of votes amongst the learners that participated in the study. The shorter bursts of challenges presented by the games may be found to be more engaging as they do not require the higher level of comprehension demanded in the narrative and scenario-based approaches.

The study could have benefited from further analysis into the actual learning outcomes of the participating learners. Further work will include delivering and evaluating the platform and also the mini-games by engaging managers and employees of multi-cultural organisations. The limitations of the current study will be addressed in the next evaluation to gain more insights into the impact of the complete platform with various resources on the actual learning.

Acknowledgement

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