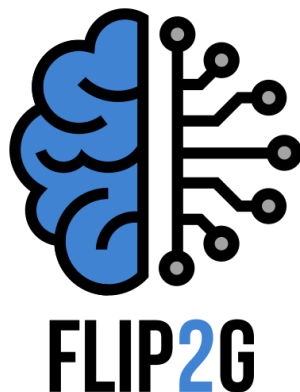




Deliverable 5.2

Evaluation Report

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Responsible Organisation:	UOM
Version-Status:	V1 FINAL
Submission date:	31/12/2021
Dissemination level:	PU

Disclaimer

This project has been funded with support from the European Commission. This deliverable reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Deliverable factsheet

Project Number:	601190-EPP-1-2018-1-DK-EPPKA2-KA
Project Acronym:	FLIP2G
Project Title:	Enhancing education and training through data-driven adaptable games in flipped classrooms (FLIP2G)

Title of Deliverable:	D.5.2 – Evaluation Report
Work package:	WP5 – Evaluation
Due date according to contract:	31/12/2021

Editor(s):	Efthimios Tambouris (UOM) Konstantinos Tarabanis (UOM)
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Reviewer(s):	Northumbria University
Approved by:	All Partners

Abstract:	The report D5.2 presents the evaluation report for the pilots. The report lists the evaluation findings from each pilot partner and provides details on the pilots' process and findings. The report aims to provide feedback for any future exploitation of the FLIP2G project results.
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Keyword List:

Flipped Classroom, Pedagogical Foundation, Educational Data, Gamification, Serious Games, Problem-Based Learning, Learning Analytics, Flipped Learning Model, Learning design

Consortium

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7.	Secondary education	Revheim skole, Stavanger Kommune	Revheim	Norway

Revision History

Version	Date	Revised by	Reason
01	01/09/2021	AAU, UOM, Norhumbria, Mandoulides, Revheim	Evaluation data / remarks sent by each pilot partner
02	07/12/2021	UOM	First draft sent to peer reviewer
03	11/12/2021	UOM	Second complete draft with additional sent to peer review
04	15/12/2021	AAU	Review report submitted
1	23/12/2021	UOM	Final version uploaded

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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List of Abbreviations

The following table presents the acronyms used in the deliverable in alphabetical order.

<i>Abbreviation</i>	<i>Description</i>
GBL	Game-based learning
FC	Flipped Classroom
LA	Learning Analytics
LMS	Learning Management System
PBL	Problem-Based Learning
WP	Work Package

Executive Summary

The FLIP2G project aims to establish a Knowledge Alliance between higher education institutions, schools and private companies that will boost skills development and introduce novel, data-driven approaches to education and training. The consolidation of all efforts will provide a transnational set of results, as follows:

- a new pedagogical method that combines PBL and flipped classroom with game-based learning (FLIP2G educational approach)
- a gaming platform that supports PBL-enhanced flipped classroom processes, adaptive pathways and educational data recording
- learning designs for higher education, schools and business that support the FLIP2G paradigm
- Learning Analytics (LA) features that produce informative insights on learning process.

The above results aim to produce engaging pedagogical models and novel technologies that can foster motivation, generate adaptive learning pathways and allow self-directed learning in education and training.

The aim of this WP is to evaluate the effectiveness of the project's results in improving education and training through a PBL-enhanced flipped classroom model and an engaging environment with gaming and artificial intelligence elements. This WP will also assess the usage of LA tools in monitoring and guiding learners' progress throughout their learning experience.

Evaluations will consist of the collection, analysis and interpretation of information about all the results (e.g. learning methods and practices, platform, gaming elements). The method that will be followed will support a broad, multidimensional analysis of learning effectiveness, appropriateness and usability cost effectiveness.

The report D5.2 presents the evaluation results for the pilots. The report lists the different findings each partner identified during their pilots and documents elements that aim to guide future stakeholders on designing, delivering and assessing their courses using the FLIP2G project's results.

1.1 Scope

The present document is the Deliverable 5.2 "Evaluation report" (henceforth referred to as D5.2) of the FLIP2G project. The main objective of D5.2 is to present all preparatory work carried out in order to retrieve and document the evaluation of the pilots and the project's results' effectiveness.

1.2 Audience

The intended audience for this document is the FLIP2G consortium, the European Commission, and the public interested in evaluating learning experiences.

1.3 Structure

The structure of the document is as follows:

- Section 2 presents the methodology followed in order to assess the FLIP2G results during the pilots.
- Section 3 presents evaluation results from the AAU pilots.
- Section 4 presents evaluation results from the UOM pilots.
- Section 5 presents evaluation results from the Northumbria pilots.
- Section 6 presents evaluation results from the Mandoulides pilots.
- Section 7 presents evaluation results from the Revheim pilots.
- Section 8 concludes on the evaluation results and presents the main findings and remarks for future consideration.

2 Methodology

The methodology followed in this deliverable aligns with the axes suggested in D5.1 for the evaluation of the project's results, i.e. Pedagogy, Technology, Performance, as shown in Figure 1.

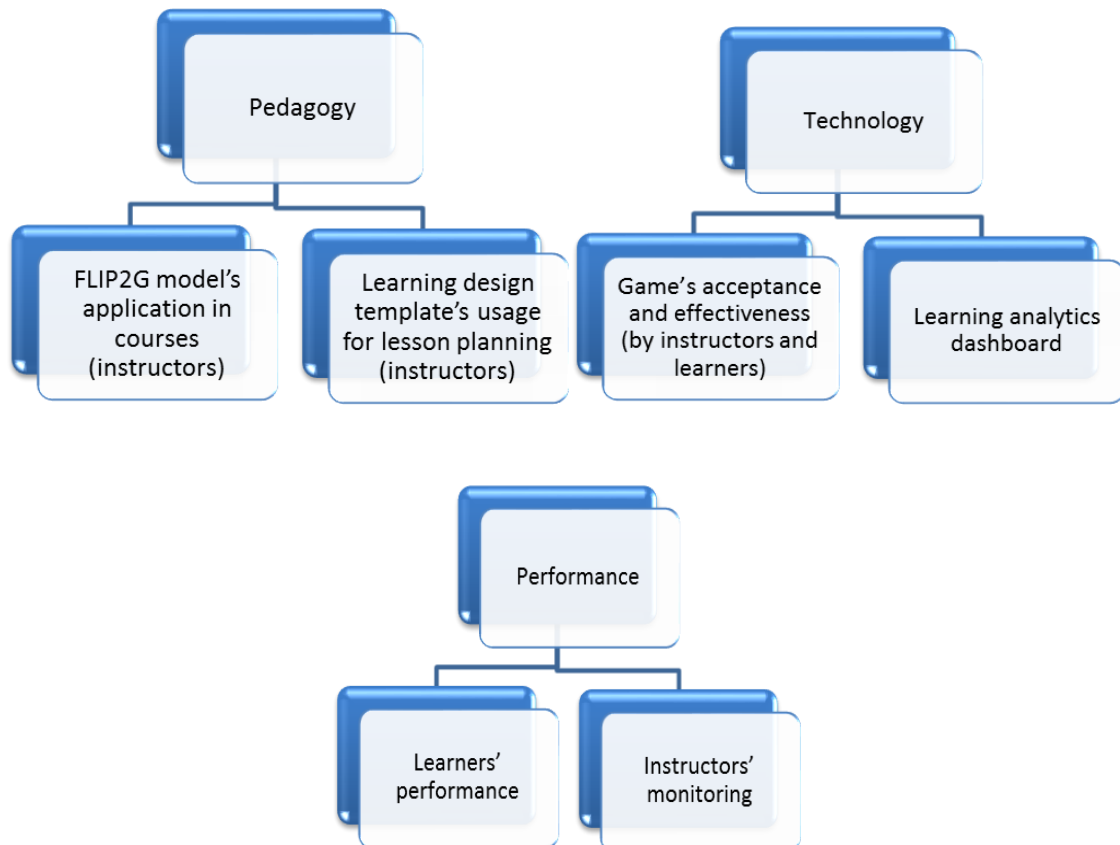


Figure 1 FLIP2G evaluation plan axes

The questions provided in the questionnaires (pre-course and post-pilot) for learners as well as any other form of inquiry provided (e.g. reflections, focus groups, discussion in classroom) covered all the methodology axes and aimed to provide a holistic overview of learners' perceptions about the pedagogical model, their learning experience, their performance and the technology they used.

Similarly, the reflection questions for instructors also covered all above axes and aimed to identify the different ways future instructors can design and deliver their courses using the project's results.

During evaluation, considerations were taken regarding any ethical or privacy issues that regard the participation of learners in the pilots. To this end, all information documented was anonymized and no personal data (e.g. name, communication information, gender etc.) were provided and documented for further processing.

Regarding the type of data that was used to generate the evaluation results, the pilot partners used a mix of quantitative and qualitative data, depending on the context and what type of evaluation technique fit best for each pilot's context. Such data include:

- Elicited data (e.g. feedback and questionnaire)
 - Reflection remarks by instructors
 - Quantitative questionnaire answers (open ended or multiple choice) from pre-course survey
 - Quantitative questionnaire answers (open ended or multiple choice) from course evaluation survey
 - Focus groups discussions
- Extant data: data on learners' performance and progress within the pilots (learners' social network interactions, classroom behaviour, game or other e-learning platform interactions).

The following sections provide information on each pilot partner's courses, where the FLIP2G project results have been tested by learners in primary, secondary and tertiary (undergraduate and postgraduate) education.

3 AAU trials evaluation

3.1 Pilot 1 evaluation

AAU ran a pilot at the Medialogy bachelor program¹ and the chosen course “Programming for Interaction” during the Spring semester 2021.

AAU learners answered the pre-course questionnaire, where 24 learners provided information regarding their previous experiences with pedagogical strategies such as PBL and flipped classroom as well as innovative technologies such as serious games and Learning Analytics (LA). Some of the most representative data retrieved from their answered are shown below.

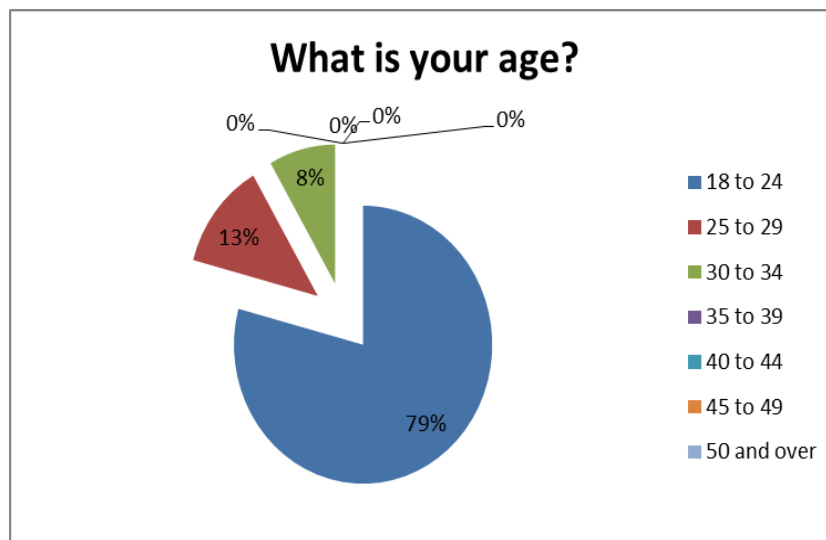


Figure 2 Ages of AAU learners

¹ <https://www.aau.dk/uddannelser/bachelor/medialogi/>

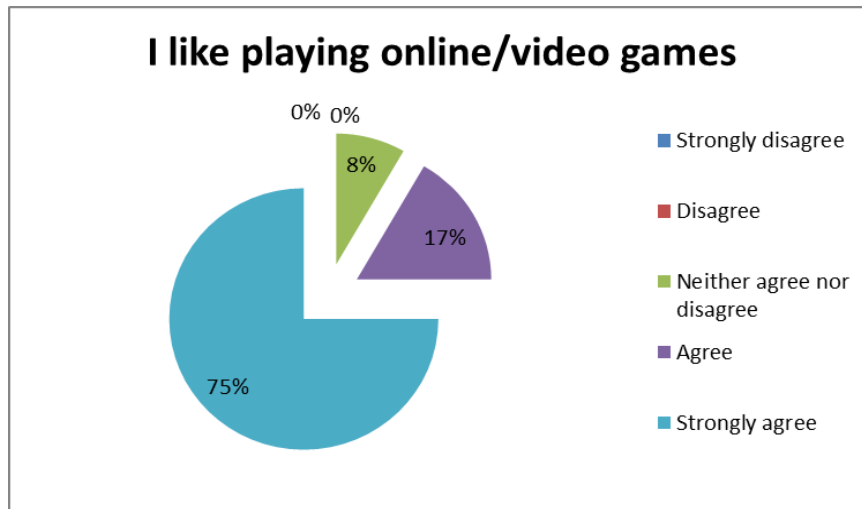


Figure 3 Answered to “I like playing online/video games” from AAU learners

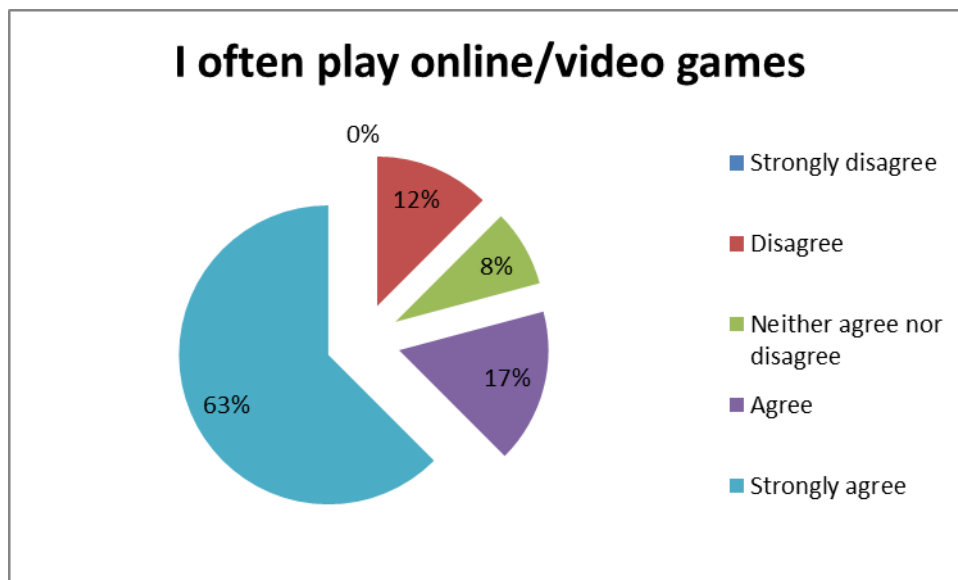


Figure 4 Answers to “I often play online/video games” from AAU learners

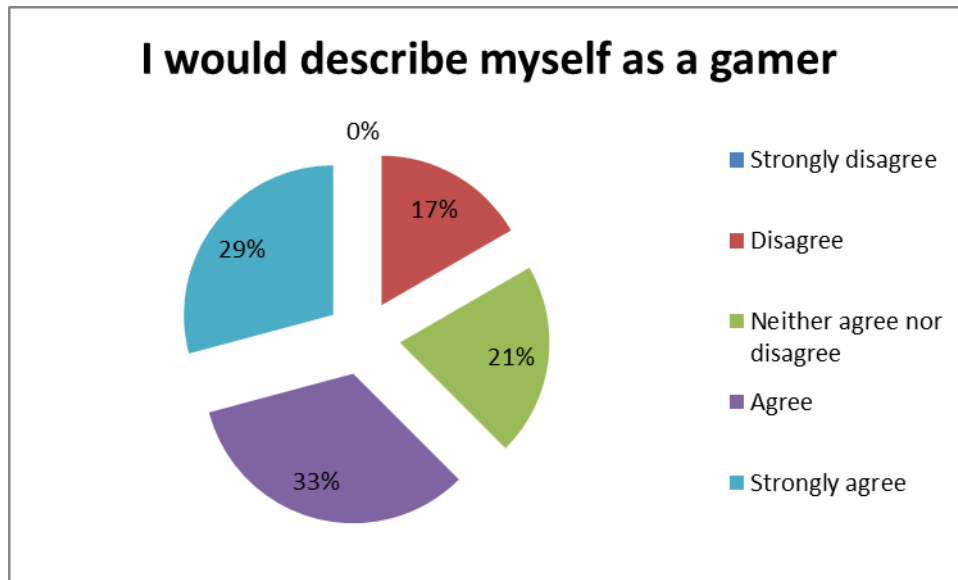


Figure 5 Answers to “I would describe myself a gamer” from AAU learners

Based on Figure 3, Figure 4 and Figure 5 it seems that AAU learners are fairly proficient in playing games on a regular basis. This was taken into consideration during the post-pilot questionnaire answers, as experienced players would be more demanding of a serious game in comparison to amateurs or non-players.

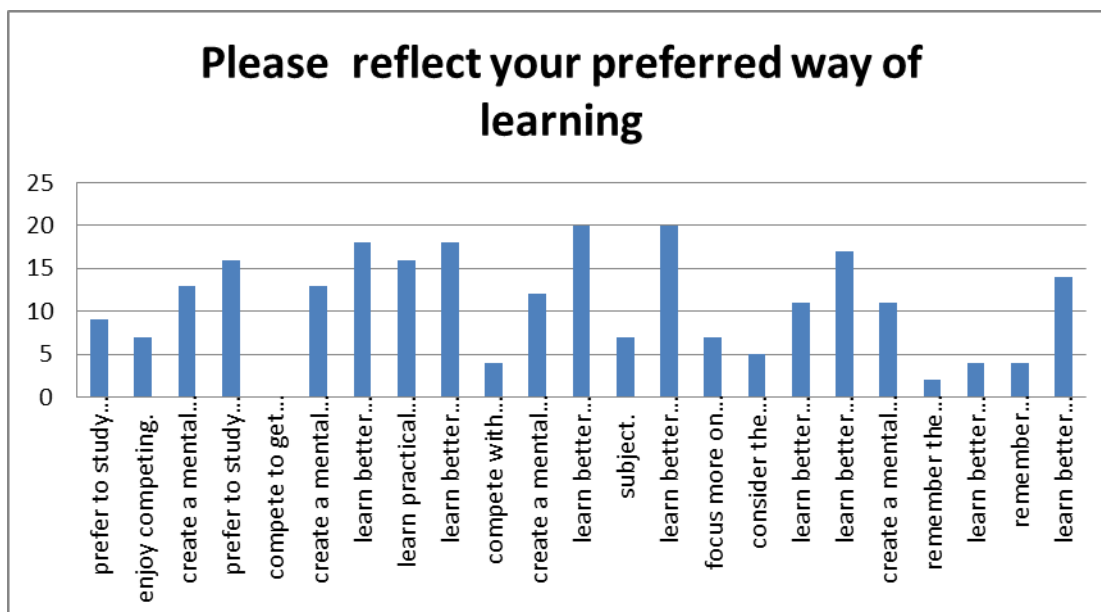


Figure 6 Answers for question “Please reflect your preferred way of learning” from AAU learners

Figure 6 shows that AAU learners' preferred ways of learning are using visual aids (e.g., whiteboard, power point), being involved in tasks and when someone represents information in a pictorial (e.g., picture, flowchart) way.

Once the pilot was completed, 14 learners answered the questionnaire where they reflected on the course's main evaluation axes and concepts and provided their feedback on their experience. Representative answered provided are shown in the following charts.

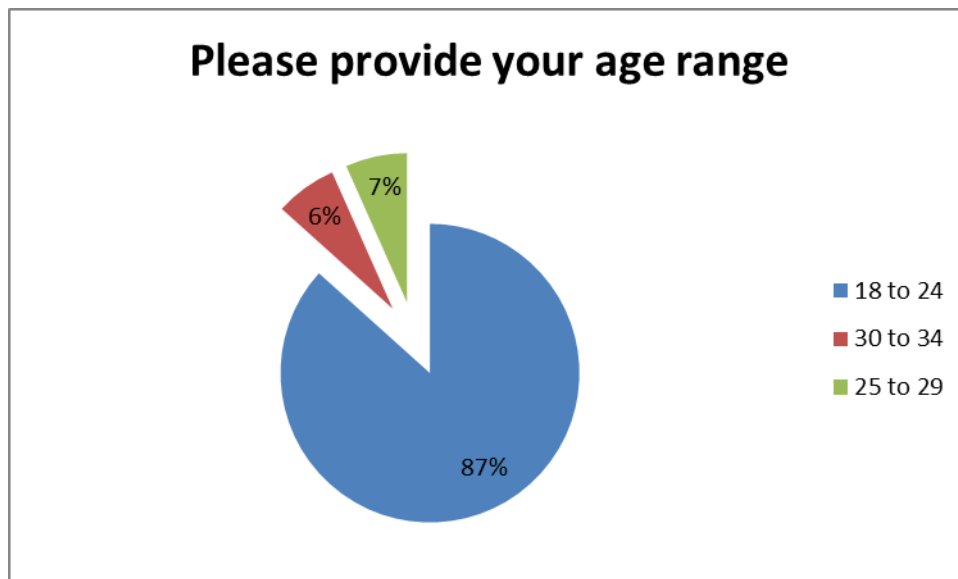


Figure 7 Age range for AAU learners

Figure 8 shows that there is a preference (47%) of learners studying the learning material on their own; however, there is a significant 27% that does not have a strong preference on the matter.

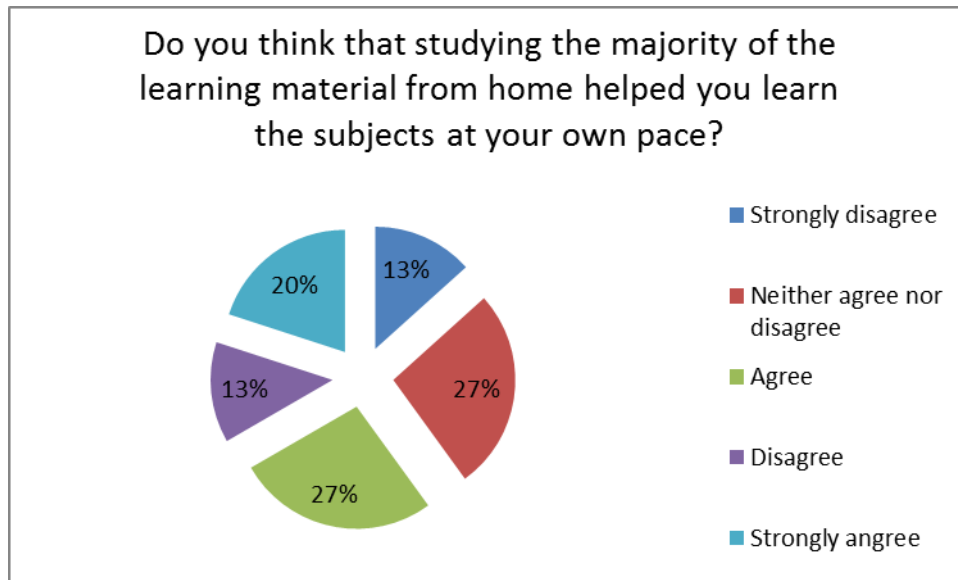


Figure 8 AAU learners' view on studying on their own pace (flipped classroom)

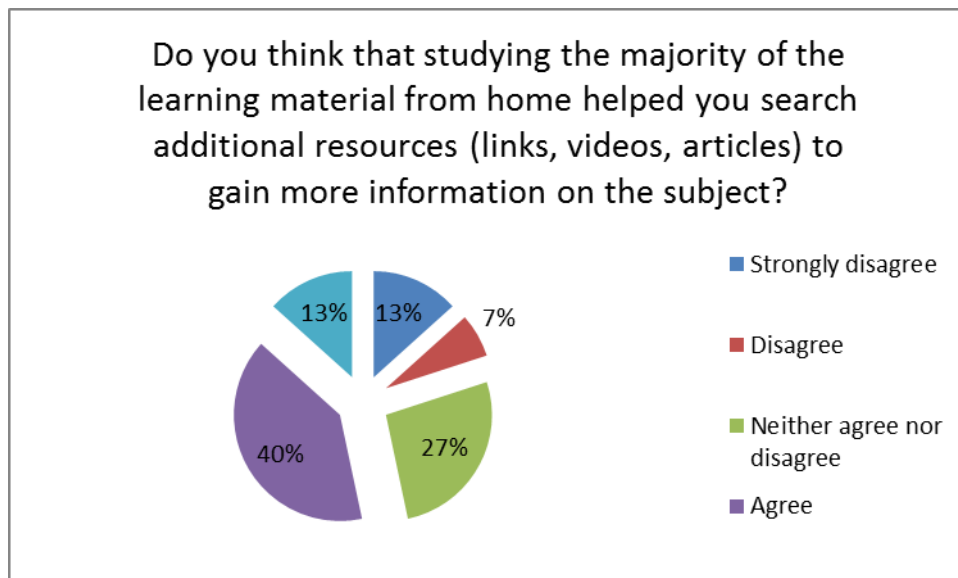


Figure 9 AAU learners' view on improved knowledge (flipped classroom)

Figure 9 shows that the majority of the learners believe that studying from home and searching on their own for additional resources improved their knowledge on the subject matter, as they were able to retrieve more information instead of just relying on the material provided by the teacher.

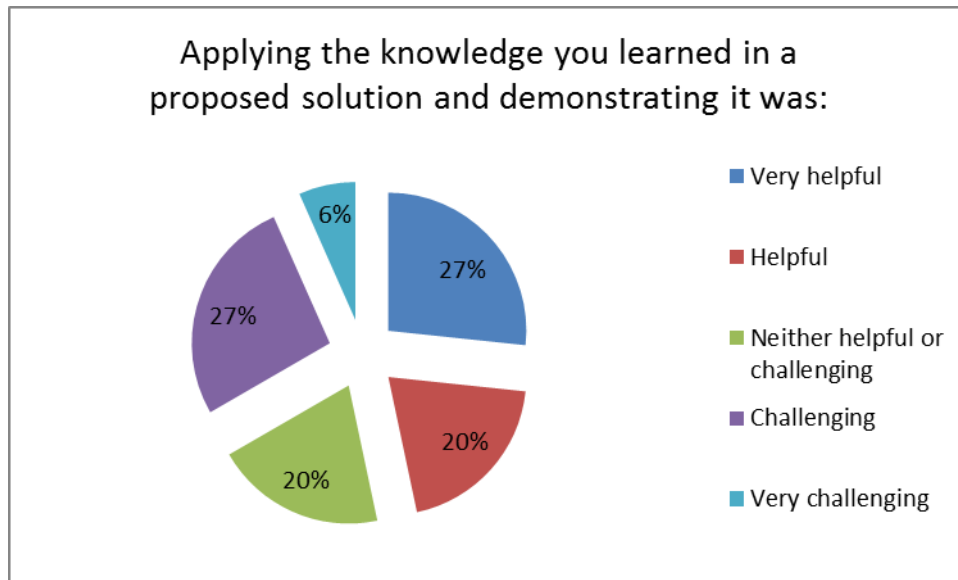


Figure 10 AAU learners' views on knowledge practice and application (flipped classroom)

Based on Figure 10, it seems that 47% of AAU learners found the task of applying the learned knowledge and demonstrating their findings in the classroom helpful, while 33% found it challenging.

Regarding collaboration during their course (Figure 11), 60% AAU learners preferred working in groups while 40% preferred working individually. The high number of individual preference can also be contributed to the fact that the course took place online to due COVID-19 restrictions, so group work was more challenging compared to working together in the classroom.

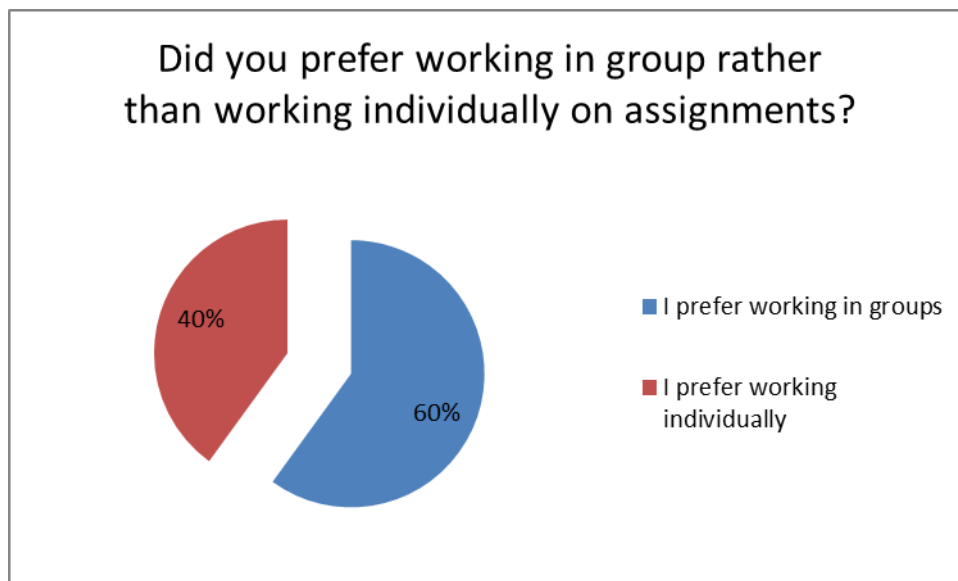


Figure 11 AAU learners' views on group-work (PBL)

For the question “What types of activities did you participate in while applying the concepts of the course or further exploring the subject matter?”, the most prominent answers were:

- Playing a game
- Discussing with my classmates
- Developing a prototype/system/solution
- Reporting my solution
- Discussing with my teacher
- Presenting my solution to classmates and the teacher

When learners were asked about their experience of the game, even though the majority experienced several technical issues during the pilot, only 14% stated that the game is not easy to use.

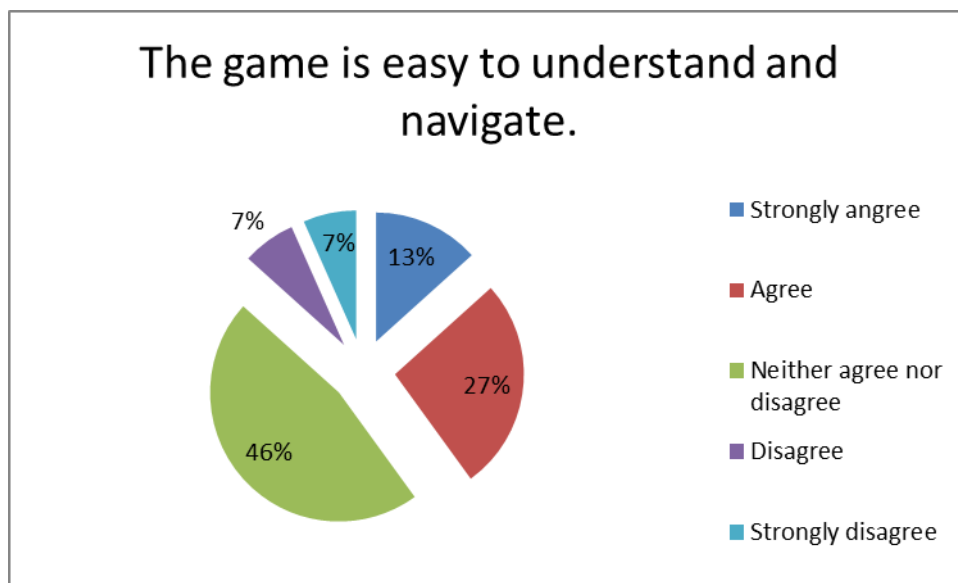


Figure 12 AAU learners' view of the game's ease of use (technology)

Additionally, learners had no issues with accessing the learning materials provided by the teacher within the gaming environment (Figure 13).

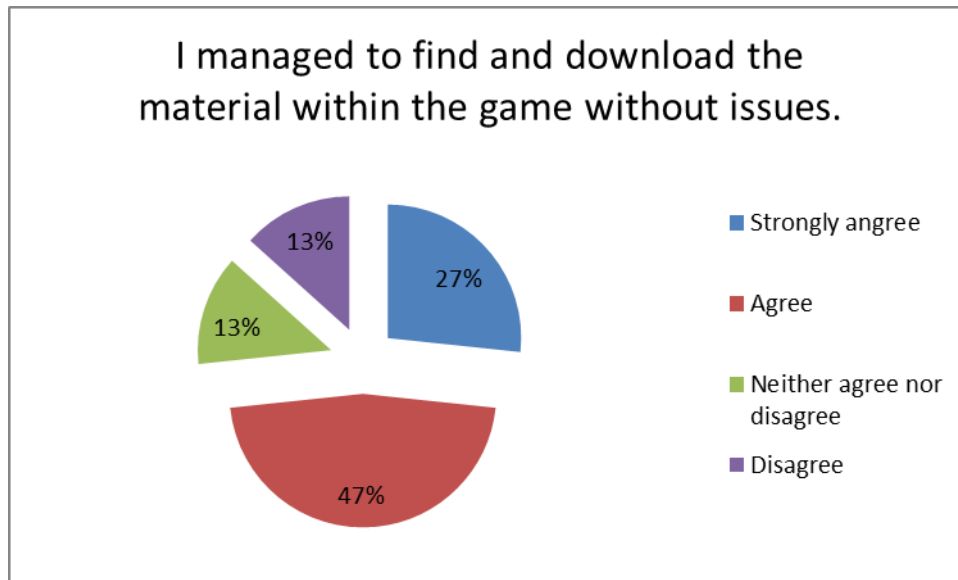


Figure 13 AAU learner's views on learning content access (technology)

Finally, regarding LA, learners showed a positive attitude towards having access in their statistical data during the game.

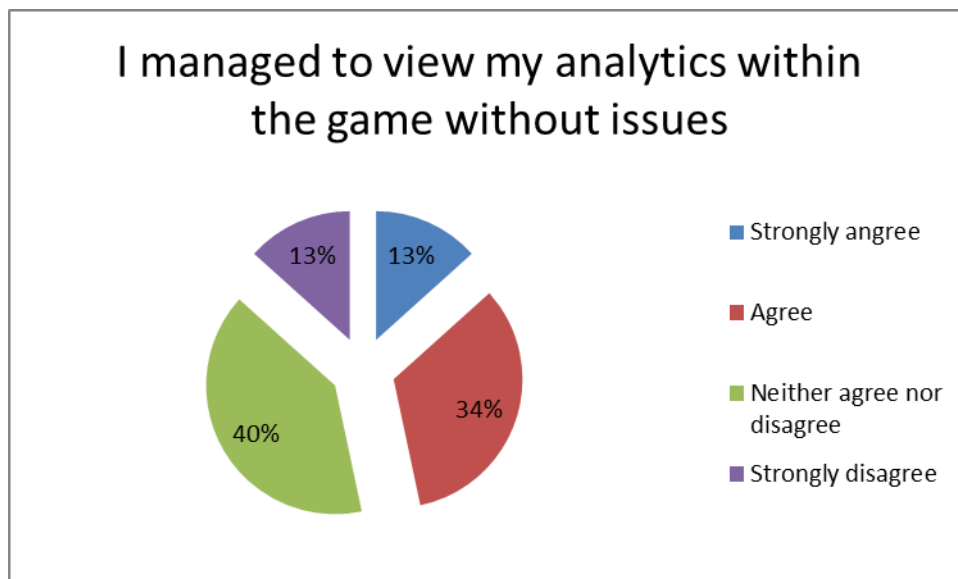


Figure 14 AAU learners' view on LA (technology)

Overall, learners enjoyed the FLIP2G pedagogical approach, as they had more freedom in the learning content they were required to study and they could work at their own pace. However, due to the COVID-19 restrictions, where they had to work exclusively from their homes and personal computers, they experienced issues with collaboration with their classmates and technical issues

with the gaming environment. Nevertheless, they were positively inclined to use the pedagogical and technological solutions again in the future.

3.2 Pilot 2 evaluation

AAU ran Pilot 2 during the fall of 2021. This pilot was comprised in the vast parts of students from Pilot 1, continuing from MED2 to MED3. This was considered as an advantage as it allowed students to follow and comment on the adjustments and interventions from Pilot 1 to Pilot 2. The pilot was run half online, half in class, with some students choosing to keep following the lectures online (the lectures were recorded and broadcasted on MSTeams by student request. This hybrid format was made necessary by ongoing Covid restrictions and student difficulties to return on campus.

Since the student group was mostly the same it was decided not to redo the pre-engagement course. The course evaluation questionnaire was circulated among the students and resulted in 10 complete answers. This number, although too small to be significant, led us to some observations as to the conduct and impact of Pilot 2.

Regarding studying the material from home, students tended to agree that it was mostly useful to encourage them to use other resources (links, videos, articles) by 6 respondents. Students were split as to whether learning the material from home helped them understand the material better (four agree, three disagree and three neither), or that studying at home allowed them to study at their own pace (four disagree, three agree, three neither). This can be explained by the rather intense rhythm to which the students from Pilot 2 were subjected (the lectures had to be condensed over a very short eight-weeks time), and the difficulties of alternating from online and in person classes.

In general the students testified that they found preparing at home challenging, but that the possibility of practising with the material and to engage in practical exercises was useful. This aligns with previous observations in the Flipped Classroom which shows that students can struggle with the autonomy demanded by pre-class preparation, but will then appreciate the time devoted in class to hands-on activities, even if they do not make the connection between preparation in the former to succeed in the latter.

Regarding activities, students gave a neat preference to interacting with their classmates through group discussions (10 respondents) and group work around the mini-project development (7 respondents). Regarding the use of the game, its salient feature for the students was the motivation to retake the quizzes and improve their score (six agree or strongly agree), and four respondents reported a positive experience with the game, although some students claimed that they would have preferred a simple quiz interface instead of a gamified one.

Our conclusions from Pilot 2 is that students still enjoyed the FLIP2G pedagogical approach, as they had more freedom in the learning content they were required to study. They still appeared positively inclined to use the pedagogical and technological solutions again in the future. However, the

3.3 Instructors' perspective

The following section provides an overview of the AAU instructor's overall reflections for their pilot.

Did you have any previous experience in your courses with flipped classroom, PBL and gaming? If yes, please provide some examples.

Previous experience with flipped classroom for the lectures and PBL (a mini-project based on PBL).

Did you apply the Concept exploration phase in your pilot? If not, why? If yes, what was your educational goal?

Yes. The goal was for learners to understand the concepts introduced in the literature/slides/video tutorials and their application in software development by accessing learning material and completing activities in the game.

How did you design your Concept exploration phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Interaction with learning material in the game, websites, slides, literature, and video lectures generated engagement data. From these data, feedback and clarifications were given to the learners based on questions posed.

Did you incorporate any of the PBL stages within the Concept exploration phase of your course? If no, why? If yes, please explain.

Yes, problem analysis. The learners were able to analyze the concepts needed for their mini-project during the concept exploration phase.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Concept exploration phase?

Provide clarifications and feedback

Did you apply the Meaning making phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners engaged with learning activities that aimed to help them understand the topics covered in the learning material provided in the concept exploration phase.

How did you design the Meaning making phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Quizzes in the game, content exploration. The quizzes in the game and the content provided engagement data and performance data (only the quizzes). Based on this data, feedback and clarifications were provided to learners. Moreover, disengaged learners were notified by emails.

Did you incorporate any of the PBL stages within the Meaning making phase of your course? If no,

why? If yes, please explain.

Yes, problem analysis. The learners were able to analyze the concepts needed for their mini-project during the concept exploration phase.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Meaning making phase?

Recommendations and feedback were given based on the most challenging questions in the game and any questions raised by learners. Disengaged learners were also reminded for engaging with the required activities.

Did you apply the Demonstration and Application phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, the goal was for learners to apply the knowledge gained in the previous stages by completing programming assignments in groups. These assignments concerned sub-parts of the application that the learners should develop for their mini projects. When learners faced problem implementing the solutions to the assignments, the instructors provided learners with hints on how to move forward/correct errors in their code.

How did you design the Demonstration and Application phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

The learning activities included group work, developing a prototype, and writing technical documentation for this prototype. Since this stage took place within the classroom and the learning activities took place outside the project's platform, the learning analytics/data collected from this stage was limited. The only things analyzed after the course completion were the submitted solutions/prototypes and the technical documentation with the aim to adjust future iterations of the course.

Did you incorporate any of the PBL stages within the Demonstration and Application phase of your course? If no, why? If yes, please explain.

Yes, problem solving, since the learners developed a prototype as a solution to a problem.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Demonstration and application phase?

The learners got scaffolding hints and formative feedback during the in-class sessions.

Did you apply the Experiential engagement phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, the goal was for the learners to design and implement a prototype where they applied the basic concepts taught in the course.

How did you design the Experiential engagement phase for your course? Please provide examples of

activities, data generated, and interventions made based on LA.

The learners were asked to submit their mini projects (finished application and report) at the end of the module. They had the chance to discuss their drafts with the instructors to get some formative feedback before submission. The mini projects were used to assess whether the main learning outcomes of the module had been achieved. The learners only received summative feedback on their mini project, no marks. The feedback aimed to help them identify areas for further improvement before the final exam. The final exam was a multiple choice quiz, where learners received individual marks.

Did you incorporate any of the PBL stages within the Experiential engagement phase of your course? If no, why? If yes, please explain.

Yes, evaluation and reporting.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Experimental engagement phase?

As described above, the learners got formative feedback, summative feedback, and final marks.

What was your overall experience with the teacher dashboard? Positive, negative? Why?

Some aspects were positive, some negative

Please let us know what the most positive feature of the teacher dashboard was and which the most negative. Provide some examples.

The questions, quizzes and courses implementation could be used easily. The tag system made it easy to move big chunks of questions from one questionnaire to the next. The course management and session activation worked fine.

Most negative was the difficulty to attach course material: it broke several times and could not be relied on even to the end

Did you find the teacher dashboard user friendly?

In general, no, especially considering that other existing quiz management systems (e.g. quizzlet) provide models of very user friendly interface for the same function

Did you manage to add learners from the Learners menu? Did you encounter any issues?

We managed to add them but could not delete inactive accounts afterwards

Did you manage to create questions in the Questions menu? Did you encounter any issues?

The questions menu was bugged at first (questions multiplied in several identical exemplaries) but was fixed eventually

Did you manage to create quizzes in the Quiz menu? Did you encounter any issues?

Quizzes creation mostly worked

Did you manage to add learning content from the teacher dashboard? Did you encounter any issues?

There were several bugs to add learning content but they were mostly fixed

Did you manage to set up courses and sessions in the teacher dashboard? Did you encounter any issues?

Adding sessions and courses was fine

What improvements do you think could add value to the teacher dashboard?

The teacher dashboard should have been made much more intuitive. For most operations several actions were needed where other LMS provide examples of much easier and user friendly interface

What was your overall experience with the LA dashboard? Positive, negative? Why?

General experience was positive, a lot of interesting data could be read on the teacher dashboard

Please let us know what the most positive feature of the LA dashboard was and which the most negative. Provide some examples.

Most positive was the visualization of scores by sessions and score/engagement ratio. The ability to access each learners dashboard was also useful to assess individual cases

Most negative was the dropout prediction that was not very easy to understand and used too little data to be really useful

Did you find the LA dashboard user friendly?

It was adequate even though the amount of information makes scrolling a bit difficult

Did you manage to make sense of your learners' progress using the LA dashboard?

The identification of under engaged learners was useful but more information could have been useful

Which LA graphs did you find more useful and which more challenging to understand?

As mentioned above the average graphs (for the whole group and session) were the most useful

The engagement graphs were more complicated because the average in seconds did not always make sense

Were you able to adapt your course based on information you gained from the LA dashboard? Please provide examples.

Between pilot 1 and 2 we pushed to get the Multiplayer game running since the information led us to think it was what the learners were interested in. We tried to intensify interest in courses in the second part of the semester since the data revealed that we always had a drop in engagement after

the first month of courses

What additional features would you want to see in the LA dashboard?

A more complete dashboard of learners and not only the 5 best/5worst would be the most useful

4 UOM trials evaluation

UOM ran six pilots in total, during academic years 2020 and 2021. Four pilots ran on courses of the undergraduate program of Applied Informatics at UOM, while two pilots ran on courses of the postgraduate program of the same department.

In total, 484 learners enrolled in the six pilots; however, due to the fact that four of the six courses ran fully online during the first two years of the COVID-19 pandemic and Greece's lockdown restrictions, this led to a major dropout rate for the learners and a significant lack of participation in the courses. Thus, the majority of the feedback gathered came from discussions in the weekly sessions on the project's outputs, such as the pedagogical model with which the course was designed and the game they used. In total, 114 learners answered the pre-course survey we provided them, where they provided information on their learning preferences, both pedagogical and technological, while 21 learners answered the online questionnaire after the courses ended. Due to the small number of quantitative responses, we provide a general overview of learners' answers in each pilot section and a holistic overview of their responses as UOM pilots in Section 4.7.

4.1 Pilot 1 evaluation – e-Government

The e-Government course ran during the 7th semester of the Applied Informatics department. In total, 74 learners were enrolled in the course for the fall semester 2020. Pilot 1 ran fully online due to the Covid-19 restriction and the weekly sessions were carried out through Zoom for the lectures. Learners also used the gaming environment and the e-learning platform available from the university in order to complete their courses. However, because the game development was still at its early stages and learners had to use their personal PC / laptops, this led to a major drop out from the usage of the FLIP2G game due to its heavy graphics, and the UOM teacher had to also largely use the university's e-learning platform for content access, quizzes and assignments submission.

During the fall semester, the evaluation questionnaire was still in draft format, and since only a few learners participated in the course, the evaluation process was carried out during the Zoom sessions through discussions, where the teacher took notes of learners' main remarks. These discussions took into account the following questions from D5.1 for the learners and the main remarks provided are shown below.

Table 1 e-Government learners' reflection remarks

Now that the course is over, what are your first thoughts about the learning approach that was followed? Are they mostly positive or negative? If positive, what comes to mind specifically? Similar with negative?

The majority of the learners greatly enjoyed the change in pedagogy, where they could read the learning content on their own pace. Learners could access the material from the e-learning platform and could also ask the teacher for clarifications on the concepts they read during the next weekly

session.

Learners also mentioned that they enjoyed the fact they were asked to solve problems based on a given scenario. This gave them the opportunity to use their thinking skills, search for possible solutions and challenge themselves.

What were the most interesting moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. Please provide information about all three.

Learners mentioned that they really enjoyed working together with their classmates, even if it was done remotely due to COVID-19 restrictions. It gave them an additional purpose to study the learning content during the entire semester instead of focusing on reading the slides closer to the final exams. Learners also stated that they surprised by their own skills to apply the knowledge they learned into the assignments and this increased their confidence in their skills.

What were the most challenging moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises.

Learners mentioned that working together with their classmates was more challenging than they expected because they could not meet with them and work together up close due to COVID-19 lockdown restrictions. This made the group work more difficult as they had to do everything online. Some learners also stated that sometimes they got easily distracted when they had to read the materials on their own, which led them to spend more hours than they would have liked to understand the learning content.

Regarding application of knowledge, some learners stated that what they found challenging was that they were sometimes unsure of their progress, as this was a new process for them, and they needed constant reassurance that they were proceeding as they were required.

Do you prefer the more traditional courses where lectures are taught during class and your participation and engagement is minimum or this new type of participatory learning experience? Please elaborate on the reasons for your preference.

All learners stated that they prefer a more interactive approach to learning, where they have an active role in the course so that they feel that they are improving their skills along with their knowledge.

Tell us about the overall experience with the game. Was it positive or negative? Why?

The majority of the learners experienced technical issues with the game, which would freeze while they were playing the game or they could not login at all. This led to their inability to experience and enjoy the game to the maximum of its ability, due to the issues mentioned already (personal computers and wifi, early stages of game development).

What features of the game did you use? How often did you login in the game and for what purpose? <i>Learners mentioned that they used the game for accessing the quiz and answering the questions given. They logged in every week during the quiz session.</i>
What did you feel was interesting and lacking about the game? <i>Interesting features mentioned were the analytics dashboard while they thought the scenario and narrative were lacking, and suggested a more engaging storyline for the future.</i>
Were there any technical issues while using the game? Did the technical issues prevent you from enjoying the gaming experience? <i>Yes, the technical issues already mentioned, which did not allow many learners to participate in the game. However, the learners that managed to login and complete the tasks, enjoyed the game very much.</i>
Would you be interested in playing an enhanced version of this game? What do you think would make the game better? <i>All learners showed a positive attitude towards using the game in the future. Lack of technical issues, a more interesting narrative and more attractive graphics were some of the improvements mentioned.</i>
Did you playing the game affect your performance in any positive or negative way? Please explain. <i>Learners took the quizzes more than one time, which allowed them to try and figure out the correct answers more actively.</i>
Did you find the quiz part of the game motivating for you to test your knowledge? What would change about the quiz process and what would you keep? <i>All learners were motivated to finish the quizzes and check if they had understood the subject matter correctly. Some learners mentioned that they would like different difficulty levels or hints.</i>
Did you find the material access easy in the game for you to read? What would change about the material access process and what would you keep? <i>Learners did not experience problems with finding the material. They suggested that the game should allow other forms of materials (e.g. videos, HTML).</i>

4.2 Pilot 2 evaluation – Advanced Information Systems

Pilot 2 for UOM ran during the Spring semester of 2021. It is an elective course that runs during the 8th semester for the Applied Informatics department. In total, 8 learners were enrolled during the pilot. Pilot 2 ran fully online due to the Covid-19 restrictions that were in place in Greece, and it was carried out mainly without the usage of the FLIP2G game, as the pilot was carried out in the

beginning of the game's launch and the learners were experiencing technical problems with the interface (freeze of the quizzes after a few questions).

Similarly with Pilot 1, the evaluation process was carried out with discussions amongst the learners and the teacher, due to the fact that the evaluation template was not yet fully developed and because of the small number of participants. The same reflection questions aforementioned and available in D5.1 were used to guide the discussion, and the main remarks documented are shown in Table 2.

Table 2 Reflection remarks for Advanced Information Systems UOM pilot

Now that the course is over, what are your first thoughts about the learning approach that was followed? Are they mostly positive or negative? If positive, what comes to mind specifically? Similar with negative? <i>Learners remarked that they found the FLIP2G learning approach interesting and challenging at the same time. The subject matter of the course (SAP S4/HANA) was more technical in nature and they didn't find many opportunities to collaborate. However, they really liked reading the content on their own before the class.</i>
What were the most interesting moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. Please provide information about all three. <i>Learners mentioned that they found it helpful having team members, since the subject matter of the SAP ERP was very new to them, so they needed the support of a group to encourage them. Learners also liked that they could read the material at home, since they didn't have any prior knowledge of SAP and they needed extra time to understand the different modules and the way they had to use all the different screens to complete their tasks.</i>
What were the most challenging moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. <i>The most challenging moments learners mentioned were the need for remote collaboration, which was not as direct as face-to-face discussions, and the fact that they didn't have the teacher present when they were learning about the learning content, so they had to take notes on the questions they wanted to ask in the next course sessions.</i>
Do you prefer the more traditional courses where lectures are taught during class and your participation and engagement is minimum or this new type of participatory learning experience? Please elaborate on the reasons for your preference. <i>All learners stated that they preferred that they were more actively involved in the course, especially for subject matters that are new to them and require more in depth understanding of the material</i>

and excessive practice to better apply the knowledge.

4.3 Pilot 3 evaluation – Innovative e-Business Systems (MSc)

Similar to the first two pilots, pilot 3 ran fully online due to the Covid-19 restrictions that were in place in Greece during the Spring semester of 2021. The course was carried out using the university's e-learning platform and the FLIP2G gaming environment.

In total, 18 learners were enrolled in the course. However, as learners again experienced connection time-out issues with the game from their personal computers, some learners executed the course's quizzes in the gaming environment and some used the e-learning platform.

Based on the evaluation questionnaire for the course with four respondents, the ages varied between the following ranges:

- 40 to 44
- 35 to 39
- 25 to 29
- 18 to 24

Thus, the course, as expected since it is on postgraduate level, included a wide variety of ages and backgrounds.

Three out of four learners responded that they believe reading the majority of the learning content on their own pace helped them understand the content better, take notes on issues they did not understand fully and needed clarifications, and search for additional content on their own to get more information. Learners also believed that reading from home before a lecture was very helpful and they were able to apply the knowledge taught more easily and effectively.

Learners were also able to collaborate with their classmates in order to complete the group assignments, present their problem solutions to their team members and the classroom/ teacher, as well as draft a comprehensive report presenting the solution and work done.

Regarding the game, learners noted that it was easy to use and they were motivated to complete the quizzes within the game in order to complete their task. However, they also stated that they had issues with the technical problems they encountered during their interactions with the game, and they proposed in the future for the game to have more interactive elements.

4.4 Pilot 4 evaluation - Information Systems Analysis and Design BSc

Pilot 4 ("Information Systems Analysis and Design" undergraduate course) ran fully online due to the Covid-19 restrictions during the spring semester of 2021. The course was carried out using the university's e-learning platform and the FLIP2G gaming environment. Similarly to the other pilots,

due to the technical issues, some learners executed the course's quizzes in the gaming environment and some used the e-learning platform.

The questionnaire was answered by 14 learners of the course, where 79% agreed that that reading the learning content from home before each lecture helped them understand the subject matter concepts at their own pace, while 64% agreed that reading the material at home helped them keep notes on concepts they could not make sense of so that they could discuss them in the class sessions with their classmates and their teacher.

Additionally, 100% of the participants stated that practicing the taught knowledge and applying it in real world problems helped them understand the material better and gain additional skills. However, 78% would prefer to have more communication with the teacher. This also stemmed from their inability to get in touch with their classmates and teacher due to the lockdown in place. This did not take away from their positive inclination to work in groups compared to individual assignments, as 67% of the learners stated group work as their prefer means of tasks completion. Finally, regarding the game, 67% stated a positive experience with the environment, 74% managed to complete their tasks within the game and 67% agreed that the game's features were interesting and easy to navigate.

Overall suggestions provided by the learners for future improvements regard the solutions of the technical issues, the existence of questions with varying difficulties and the inclusion of more rewards to increase motivation for participation.

4.5 Pilot 5 evaluation - e-Government (2nd iteration)

Pilot 5 regards the second iteration of the e-Government course. During the second iteration, the pilot was carried out in a blended setting, where weekly lectures were performed in the university facilities, while technologies such as the course's e-learning platform and the FLIP2G game supported the course's successful operation. From the 111 enrolled learners, approximately 34 to 36 learners participated actively.

Due to limited time, as the pilot had to be completed at the beginning of December to ensure the on time documentation of the relevant deliverables (D4.2, D5.2), the evaluation of the course by the learners followed the reflection methodology, where discussions were carried out in the classroom on learners' experience with the new pedagogical approach and gaming environment.

Table 3 e-Government (2nd iteration) reflection remarks

Now that the course is over, what are your first thoughts about the learning approach that was followed? Are they mostly positive or negative? If positive, what comes to mind specifically? Similar with negative?

Even though learners experienced the project's results for one month, they remarked that they enjoyed having a more active role in the learning process and that they were able to work together

with their group members to complete the given tasks.

What were the most interesting moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. Please provide information about all three.

Learners stated that they were able to better understand the topics of the course by discussing them with their team members and dividing the work to be done for the problem. This allowed them time to put the knowledge to practice and not be overwhelmed with all the task's requirements.

What were the most challenging moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises.

Learners mentioned that being able to set the pace of their own learning provided them with a freedom that they did not have before, but they were also sceptical because they were not sure they understood the material correctly. So they waited for the weekly lecture to confirm their findings with the teacher.

Do you prefer the more traditional courses where lectures are taught during class and your participation and engagement is minimum or this new type of participatory learning experience? Please elaborate on the reasons for your preference.

All learners remarked that they prefer active participation to traditional learning, because this way they are able to check their own progress during the semester and not wait until the final exams to read the entire curriculum and depend on their final scores for their total course grade.

Tell us about the overall experience with the game. Was it positive or negative? Why?

The majority of the learners experienced a positive interaction with the game.

What features of the game did you use? How often did you login in the game and for what purpose?

Learners mentioned that they used the materials access and the quizzes. They logged in once a week to complete the quiz.

What did you feel was interesting and lacking about the game?

The most interesting feature of the game was the fact that learners could remove one answer from the possible answers pool of a question, if they had difficulty identifying the right answer at once. Even though this feature reduced the total scores of the question, they found it unique and engaging.

Were there any technical issues while using the game? Did the technical issues prevent you from enjoying the gaming experience?

The majority of the learners did not have any difficulties accessing and navigating the game.

Would you be interested in playing an enhanced version of this game? What do you think would

make the game better? <i>Learners agreed that they would play an improved version of the game, with a more relevant narrative to the course.</i>
Did you playing the game affect your performance in any positive or negative way? Please explain. <i>Learners stated that the quizzes with the new feature aforementioned provided them with an active way to test and validate their knowledge, thus improving their performance.</i>
Did you find the quiz part of the game motivating for you to test your knowledge? What would change about the quiz process and what would you keep? <i>Yes learners were motivated to test their knowledge through the quizzes. They would like hints provision or to skip a question and come back to it later.</i>
Did you find the material access easy in the game for you to read? What would change about the material access process and what would you keep? <i>Learners had no problems or comments about materials access.</i>

4.6 Pilot 6 evaluation - Information Systems Analysis and Design MSc

Pilot 6 regarded a postgraduate course that was carried out from October 2021 until the end of November 2021.

Similarly to pilot 5, the evaluation of the course by the learners followed the reflection methodology, where the main remarks are shown in Table 4.

Table 4 Information Systems Analysis and Design MSc - reflection remarks

Now that the course is over, what are your first thoughts about the learning approach that was followed? Are they mostly positive or negative? If positive, what comes to mind specifically? Similar with negative? <i>Learners were very pleasantly surprised by the new learning approach. Even though their ages varied since this was a postgraduate course, all of them were interested in being more active in the course and preferred studying at their own pace, especially learners that had full time jobs.</i>
What were the most interesting moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. Please provide information about all three. <i>All learners enjoyed working in groups and practicing what they learned.</i>
What were the most challenging moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical

exercises.

Some mentioned that they were sometimes unsure if the content they found online was accurate or relevant to the course.

Do you prefer the more traditional courses where lectures are taught during class and your participation and engagement is minimum or this new type of participatory learning experience? Please elaborate on the reasons for your preference.

The majority of the learners preferred active engagement and usage of technology for learning.

Tell us about the overall experience with the game. Was it positive or negative? Why?

Learners enjoyed playing with the game, even though their interaction with the environment was limited due to time restrictions. They didn't experience any problems.

What features of the game did you use? How often did you login in the game and for what purpose?

Learners logged in every week on the course session and accessed the learning content as well as the quizzes.

What did you feel was interesting and lacking about the game?

Learners mentioned they liked the feature of the game where they could remove possible answers. It reminded them of TV gameshows and they could experiment with the questions. They would have liked more levels of difficulty.

Were there any technical issues while using the game? Did the technical issues prevent you from enjoying the gaming experience?

No major technical issues were reported.

Would you be interested in playing an enhanced version of this game? What do you think would make the game better?

All learners showed interest in playing the game in the future. They would like a more interesting end goal, more interactions with the other learners and gadgets.

Did you playing the game affect your performance in any positive or negative way? Please explain.

Learners mentioned they didn't have enough of an interaction with the game to affect their performance. They did say that they were more interested to answer the quiz by playing the game.

Did you find the quiz part of the game motivating for you to test your knowledge? What would change about the quiz process and what would you keep?

Yes they did. They would like more hints and for more dialogue between their character and the villain character.

Did you find the material access easy in the game for you to read? What would change about the

material access process and what would you keep?

No issues were reported.

4.7 Overall UOM learners' evaluation

An overall overview of UOM's learners can be provided by looking at the responses from the pre-course questionnaire, with information on their learning and technological preferences, and from the post-course questionnaire, with information on their experience with the project's results.

For example, Figure 15 shows that the majority (93.9%) of the learners that participated in the survey range from ages 18 to 24.

Παρακαλούμε επιλέξτε το εύρος ηλικίας που ανήκετε

114 responses

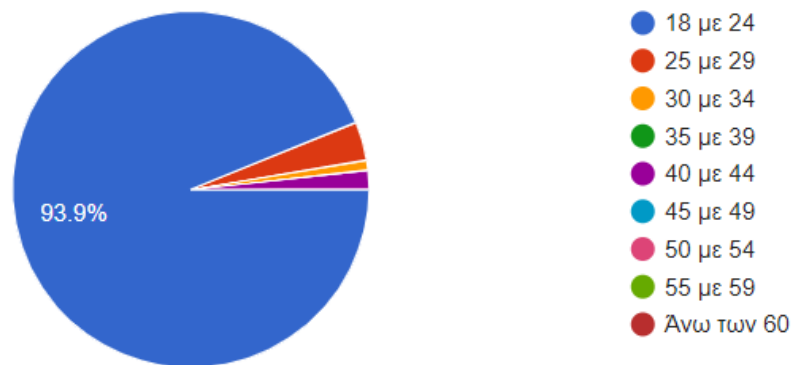


Figure 15 UOM learners age ranges

Figure 16 shows that the majority of the UOM learners prefers learning with practical application of knowledge (77.2%), when they participate in learning activities 966.7%) and when they study subjects they can later put into practice (65.8%).

Παρακαλούμε επιλέξτε τις προτάσεις που αντιπροσωπεύουν τους τρόπους μάθησης που προτιμάτε (μπορείτε να επιλέξετε πάνω από μια απαντήσεις. Τις περισσότερες φορές...

114 responses

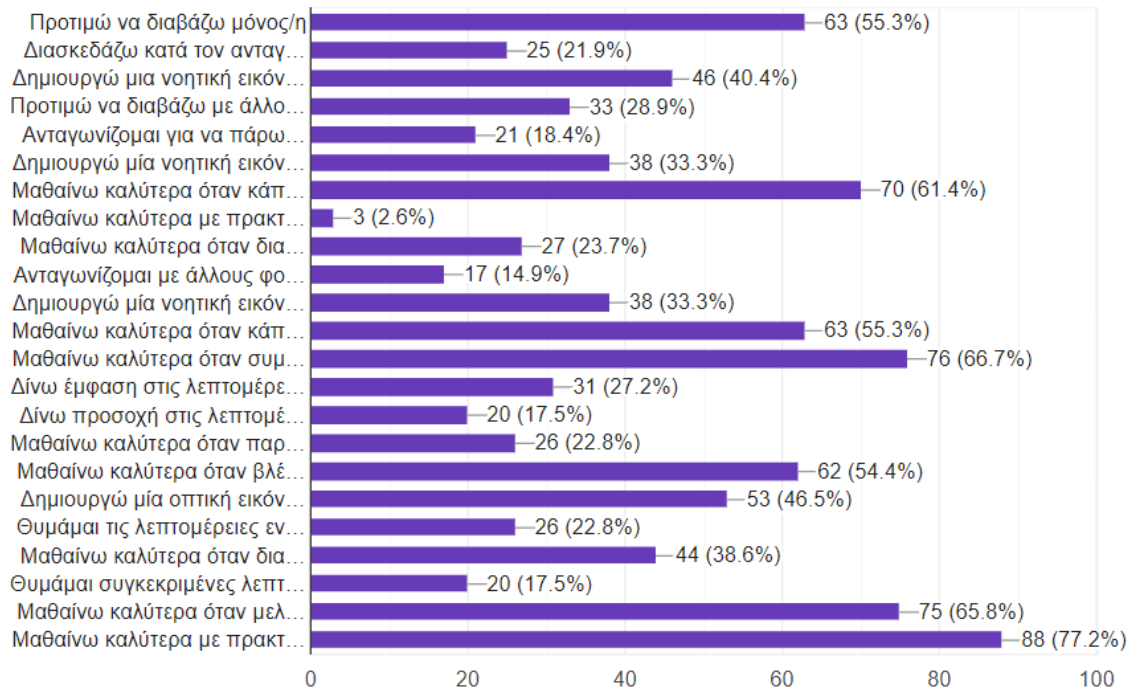


Figure 16 UOM learners' preferred ways of learning

Figure 17 shows that the majority of the UOM learners is not considered an experienced player; however, they do enjoy playing computer games.

Ποια είναι η εμπειρία σας με τα παιχνίδια υπολογιστή;

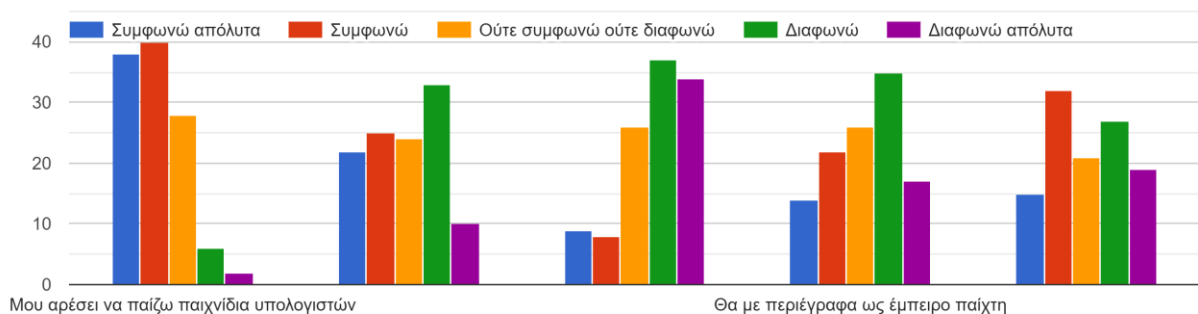


Figure 17 Game experience

Figure 18 provided us with an interesting overview of learners' previous experience in tools used to facilitate learning. As shown, 77.2% have used some sort of co-writing tool (e.g. Google Docs), 68.4% have used chat tools, while 74% have used quizzes. It should be noted that 29.8% stated they have used games for learning before, showing the increasing adoption of games in education.

Τι είδους εργαλεία έχετε χρησιμοποιήσει σε προηγούμενα μαθήματα για να σας βοηθήσουν με την μαθησιακή σας εμπειρία;

114 responses

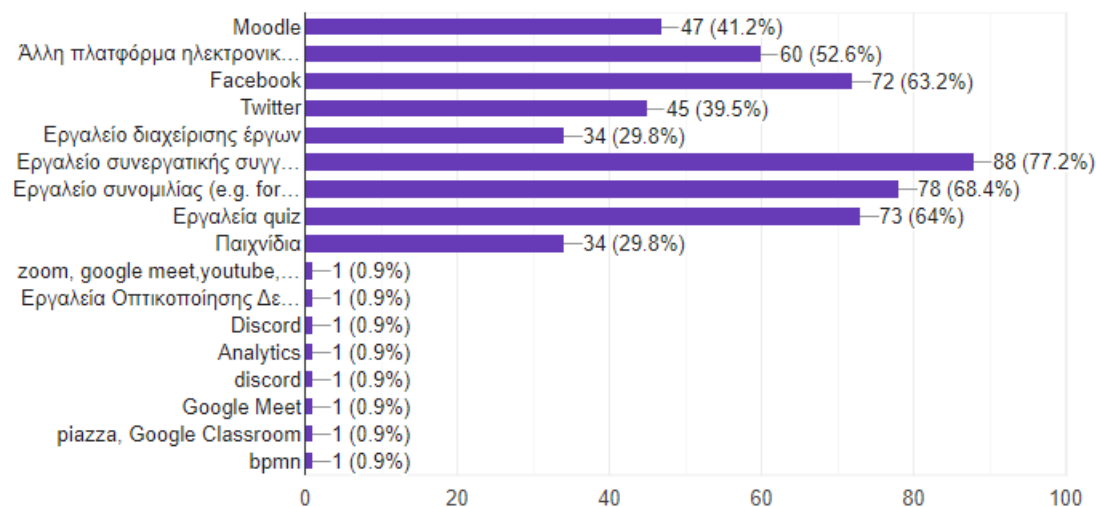


Figure 18 Tools used for learning

The answered provided in the post-course questionnaire are visualized in the following figures.

Παρακαλώ επιλέξτε το εύρος ηλικίας στο οποίο ανήκετε.

21 responses

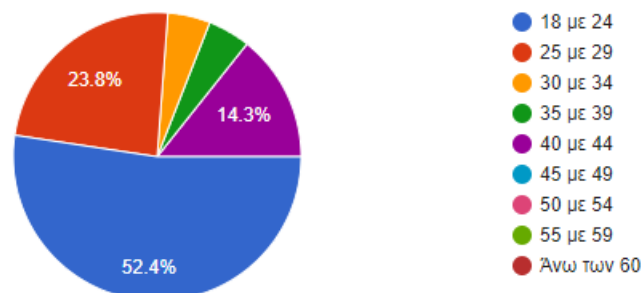


Figure 19 UOM post-course learners' age ranges

Figure 20 shows that the majority of the learners enjoyed reading from home, as it allowed them to study the course concepts at their own pace, understand each concept easier, keep notes when necessary for clarifications and search additional material if needed.

Πιστεύετε ότι το ότι διαβάσατε την πλειοψηφία του εκπαιδευτικού υλικού από το σπίτι σας βοήθησε να...

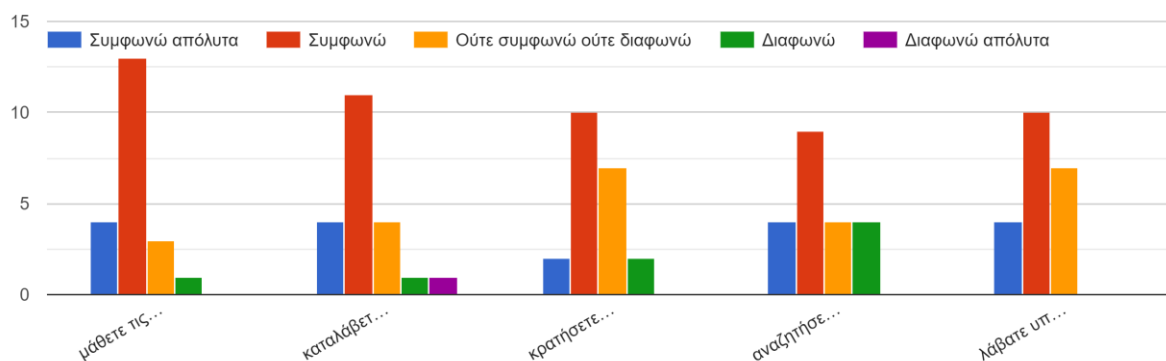


Figure 20 “Do you believe that reading the majority of the learning content from home helped you...”

At the same time, Figure 21 shows that the majority of learners (62%) believed practicing the taught knowledge was very helpful for them. This is in line with the discussions that occurred during the weekly sessions, where learners expressed their positive attitude towards the learning by doing technique.

Θεωρείτε ότι η εξάσκηση της γνώσης στην τάξη ήταν...

21 responses

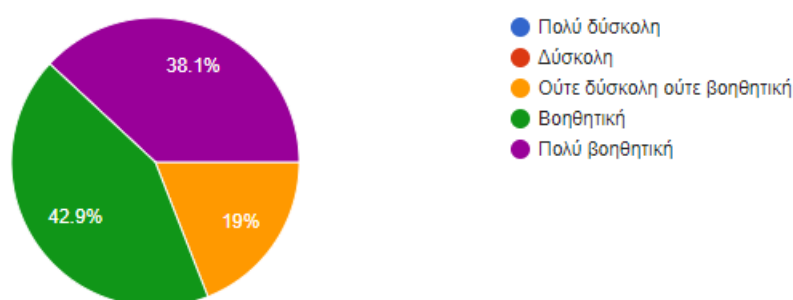


Figure 21 “Do you believe that practicing the taught knowledge in class was...”

The next two figures (Figure 21 and Figure 22) provide an overview of learners’ opinions on their interactions and collaboration with their classmates and their teacher. More specifically, 28.6% stated that they were able to interact and get feedback from the teacher regarding their questions, while 52.4% were unsure if they managed this kind of communication. This leads to the conclusions

that we need to put in place more clear and direct communication channels between learners and teachers.

Μπορέσατε να έχετε περισσότερη αλληλεπίδραση με τον καθηγητή και να κάνετε ερωτήσεις για το υλικό σε σχέση με πιο παραδοσιακά μαθήματα που έχετε παρακολουθήσει;

21 responses

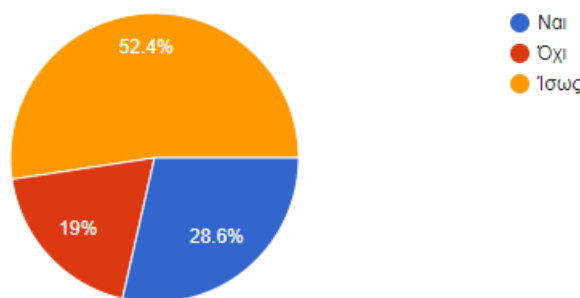


Figure 22 “Were you able to interact more with your teacher and ask questions on the learning content”

Learners also stated that they preferred working in groups (71.4%), as they were allowed to get more diverse opinions on the subject matter and divide the workload for the assignments.

Πώς αισθάνεστε ως προς την εργασία σε ομαδικό επίπεδο συγκριτικά με ατομικές εργασίες;

21 responses

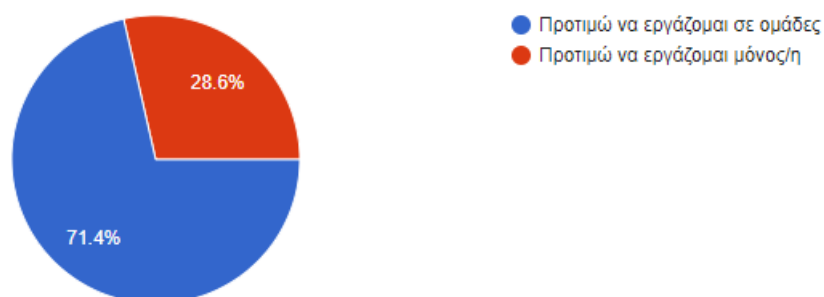
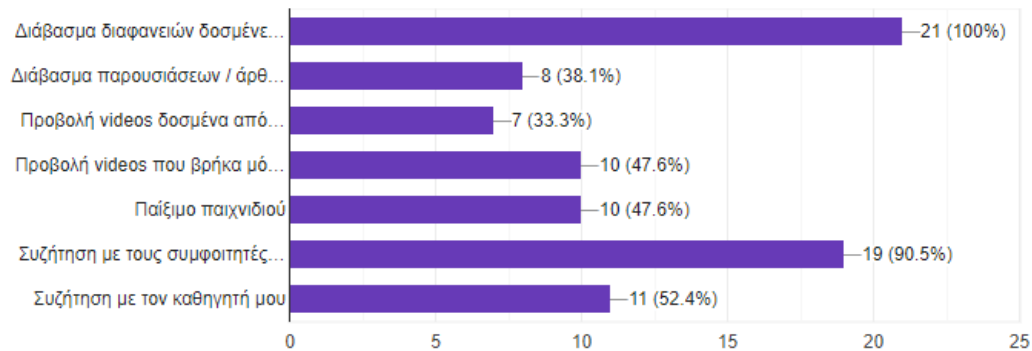


Figure 23 “How do you feel on group work compared to individual assignments”

Regarding the two first FLIP2G stages of the pedagogical model (concept exploration and meaning making), 100% of learner read the material provided by the teacher, while 90.5% also engaged in discussions with their classmates (Figure 24). Additionally, 71.4% also read additional presentations and articles identified, and reported and presented their ideas in the classroom (Figure 24).

Τι είδους δραστηριότητες πραγματοποιήσατε κατά την προσπάθειά σας να αναζητήσετε και συλλέξετε έννοιες κάθε θεματικής ενότητας;

21 responses



Τι είδους δραστηριότητες πραγματοποιήσατε κατά την προσπάθειά σας να κατανοήσετε τις έννοιες κάθε θεματικής ενότητας και να δημιουργήσετε περιεχόμενο σχετικό με τις εργασίες σας;

21 responses

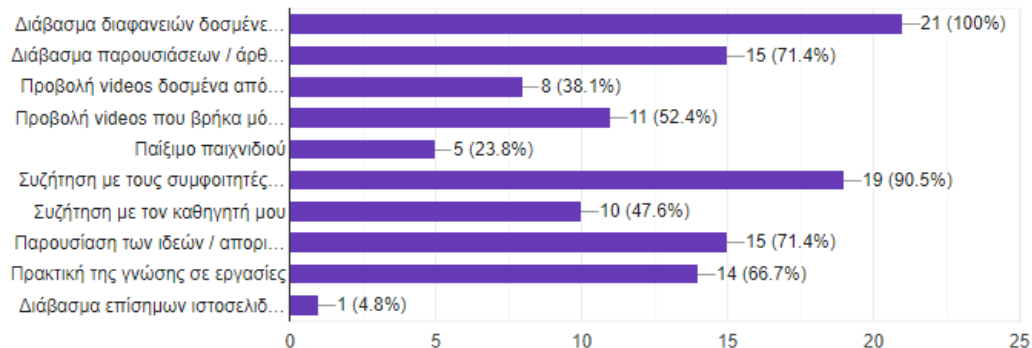
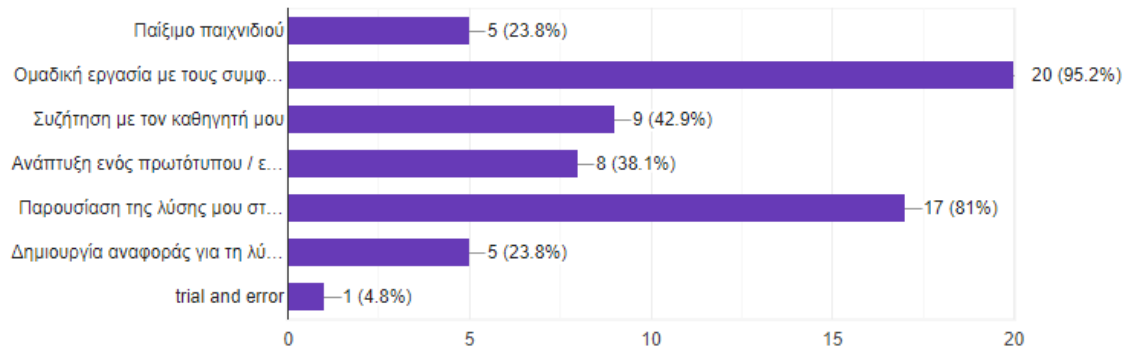


Figure 24 “What types of activities did you realize to search, collect and understand the learning material and make content of your own”

Regarding the two last FLIP2G stages of the pedagogical model (demonstration and application and experiential engagement), 95.2% of learners worked together with their team members in order to execute the group assignment, 85.7% reflected on the knowledge they gathered during the course, while 81% presented their solutions to their teacher (Figure 25).

Τι είδους δραστηριότητες πραγματοποιήσατε κατά την προσπάθειά σας να εφαρμόσετε και να παρουσιάσετε τη δουλειά σας;

21 responses



Τι είδους δραστηριότητες πραγματοποιήσατε κατά την προσπάθειά σας να εξερευνήσετε επιπλέον τις θεματικές ενότητες και να μάθετε από την εμπειρία σας στο μάθημα;

21 responses

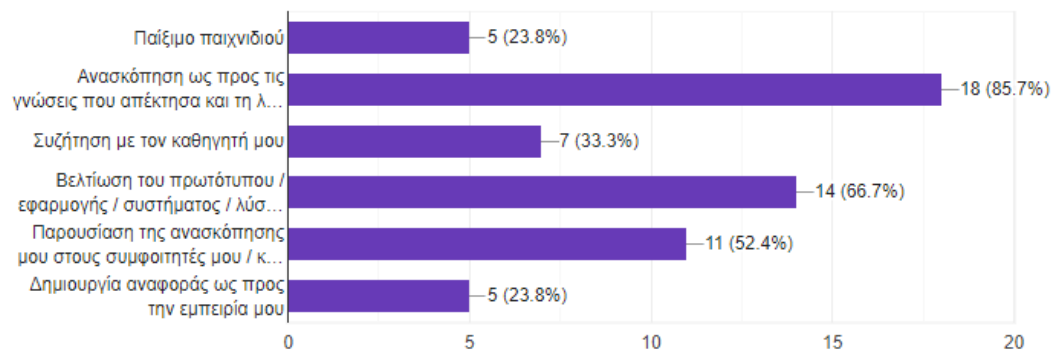
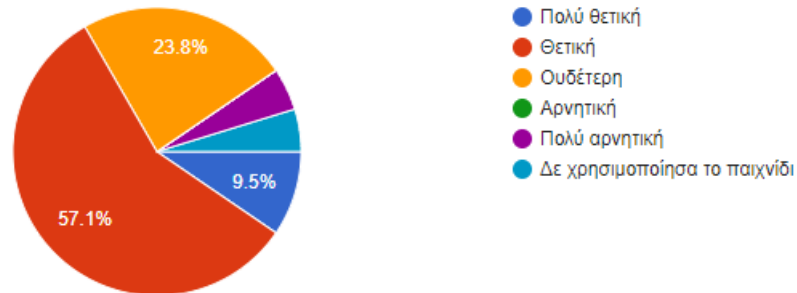


Figure 25 “What types of activities did you realize while trying to demonstrate your work and further explore the subject matter after your experience with the course”

Regarding the gaming environment, 66.6% stated that their overall experience was positive, and 61.9% stated that they found the game easy to use (Figure 26).

Πώς ήταν η γενική σας εμπειρία με το παιχνίδι;

21 responses



Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Το παιχνίδι είναι εύκολο στη χρήση.

21 responses

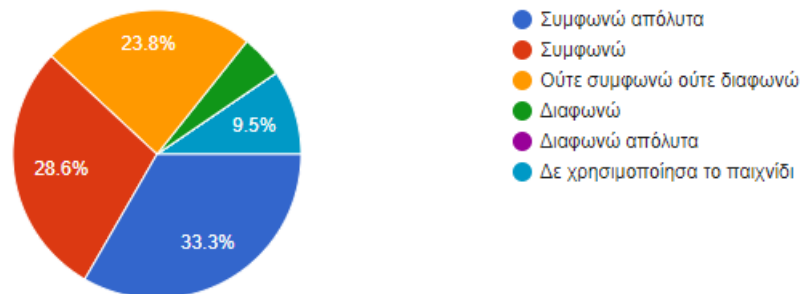
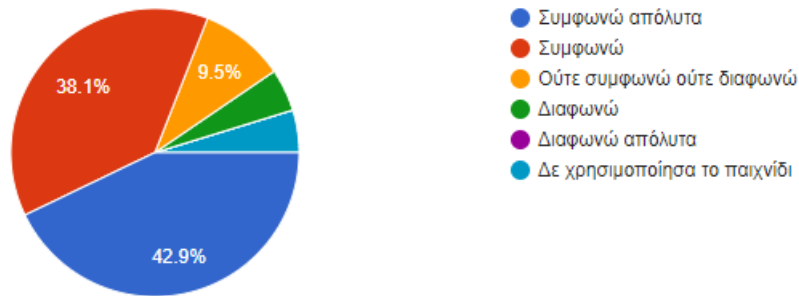


Figure 26 “What was your overall experience with the game? Do you believe the game was easy to use?”

Based on Figure 27, 81% agreed that the game was easy to understand and navigate, while 66.7% of the learners were able to complete the quizzes of the game. From the respondents, 9.5% was not able to use the game at all due to the aforementioned issues.

Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Το παιχνίδι είναι εύκολο στην κατανόηση και την πλοήγηση.

21 responses



Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Κατάφερα να ολοκληρώσω τα quizzes μέσα στο παιχνίδι.

21 responses

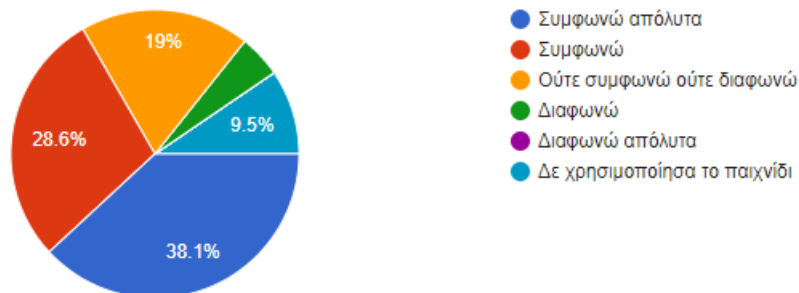
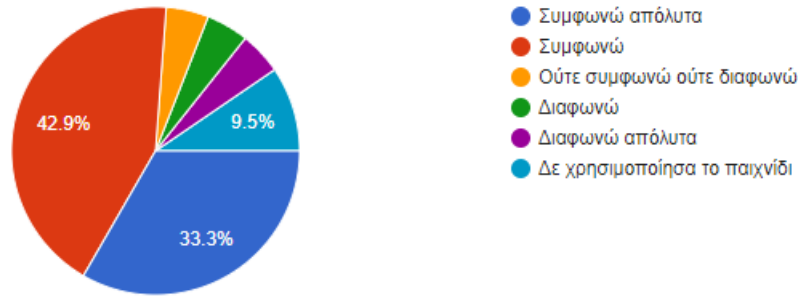


Figure 27 “Do you think that the game was easy to understand and navigate? Did you manage to complete the quizzes in the game?”

Figure 28 investigated learners’ motivation within the game, and 76.2% stated they were motivated to complete the quizzes in the game and succeed in getting higher scores, and 52.4% performed more than one attempts on the quizzes to improve their performances.

Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Είχα κίνητρο να ολοκληρώσω και να πετύχω στο quiz μέσα στο παιχνίδι.

21 responses



Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Το παιχνίδι με έκανε να θέλω να ξανα-τρέξω τα quizzes για να βελτιώσω το σκορ μου.

21 responses

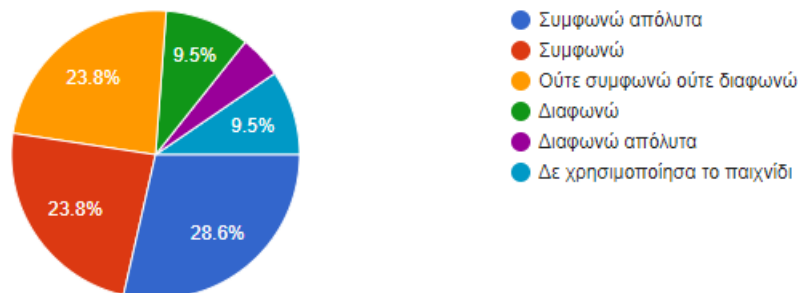
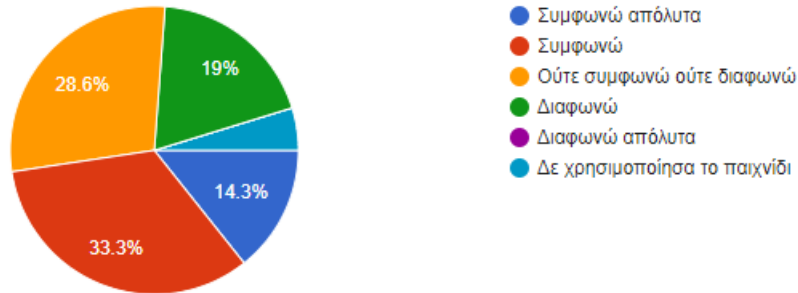


Figure 28 “Were you motivated to complete and succeed in the game? Did the game make you re-run the quizzes to improve your score?”

In Figure 29, 47.6% stated that the game was stable. This calls for future reinsurance of technical stability for the gaming environment. Even with the technical difficulties, 62% of learners found the game’s features very interesting.

Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Το παιχνίδι ήταν σταθερό.

21 responses



Παρακαλώ καταχωρήστε την επιλογή που αντιπροσωπεύει τις σκέψεις σας ως προς το παιχνίδι. Τα χαρακτηριστικά του παιχνιδιού ήταν ενδιαφέροντα.

21 responses

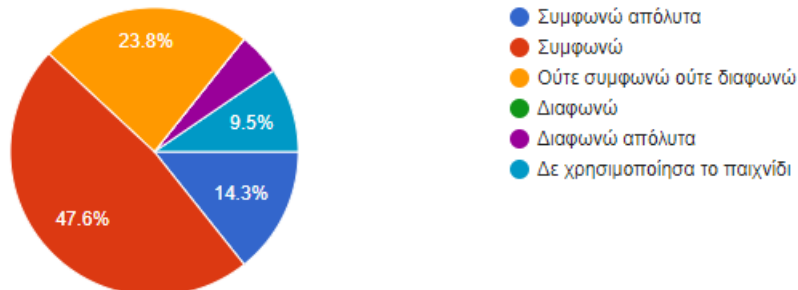


Figure 29 “Was the game stable? Were the game’s features interesting?”

The general consensus on learners’ acceptance of the technology provided in the UOM pilots was that they want to use innovative tools such as serious games in their courses, and they plan to continue using the FLIP2G game, especially if its technical issues are solved and the narrative becomes a bit more interesting.

4.8 Instructors’ perspective

The following section provides an overview of the UOM instructor’s overall reflections for UOM pilots.

Did you have any previous experience in your courses with flipped classroom, PBL and gaming? If yes, please provide some examples.

For the past 5 years I have designed and delivered all my courses following the PBL approach and we have used tools to improve data recording and adaptation of the learning process. This is our first time exploring the flipped classroom and gaming elements inside my courses.

Did you apply the Concept exploration phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to read the material provided in the gaming platform that explained some initial information on the weekly topic, and they also had to search on their own and with their team members for more in depth information in order to fully understand the subject matter and complete their assignments.

How did you design your Concept exploration phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners had to access the taught material from the e-learning platform or the game in the form of slides and external links. They could also search for extra material on their own from scientific articles, relevant videos or any other accurate resource.

Did you incorporate any of the PBL stages within the Concept exploration phase of your course? If no, why? If yes, please explain.

Learners had to explore the subject matter concepts as a preparation for the PBL problem analysis phase, where they had to gather as much relevant information as possible and then collaboratively decide which of the data gathered are important for the problem that needs to be solved.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Concept exploration phase?

I asked for feedback on how they were progressing with their individual search and gave them additional material or inspiration for resources when they couldn't find anything relevant.

Did you apply the Meaning making phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to complete different tasks in their groups taking into consideration the lessons they learned in the previous phase.

How did you design the Meaning making phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

I provided scenarios of the tasks they had to complete and the learning objective of each task. Depending on the course, they had to analyze and design different UML diagrams for the information systems they had to build, identify and collect different types of open data and other different assignments.

Did you incorporate any of the PBL stages within the Meaning making phase of your course? If no,

why? If yes, please explain.

Yes, learners had to collaborate in order to synthesize information for their tasks (e.g. concepts of diagrams) and they had to also discuss the different ways the task could be completed.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Meaning making phase?

I monitored each group's progress on a weekly basis so that I could intervene whenever their tasks were behind schedule or they were doing things that were not related to the learning objective (e.g. find open data for a topic, create a UML sequence diagram etc), or required additional work. Learners could also communicate and discuss with me directly any questions in the classroom and through email.

Did you apply the Demonstration and Application phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to present their work as reports and as presentations in the classroom multiple times during the project work period. Learners had to also apply the knowledge they learned into an actual scenario that simulates real life (e.g. a life event such as passport issue-ing, an information system for a company etc.).

How did you design the Demonstration and Application phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners had to create presentations using a template with an agenda, timesheets, communication techniques and group progress. Other learners that were not part of the group could also provide constructive feedback in the classroom and discuss possible improvements.

Did you incorporate any of the PBL stages within the Demonstration and Application phase of your course? If no, why? If yes, please explain.

Yes, learners had to communicate their ideas as a part of the Problem Implementation phase and show they applied their solution to the given scenario.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Demonstration and application phase?

Each presentation was discussed amongst all learners and with me, and we all provided feedback on each team's progress. The team was also required to express their reflections on the group's performance and possible issues they encountered.

Did you apply the Experiential engagement phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to document and present a final report of their work, taking into consideration all previous lessons learnt.

How did you design the Experiential engagement phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Each learner was also required to submit an individual reflection report, where they reflected on the team's work, the course itself and their individual performance in the course.

Did you incorporate any of the PBL stages within the Experiential engagement phase of your course? If no, why? If yes, please explain.

The PBL stage of Problem evaluation is a part of our experimental engagement phase, since learners had to assess the work done and reflect on their experience.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Experimental engagement phase?

I studied their final reports and individual reflection assignments and communicated with them whenever I saw issues that could be improved with my help.

What was your overall experience with the teacher dashboard? Positive, negative? Why?

My overall experience with the teacher dashboard was positive. It had some issues with freezing at times, but overall it was very easy to navigate and find all the necessary information in the menu.

Please let us know what the most positive feature of the teacher dashboard was and which the most negative. Provide some examples.

The most positive feature for me were the data analytics, where I could get all the information on my learners' scores and the time they passed in each quiz. I could also easily download all scores so that I could edit them and create my own reports.

The most negative feature was the fact that at times it would not save my input and I had to resubmit the changes.

Did you find the teacher dashboard user friendly?

Yes it was user friendly, with simple visuals.

Did you manage to add learners from the Learners menu? Did you encounter any issues?

Yes I added all my learners without major issues. I encountered some problems in the new version of the game but they were fixed quickly.

Did you manage to create questions in the Questions menu? Did you encounter any issues?

Yes I created questions without any issues. Some issues that we encountered at the beginning of the game's launch (maximum number of characters per question was too low) were fixed.

Did you manage to create quizzes in the Quiz menu? Did you encounter any issues?

Yes I created quizzes with no issues.

Did you manage to add learning content from the teacher dashboard? Did you encounter any issues?

Yes I added learning content with no issues.

Did you manage to set up courses and sessions in the teacher dashboard? Did you encounter any issues?

I managed to set up courses and sessions without any problems. I could activate and deactivate my sessions so that learners could access them at a specific period of time.

What improvements do you think could add value to the teacher dashboard?

Some improvements would be the ability to add more types of content (HTML, videos, links) and collaboration tools (chat, forums).

What was your overall experience with the LA dashboard? Positive, negative? Why?

My overall experience with the LA dashboard was positive. I could access all LA visualizations for my courses. Some issues with charts that needed clarification on what they were showing to the teacher were fixed.

Please let us know what the most positive feature of the LA dashboard was and which the most negative. Provide some examples.

The most positive feature of the LA dashboard is the list of top learners and learners with the lowest scores. In courses with a large number of learners it is essential for the teacher to easily have this information in order to help and scaffold learners in danger of drop out.

The most negative feature was that some of the charts did not help me significantly to understand the course's progress.

Did you find the LA dashboard user friendly?

Yes it was user friendly.

Did you manage to make sense of your learners' progress using the LA dashboard?

In most cases yes, there were some charts (engagement score) where I would have liked to have a more detailed representation of the information.

Which LA graphs did you find more useful and which more challenging to understand?

The lists of top learners and the table with the wrong answers provided were the most helpful, as it allowed me to understand which of my learners needed adaptation of the course to improve their performance.

The engagement chart was the most challenging as I only got an overall overview of the course's engagement.

Were you able to adapt your course based on information you gained from the LA dashboard?
Please provide examples.

Yes I could detect which of my learners answered some important questions wrong, or I could understand if a question I had added was answered incorrectly by the majority of the course, and thus I changed it or I provided clarifications.

What additional features would you want to see in the LA dashboard?

Additional charts that provide warnings of possible dropouts with low engagement, learner that don't complete the quizzes.

5 Northumbria trials evaluation

5.1 Selection of methods and research design

In order to evaluate the learner experience with the course at Northumbria University, qualitative methodology has been followed. This is due to the smaller number of learners participating in the NU pilots, which indicated that using qualitative methods would be a better choice for getting reliable findings and would allow the in-depth examination of learners' attitude and experience with the course and the game. Focus groups were selected as the data collection method as they are ideal for studying shared lived experiences and exploring 'diverse understandings' (Liamputtong 2011, p. 5). The instructor sent invitations to the whole cohort, explaining the purpose of the research and the ethical procedure followed. For the first pilot, learners that volunteered to participate (10 out of the 48 enrolled in the course) were asked to sign electronically the consent form prior to the focus group. The learners were also asked to complete a pre-pilot survey (see Appendix I) at the beginning of the course that helped the instructor understand their expectations from the course. The second pilot had only 8 enrolled learners, of which 7 completed the pre-pilot survey. However, none of them volunteered to participate in a focus group, so the research team sent the online survey developed for the project instead. Only two of them completed the survey and while their responses are discussed in the next sections, it should be noted that their responses may not be representative of the whole cohort.

The focus groups for the first pilot (two focus groups with 5 learners each) were organised during the last session of the pilot and ran online (via MS Teams also used as part of the delivery) due to the Covid-19 restrictions. They were facilitated by a research assistant that was not involved in the delivery of the course to ensure that learners felt comfortable to share their feedback. The focus groups were recorded with the permission of the learners and the transcriptions were anonymised to protect the participants' privacy. The focus group protocol used in the study (see Appendix II) was developed with the help of relevant literature (Jagger, Siala and Sloan, 2016).

5.2 Findings

5.2.1 January Pilot

The pre-pilot survey was completed by 24 learners out of the 48 enrolled to the course. While most of respondents belonged to the 18-24 year old group, there were also learners in their 40s and 50s that completed the survey (Figure 30). Also, most of the respondents worked in the financial sector, while the health sector was the second most common answer (Figure 33). It was clear from their answers (Figure 31 and Figure 32) that most of them did not have much experience with playing video games and they were not really interested in them.

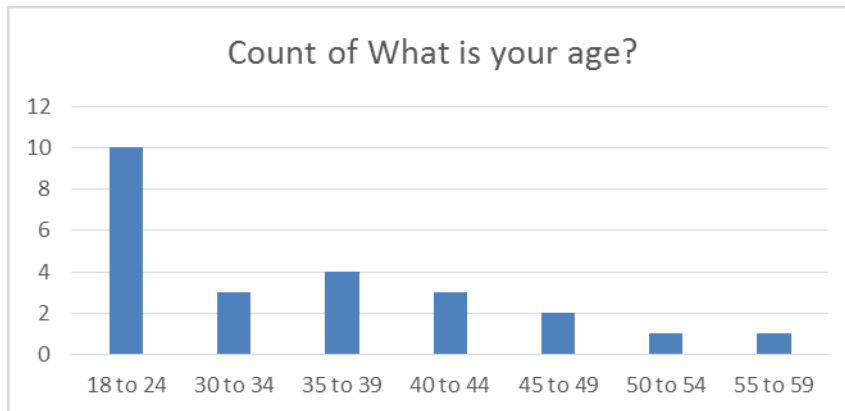


Figure 30 Age groups of the participants of the pre-pilot survey

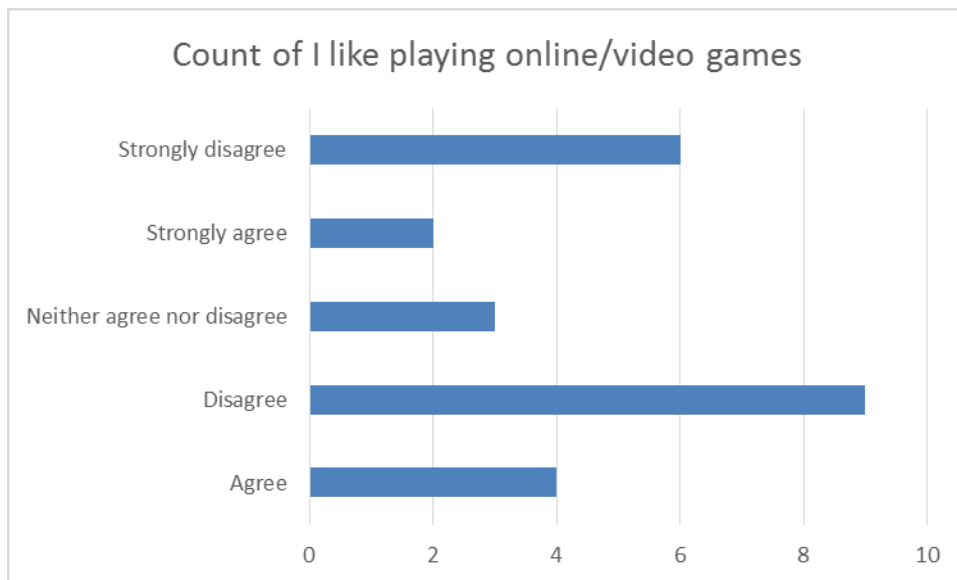


Figure 31 Answers to the statement "I like playing online/video games"

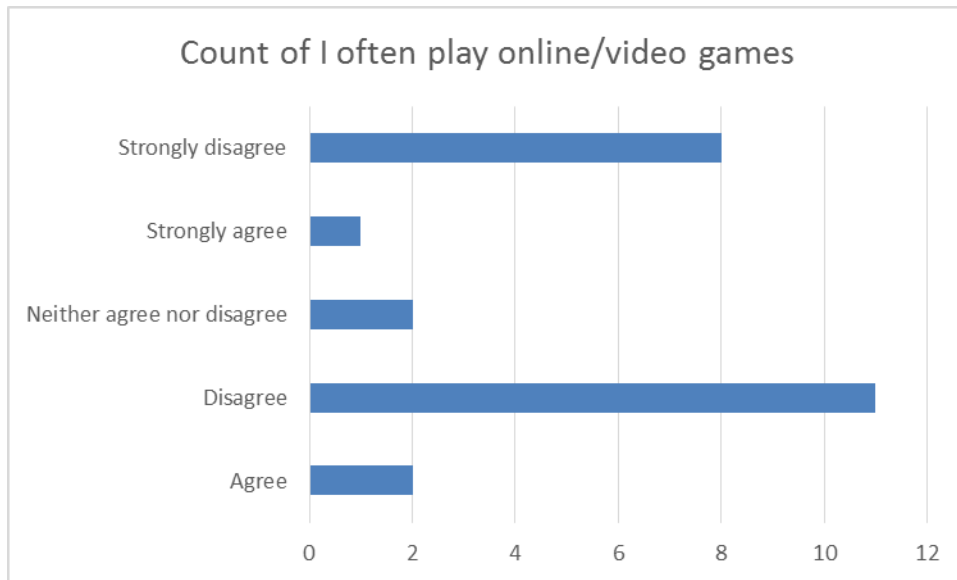


Figure 32 Answers to the statement "I often play online/video games"

In terms of the way they approached learning, the majority of them expressed preference for learning with other learners (Figure 34) and practical tasks (Figure 35), which was promising, as the project's pedagogical model relies on learners being active and working with others. Many of them expressed a preference for visual aids and the use of graphs/pictures for communicating information (Figure 35), so it was interesting to see how these tools could work in a fully online learning environment.

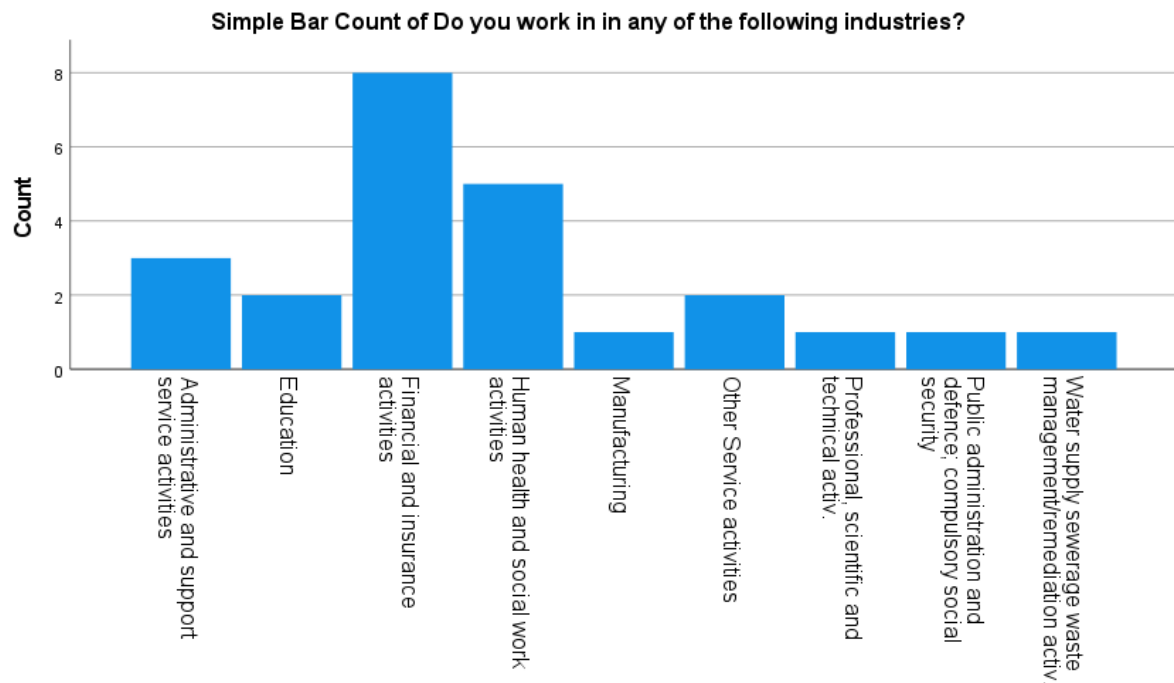


Figure 33 Industries in which the respondents work

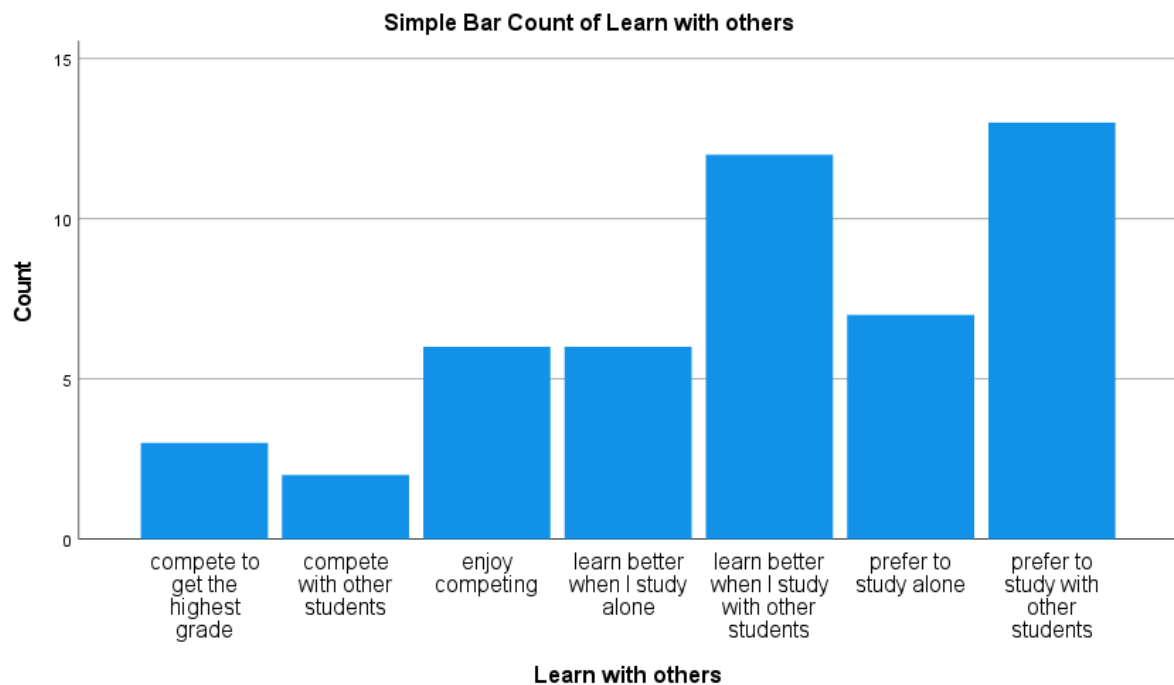


Figure 34 Attitudes towards learning with others

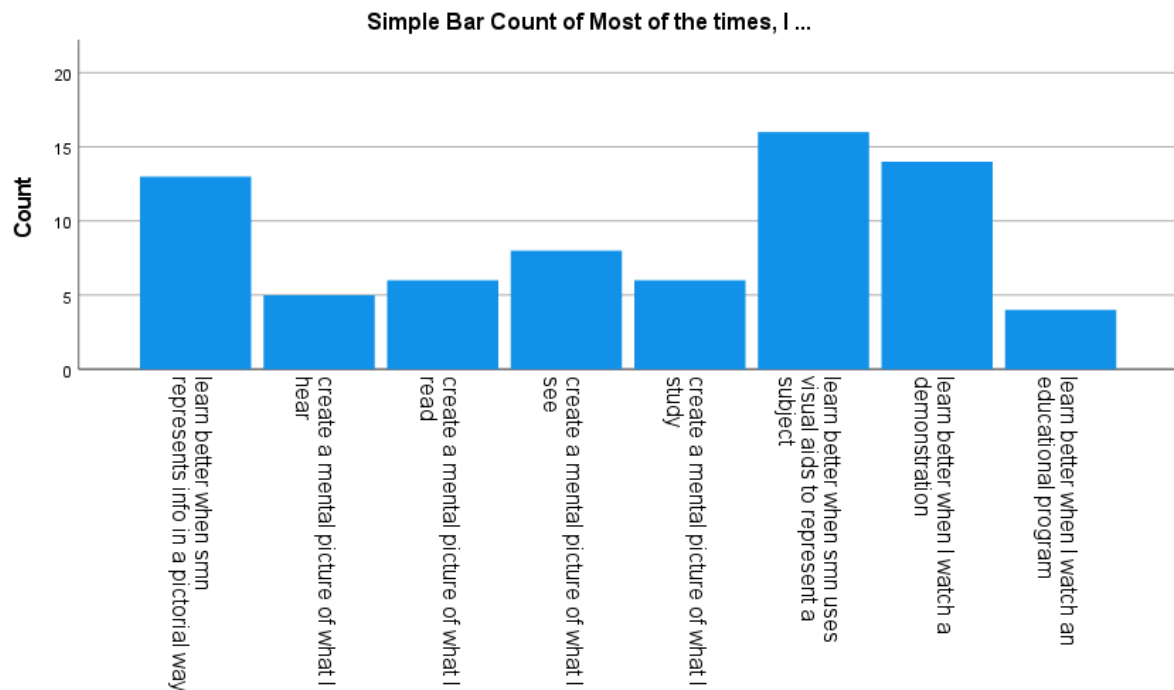


Figure 35 Learning process followed by the participants

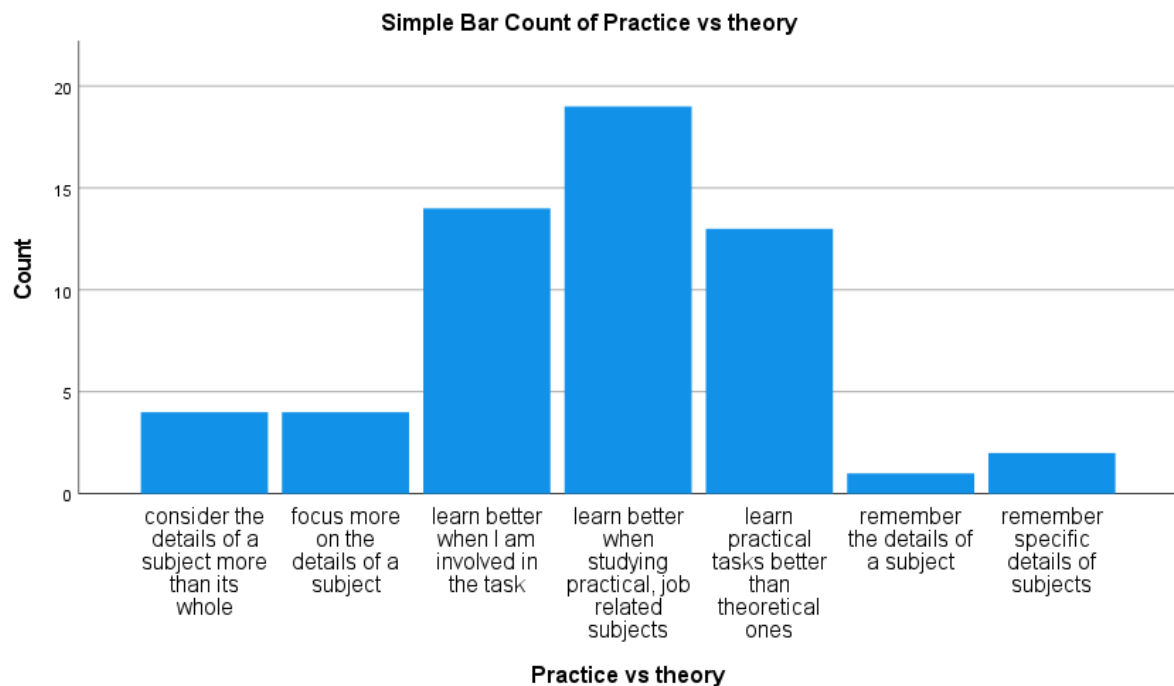


Figure 36 Attitudes towards theory and practice

The questionnaire included also an open-ended question about the participants' personal learning goals. The answers ranged from broad ones (*"To further understand how digital software can help businesses grow"*) to specific ones (*"Learning how to improve my knowledge on digital business and how I can then apply this in the workplace. Looking at improving our website, maybe on line ordering, Business Intelligence, data analytics"*), which showed that while some learners did not have any particular interest in the course, others had already thought about potential applications in their workplaces. The question about the learning goals emerged again during the focus groups at the end of the course, when learners had to reflect on their achievements and whether they actually achieved the learning goals that they had set for themselves in the beginning.

From their answers in the focus groups, it seems that the ones that had set broad goals (e.g. learning more about the concept of digital business) managed to achieve them, while the ones that wanted to learn more about the possible applications in their workplace felt somewhat uncertain about that (*"... but I don't feel confident about going over and applying it in the workplace"*). They also mentioned that at first, they found the course difficult due to the different delivery (*"I think initially because this module is so different to all other modules, that we've done. I think it was for me personally was quite hard to get into the routine of, obviously, completing the reflective journal outside the time at Uni."*), but realised at the end of the course the benefits of the course's structure (*"I think once somebody's seen the benefit of doing that and obviously the benefit now when you go through your assignments surgery and you've got the information you've reflected on"; "but I think once I got my head round it and learn how to do it and use the reflective journal and you can see the hand-outs of next week and have a look at them, none of the module have been like that, but I have learned a lot, it's been really useful, because now have my information stuff that documented, that is there for me and for my assignment [...] I can go back, which I've never been able to do this before"*).

The above highlights one of the most interesting findings of the focus groups, which was that there was an agreement among the learners regarding the usefulness of the reflective journal, regardless of the reflective process followed or the time each one spent on it. There were learners that felt they did not have time to actually reflect on their learning and they just tried to do research and add information in their reflective journal (*"I just felt it was really fast paced and that I was just trying to gather information rather than having time to digest what I was looking at"; "I would echo what [name of the participant] said in terms of like trying to gather information and then you don't really have time to look at it and understand it fully"*) and learners that wished they had engaged with it more (*"I do, wish I had put more in and did, you know, I've been completed it weekly, but probably didn't put enough in"; "I think initially we didn't realise how much impact would be at the end of it and I found it as we went through the weeks, I would have put more into the reflective journal"*), but everyone agreed about the benefits of completing the task, such as receiving feedback from the instructor (*"[the instructor] gave you feedback on that and obviously you can use it back and forth to look back on what you need to do and have support and yeah it was beneficial for me to use."*), being able to identify gaps in one's learning (*"...and then put at the end of each reflective report what we scored in the quiz each week it helps us to take responsibility about gaps in our learning"*).

reflect on areas that we need to improve on going forward and then the slides are available to re-watch so for me I think that it's helped with my self- reflection") and making sense of the course's assignment and degree apprenticeship portfolio ("I think it's really good the way that at the top of each reflective journal it just makes a note of which standard specific reflective journal is looking at - it's kind of linking the assignment to your organization and portfolio altogether just kind of let me just focus on what should be in specific reflective journal").

The reflective journal that was used in the course clearly affected positively the learners' perception about the communication with the instructor, as learners appreciated the extra guidance (*"... because the feedback was really specific and tailored to what we'd put into the journal and then she was giving me links and guides to different areas where I can expand my knowledge so I think having done it now it was really useful"*). The journal was used also as a starting point for discussion during the one-to-one meeting with the instructor about the assignment, which took place at the end of the course (*"the journal helped me with specific things for my assignment and [name of the instructor] helped me with the one-to one as well, as she's even used specific things from my journal"*). The learners also appreciated the flexibility of the instructor regarding the structure of each workshop (*"we fed back that we didn't find that approach useful and in the last two or three sessions, [name of the instructor] was going through the slides at the beginning or just what to take away from the session and I found that a lot more helpful"*), which was possible due to the flexibility that the flipped classroom approach offers.

The views regarding the communication with classmates and collaboration on the PBL activities however, differed from learner to learner depending on whether they were able to find other classmates that worked in the same industry to form a group. As it was discussed above (see tables with demographics), many learners were professionals from the financial or health sector. For those learners, it was quite easy to form teams with their colleagues and split the tasks among 4 – 5 members. For them, the collaboration within the team went quite well (*"when you are in a group you have to continuously talk about what you work on, somebody is sharing screen, somebody takes responsibility to take notes"*) and they found the PBL experience useful as they could use their shared experiences from their workplace to solve the problem (*"I found the breakout sessions for me quite helpful, because I was in a group with just [name of the organization] apprentices"*). Learners that couldn't find colleagues to work on the activity however, ended forming smaller teams, sometimes with learners from other industries, which put more pressure on them to complete the task (*"it was so much information in there if you are having to look, I know you were supposed to spread the task between people in your workshop, however, if there was only two of you in your workshop you probably couldn't get too much done"*; *" I think it's been difficult because of lots of stuff come from the big organizations, like the [name of the organization] or so, and so I think what helped [learners from] those organizations is they've been added up there in call groups when other, others of us, are practicing into smaller groups, absolutely fine, but this makes it a little bit harder if there's only two or three of you trying to recount the activities in the workshop, you know, do the*

research and bring it back and think about how you're gonna present it, so it's just a little bit more difficult").

Overall, the learners found the study from home experience challenging, especially due to the Covid-19 implications that resulted in limited time (*"It is what it is and it's virtually and it's a lot of computer time and recording should have been done and the current climate and teaching at home, have children, have to work full-time, it was a lot"*). The online delivery created also some challenges regarding the communication among the learners, although overall, they found the online conversations useful (*"But sometimes I think it's difficult online for people to express opinions as well, so sometimes it's been a hindrance for some people, but it's really good to hear opinions and their industries and obviously triggers thoughts about things that you can think about in your industry as well"*). It also exacerbated any issues with the technology that would have been easily fixed if the course was delivered on campus (*"whereas when you work from home, you feel you've been left in the dark with struggling with technology, but that's not reflective on the module, that's a common issue"*).

Additional factors that affected the learner experience with the technology of the course was the learners' attitude towards the technology in general and their prior experience with using it. As it was clear from the pre-pilot survey, most of the learners were not really interested in gaming and that was also mentioned during the focus groups (*"it [i.e. the game] has worked OK but not everybody's into games or technology so it doesn't always fit for everybody"*). Some participants even self-identified as 'old', with limited experience in technology (*"[you may want to talk also to] another group of people who are a mix of, sort of, you know, 19-20 years old, who would be using gaming continually throughout their life rather than the sort of the older generation, who have children, you know, and not knowing how to do with that kind of thing I think"; "we use Teams and the Microsoft products all the time but the people, maybe like [name of the participant] and [name of the participant] and [name of the participant], who because they're old, it doesn't take them into that realm, so I haven't had the exposure to those tools"*) and mentioned that initially felt 'lost' using the online tools of the course (*"But in the module, just using Teams and have the reflective Journal and the hand-out of it, during the first week, I was lost, I'm not gonna lie, I was totally lost. I didn't know which screen I was supposed to be on, I didn't know where I was, you know, I was absolutely panicking, but now that I know, you know, when you start in the morning, you have to be on Blackboard, you have your screen, you have your teams logs in, I was not even logged in on Teams I didn't know how to log out of Teams, I didn't know how to log in and that was a bit of disaster"*). On the bright side, it seems that the course helped a lot of them to expand their horizons and start exploring the functionalities of these tools (*"So I think [name of the participant] is majoring in point that it's taught her and lots of us a lot more things, other things that you can do in Teams and understand and I think it's been a really good experience start to use the Microsoft suite more in this module"*), something that could be beneficial for their career in the long term.

When it comes to the FLIP2G game, some participants reported also some issues accessing the quizzes, which, it seems, were solved during the course, so they did not disrupt the overall experience with the game (*"once we sorted out with it was absolutely fine, I mean with all that access issues to some of the quizzes and things like that, but I think we were all around that, but that time was probably a little bit frustrating"*). The attitude towards the game seems to be affected by the learners' demographics and attitude towards technology, with younger learners showing more appreciation of its impact on their learning (*"I think the game highlighted what I knew and didn't know- that was a quick way of highlighting it"; "I think it does help the overall learning for the module, so then you think you understand [something] and it's only when you are tested that you realize that actually I don't think I fully understand this concept or this framework, it encourages you to go back and revisit what you've learned- so yeah it was really helpful"*). In contrast, the more mature learners felt unsure about its purpose (*"I'm not sure I quite understood the game in itself because it was literally just a question and a choice of answers. It wasn't a game, you didn't do anything other than get a score at the end."*). This might have to do with the fact that learners seem to not have used the learning analytics dashboard, probably because they hadn't read the game's instructions on Teams and the button that allowed them to access their profile was not that easy to be found (i.e. the player could access their profile only while completing the quiz). For example, in the question of the researcher about what they would like to change in the game, one learner mentioned that she would like to be able to check her responses to the quiz (something that is possible for learner to do by accessing their learning analytics dashboard), which shows that it was unclear to her how to do that (*"Being able to go back and see what you selected for each question, go back and review reports of your previous scores, because like [name of a participant] said before, once she finished it there's no way of going back to see what your score was it yourself flashed up on that last screen but you can't go back to review it. So, I would like to see it and do it again."*).

In terms of the learners' suggestions for improving the game further, these focused on the following main areas: a) interactivity/format of the game, b) its usage within the session, and c) co-op gameplay:

- a) Learners in both focus groups expressed strong interest for simulation games, which are more interactive and thus more engaging. For example, when asked about whether there is anything particular that they remember from the game, one learner mentioned a simulation game about cyber security that was added in the learning design as an out-of-class activity instead of the FLIP2G game (*"Yeah, probably more on the cyber security site- that section probably stuck in my mind more. It was just because it was a little bit more interesting"*). Another learner in the second focus group also mentioned the simulation game although not asked about this (*"there was another game that we've played at the last sessions and I actually went through different sort of problems like you know, I don't know if you know what it is, but I found that really quite useful, so it was really good to go through all the different paths and yes, I found it really ok, although I haven't managed to save what I need to save and I failed at the end, but I know now the different parts and what you should have done on each part each time"*). A second learner in the same focus group mentioned the

simulation game too, as an interesting activity that can remember from the course (*"I also really enjoyed that video on, I think it was session 5 at the end, when it was, you know, you had to make the decisions and then, then it sort of whichever direction you had chosen to go down but that was really interesting. I was quite anxious doing that because I was worried in case everything went wrong, but yeah that was really interesting"*). At the same time, the FLIP2G game was described just as a series of quizzes that tested knowledge (*"the quizzes were just quizzes and didn't have an impact at all. It was just your knowledge, do you know it? Don't you know it? Yes? No? But the other game, did have a positive impact, because you could see where you went wrong and it was explained, you could see how different things make different things happen"*). The importance of feedback being provided through the game was also discussed from other learners in the focus groups (*"If it was more interactive at the end, so you failed on this, this and this question, this is the reason why, research bit more there, so look at this just a bit more. I know it's very basic guide, they just, it just needs to sort of building on that knowledge but even more in-depth feedback which doesn't do - is either you passed or you failed"; "I probably agree [it] would be apparently an end to test knowledge and it should be more interactive and explanatory on why you did things wrong"*). There were also learners that mentioned that they would like to see scenario type questions (*"Maybe's the questions could be slightly different so that [they addressed] most scenarios in real life rather than quite technical questions - about there's a reason behind that, yeah I know, it's just a different in, you know, this scenario type questions"*) or quizzes tailored to the industry (*"may be having separate quizzes for- just for like- the general one for the general financial services, one for and like [name of organization] just just..."*), which again explains the preference for simulation games.

- b) Learners in both focus groups agreed that in its current form (i.e. quiz that tests knowledge), the FLIP2G game would be more useful at the end of each workshop (instead of the beginning which was how they were used during the pilot), as learners were not always able to complete the pre-class learning activities (e.g. watch the recorded on Panopto lectures), in which case, they felt stressed by playing the game (*"I think it probably would have been better at the end of the session, you know, because obviously if you don't do all your Panopto learning and then gone through the workshop it might have been a good of refresher rather than the start, at the beginning where if you haven't done all of your learning you go on to the game and then give you sort of automatically think you don't really know very much if you don't score very high, whereas at the end, you know if you've learned a bit more, then you might be feeling a bit better about that."*; *"At first, it was not what I thought, I just thought it was wasting time at the beginning of the session and at first I wasn't scoring very highly at all, like I hadn't done the pre-work in the first couple of sessions, so it's just [being] basically angry at myself for doing rubbish, but I think that that in itself is motivating to understand that there was clear gaps in my knowledge"*). They also asked for additional scaffolding regarding the different way of learning, as while there were relevant announcements on the LMS about the structure of each workshop and a pre-recorded, introductory video about the course, learners either did not pay attention to them or had issues with accessing the relevant information, as one learner suggests, or simply they could

not fully understand the different learning approach the course adopted (*"I think it's appreciated how much work [name of the instructor] has put into it. It is completely new style of learning. So, I think at the beginning [of the workshop] it definitely would have been better [to] spend a bit more than she did it in the Panopto you know, maybe just a face to face in the very beginning of the session, just to say how different this is from the rest of the modules"; "I think I would just like to say that [...] a short video about what's gonna happen for these lectures [workshops?] would be ideal and what you're going to use and how it's gonna be set up and the systems that are going to be used and so people are aware that when they first join the sessions- have got some idea about how it's gonna be carried out, but it just has to be like a very short brief, a couple of minutes video or something just to give everyone, I mean, I think that we all saw an email as [we joined] Teams, I mean I had lots of issues with the Teams when I first started, and not because I don't, didn't know how to use it- 'cause I do right use it every day at work- it was because it was clashing with work"*). One of the learners also asked for some kind of recognition for completing the learning activities (including playing the FLIP2G game) that felt as something extra, as they were not directly linked to the assessment of the course or contributed towards their grade (*"I don't know, maybe it's like recognition, something as a recognition, so people do the quizzes, some people filled in their reflective diary every single week, [...] and then we did try [...] and some people did nothing and, you know, I guess it's just what you get out of it, that they will not get as much out of it as other people, and I think I don't know if that's doable or not - just to kinda see I don't get recognition for actually doing the work or for not doing the work"*).

- c) Finally, some learners would like to see more collaboration among the learners as part of the game (the multiplayer game was not available when the pilot ran). This could either take the form of completing the quiz together as a group (collaboration during the game) or completing the quiz individually and discuss the learners' answers in groups afterwards (to help learners understand why they answered wrong the questions). For example, as one learner mentioned *"one of the suggestions I was thinking - I don't know if it would be possible- would be if the actual group complete quiz together, maybe like a poll, obviously most likely won't be choice questions and then we see what the public group thinks as well obviously what's received is anonymous in the sense that you choose A,B,C or D or whatever then structure into the quiz"*. Another learner in the same focus group agreed on that (*"I find discussion the same as [name of a participant] the most helpful thing so just a little bit of wider discussion with the group about different aspects of the quizzes were very much left to do it independently. Like [name of a participant] suggests there would quite be nice to have a little bit more collaboration in terms of the quiz"*).

5.2.2 April pilot

The pre-pilot survey was completed by 7 out of the 8 learners enrolled to the course. All the learners came from the same organisation (police UK force), so learners differed only in terms of age and experience with games, when it comes to the demographics. Compared to the January's pilot, there was more balance in terms of the number of learners in each age group and the oldest learners were 49 years old or younger (Figure 37).

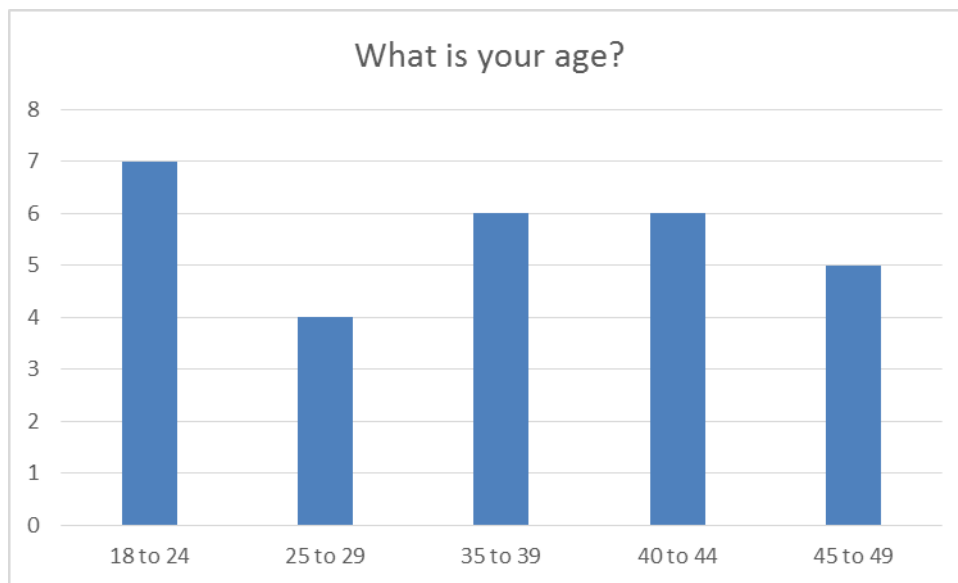


Figure 37 Age groups of the participants of the pre-pilot survey- April's pilot

An important difference with January's cohort is that the learners in April's pilot seemed more interested in online games (Figure 38), although that did not necessarily mean that they actually spent time on playing them (Figure 39). This could be due to the limited free time that they may have as full-time professionals/mature learners with family responsibilities.

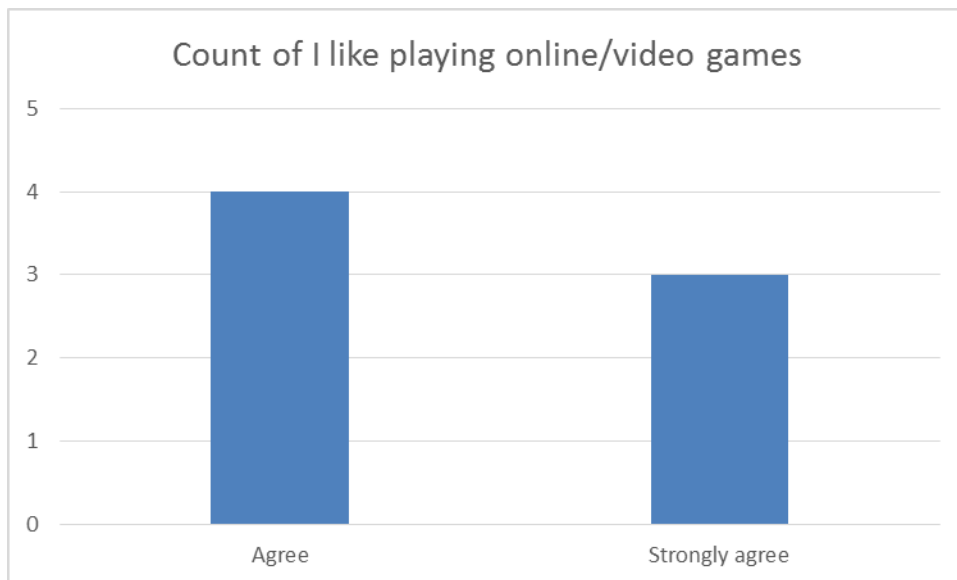


Figure 38 Answers to the statement "I like playing online/video games" – April's pilot

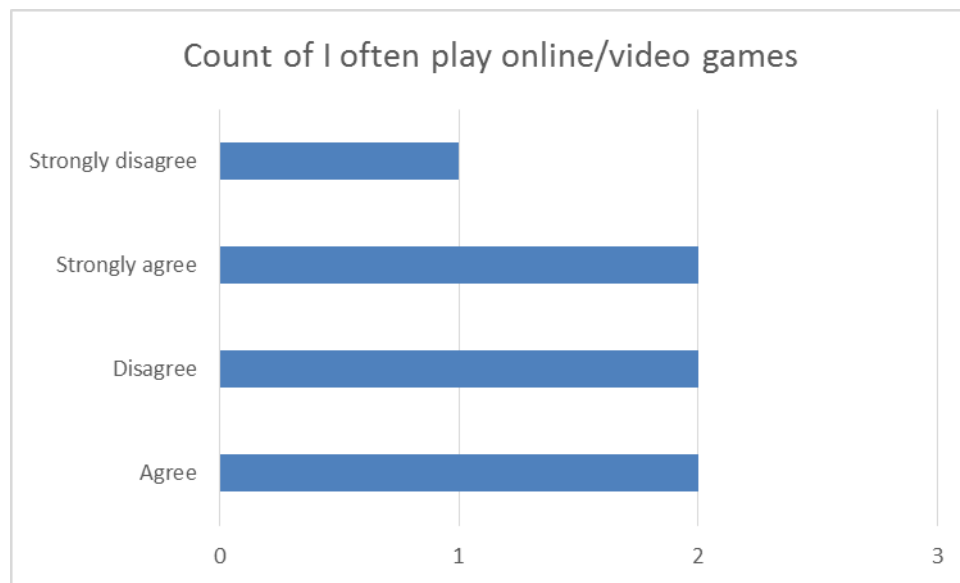


Figure 39. Answers to the statement "I often play online/video games" – April's pilot

Another interesting difference in the learners' attitudes towards learning was that the April's cohort was clearly more competitive towards their classmates and many of them preferred to study online (Figure 40). This might have to do with the requirements of their profession or the fact that all of them worked for the same employer, which could potentially create competition in general.

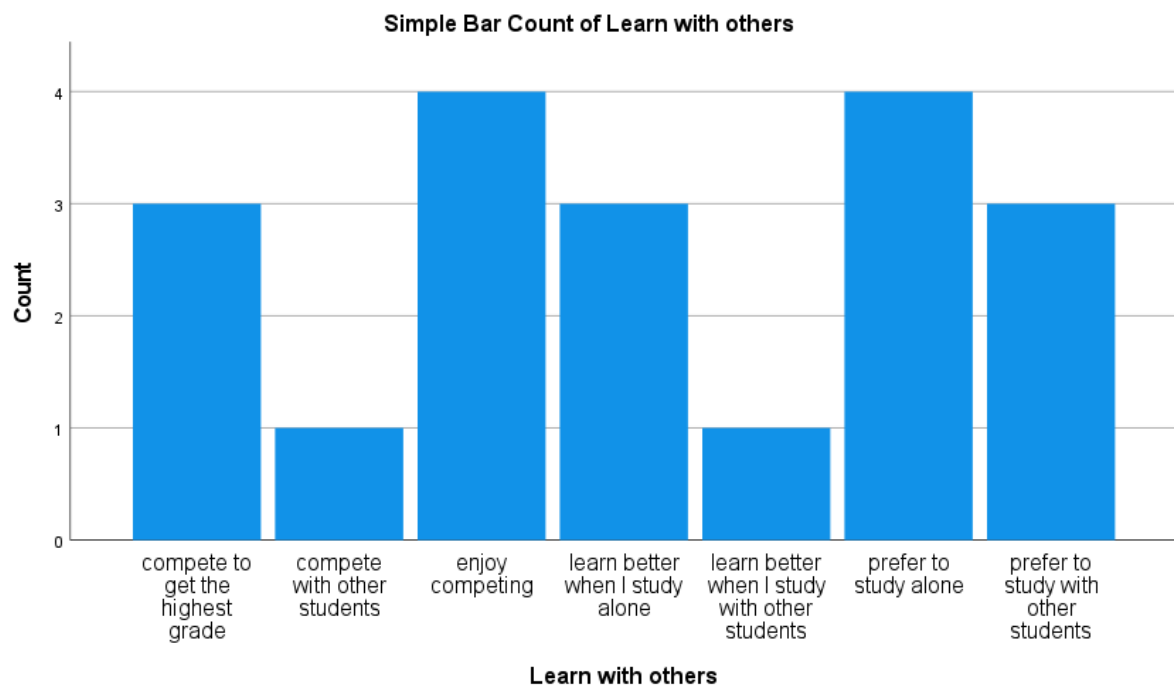


Figure 40 Attitudes towards learning with others – April's pilot

Despite the above differences, the April's cohort expressed a similar to the January's cohort preference for visual information (Figure 41) and practical tasks (Figure 42), something that confirmed that degree apprenticeship learners think more of the application of the knowledge in their workplace rather than the knowledge per se.

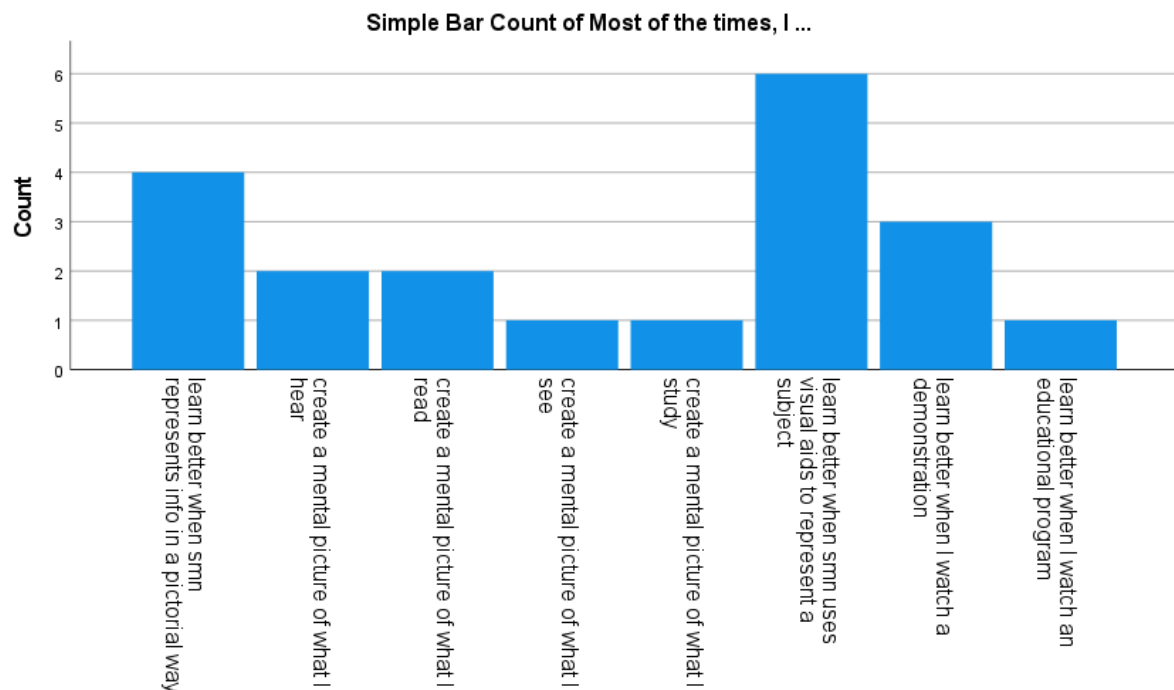


Figure 41 Learning process followed by the participants – April's pilot



Figure 42 Attitudes towards theory and practice – April’s pilot

Like in the case of the first pilot, the answers in the open-ended question about their personal learning goals varied. Some of them expressed no interest in the topic of the course, but seemed open to learn more about the subject (*“I’m not sure at this stage”; “Digital Business tends to be the last thing on my mind, I tend to focus on immediate tasks in front of me, and not pause and consider if any digital opportunities exist that would make my current task easier. It would also be good to gain a good understanding of the impact of our existing digital presence on public confidence and satisfaction.”*). Others focused on their workplace and how digital business can improve organisational processes (*“More about how we can improve the way our organisation works in the Digital world as it feels like we’re quite behind.”*) and others showed a broader interest towards digital business that included how digital technologies can help companies (*“I would like to learn about the relationship between the Business and IT departments and how these can be managed effectively to drive a business based on organisational data”; “I would like to learn the technical skills to successful launch a business online and how does a business digitally attract and retain customers.”*), although that knowledge would not have a direct impact on their job.

Unfortunately, as mentioned in the “selection of methods and research design” section, the learners did not volunteer to participate in a focus group, so it was not possible to explore their learning experience with the course in depth. That might have to do with the fact that in their case the course was intensive (all the workshops were delivered within 4 days), which probably made them reluctant to engage with any extra activities about the course. The questionnaire that was sent to them was completed by only 2 of them, which does not allow any meaningful statistical analysis to

take place. Having said that, the completed questionnaires included some comments in the open-ended questions that may shed some light about their views of the game and/or course, and considering how small and homogeneous that cohort was, the researchers thought that it would be interesting to report these answers.

The two questionnaires were answered from two learners 29 years old or younger (one was in the age group 18-24 and the other in the age group 25 – 29). While both of them found studying the material at home and not participating in face-to-face workshops challenging in general, one of them seems to have had a more positive experience while studying from home, as he/she agreed that he/she understood the material better and learned the subject at their own pace. Both of the learners found practicing the knowledge they gained in the virtual classroom helpful, but only one of them found applying the knowledge they gained to a case scenario and demonstrating it very helpful. That was the learner that stated that they enjoyed working in a team, while the other learner that mentioned that they would prefer working on individual learning activities, had a neutral attitude (“Neither challenging or helpful”) towards applying the knowledge to a case scenario (i.e. the PBL activities that took place in-class). The learner that stated they enjoyed working in team clarified that *“It was helpful to have the opportunity to discuss the topics with my peers as they have good experience to draw upon from their work life”*. That was the younger of the two respondents (i.e. 18-24), so it made sense that was willing to learn from more experienced colleagues.

When it comes to the experience with the FLIP2G game, there was a clear disagreement between the two learners. One of them agreed that the overall experience with the game was positive and that the game was easy to use and easy to understand/navigate, while the other disagreed with those statements. Both agreed that they managed to complete the quizzes within the game without issues and that the game was stable, but only the learner with the overall positive view about the game agreed that managed to view their analytics within the game without issues. The game did not seem to particularly motivate either of them, as the learner with the overall positive attitude towards the game gave a neutral answer (“Neither agree nor disagree”) to the statements “The game motivated me to complete and succeed in the quizzes” and “The game made me want to retake the quizzes to improve my score”, while the other learner strongly disagreed with them. Understandably, there was a disagreement between them regarding whether they liked using a gaming environment in the course compared to an e-learning platform, with the learner that agreed with the above statement also agreeing that the game's features were interesting and that the analytics of their performance were also interesting and helped them understand their progress better. The other learner disagreed with those statements, especially with the last one about the learning analytics (as they stated above, they did not manage to access them). Finally, the learner with the overall positive view of the game gave the following recommendation as a way to improve the game further: *“A bit more interactive with the role of the robot changing to respond to the results”*.

While it is not easy to draw conclusions based on the above due to the limited number of answers, the findings from the April's pilot are in line with the findings from the focus groups, as there are two main themes that are repeated here: the fact that some learners could not understand how to access their analytics (and that may affected their view regarding the usefulness of the game) and that the game could be more interactive in order to be engaging (and motivate them to complete the quizzes multiple times).

5.3 Instructor's perspective

The following section provides an overview of the Northumbria instructor's overall reflections for their pilots.

Did you have any previous experience in your courses with flipped classroom, PBL and gaming? If yes, please provide some examples.

I had some experience with PBL used to help UG first-year learners develop professional skills (e.g. teamwork, project management, communication, research skills etc.). In that course, learners had to work in small teams on problem that a real company in the UK had. They were learners of Marketing, so usually the problem was about developing a marketing plan/strategy for the company.

Did you apply the Concept exploration phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to play the game to test their knowledge of the concepts covered in the session. They were also given small problems in each session that were relevant to the topic of that week (e.g. strategy, cyber security, digital marketing etc.). The goal was for learners to try to understand how the concepts of each session can be applied to their workplace.

How did you design your Concept exploration phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Before the class, the learners had to access the learning material (e.g. recorded lectures, articles etc.) for the relevant session. At the beginning of each session learners had to play the game to test their understanding. Then, we had a discussion in plenary about their answers so they could understand if/why they had answered any of the questions wrong. I checked the LA mainly to understand how well the cohort performed in the quizzes and whether I had to explain any concepts again during the class and before the learners started the work on the week's problem.

Did you incorporate any of the PBL stages within the Concept exploration phase of your course? If no, why? If yes, please explain.

The problems on which the learners had to work in each session were formulated by the instructor. Most of them were open to interpretation though and learners had the option to choose one of the given problems (e.g. the one that they felt was most relevant to their industry/workplace).

How did you plan to engage with / intervene with your learners in order to adapt the course during the Concept exploration phase?

I asked for feedback in the first two sessions and the learners mentioned that they wanted a short introduction at the beginning of each session, before they play the game. That was because many of them said that they did not have much time to complete the pre-class activities. I adapted the session accordingly to support them.

Did you apply the Meaning making phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to work on small problems relevant to the topic of the session and their workplace. So, part of the session was about analysing these problems. The goal was to help them understand how they can apply the theory to their professional practice.

How did you design the Meaning making phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

I designed the problems that learners had to solve during the class. LA were not used as part of that phase as the game was not used as part of the problem analysis stage.

Did you incorporate any of the PBL stages within the Meaning making phase of your course? If no, why? If yes, please explain.

Yes, learners had to analyse the problem of the session before coming up with a solution for their organisation. This happened mainly via team discussions that they had in the break-out rooms on Blackboard. Learners conducted online research as part of the problem analysis and they shared findings with their colleagues.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Meaning making phase?

I joined their break-out rooms while they were working and participated in their discussions. When needed, I offered links to additional relevant resources that learners could use as part of the analysis of the problem.

Did you apply the Demonstration and Application phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to come up with some recommendations about their organisation after solving the problem. The goal was to understand the different options that organisations in different industries have when it comes to digital business (e.g. how different types of organisations would use social media platforms to engage with different types of audience).

How did you design the Demonstration and Application phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners had to create short group presentations of their findings from the previous stage. They received feedback from the instructor and the other teams. Again, LA were not used at this stage as the game was not used as part of the demonstration/application.

Did you incorporate any of the PBL stages within the Demonstration and Application phase of your course? If no, why? If yes, please explain.

Problem solving, as explained above.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Demonstration and application phase?

I provided feedback to the teams after they presented their solutions.

Did you apply the Experiential engagement phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners had to keep a reflective journal for the course. The goal was to help them track their progress and understand how they could potentially apply some of the learning as individuals in their job role. Also, learners could use their answers to the reflective journal as guidance for the course's assignment (i.e. a business report about how well their organisation is doing in the area of digital business compared to the main competitors).

How did you design the Experiential engagement phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

I created a reflective journal on Microsoft Teams that included questions and small activities relevant to the topic of each session. At the end of each page, learners had to reflect on their performance in the FLIP2G game and identify concepts that would have to study in more depth. That made them to check their LA from the platform. However, very often learners chose to skip these questions.

Did you incorporate any of the PBL stages within the Experiential engagement phase of your course? If no, why? If yes, please explain.

Yes, reflection, as explained above.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Experimental engagement phase?

I had access to the learners' reflective journals as they were available online, so I checked them every week and added feedback to their points. They could use that as guidance regarding how they could improve their knowledge in digital business and/or how they could prepare for the assignment.

What was your overall experience with the teacher dashboard? Positive, negative? Why?

In general, it was positive, as the platform was reliable and it was easy to add quizzes and learners. I had some difficulties with adding questions with long answers, but that was because my pilots were

among the first to run, while the dashboard was still under development.

Please let us know what the most positive feature of the teacher dashboard was and which the most negative. Provide some examples.

The platform is really easy to use. I think that more options need to be added though, e.g. the option to delete learners and upload various types of files (e.g. for the quizzes). Also, a single view of each learner (instead of editing/saving the whole class at the same time) would be better. That would help towards avoiding changing any details for a learner by mistake (e.g. typing something in the wrong field without realizing and then saving it while trying to edit another learner profile).

Did you find the teacher dashboard user friendly?

Yes, apart from the points mentioned above, I think the dashboard is user friendly.

Did you manage to add learners from the Learners menu? Did you encounter any issues?

No issues while adding the learners, but when I tried to edit the password for one of them, other fields were changed by the auto-complete option of my password manager, and with the passwords being hidden, it took me a while to understand what the issue was. That could be avoided, if there was a single view for each learner profile as mentioned above (so only one profile could be edited at a time).

Did you manage to create questions in the Questions menu? Did you encounter any issues?

Yes, I had some issues adding long questions/long answers as mentioned above, but that was fixed.

Did you manage to create quizzes in the Quiz menu? Did you encounter any issues?

It is easy to create the quizzes if you have added the correct tags.

Did you manage to add learning content from the teacher dashboard? Did you encounter any issues?

Yes, but only pdf files. It would be useful to add different types of content e.g. URLs.

Did you manage to set up courses and sessions in the teacher dashboard? Did you encounter any issues?

Yes, no issues, although at first it was not that evident that you had to click on the 'activate' button for the session to actually become live. Usually when you schedule something, by adding specific date/time, and clicking 'Save', you don't have to do anything else.

What improvements do you think could add value to the teacher dashboard?

Adding the options mentioned above that would allow the instructor to add different types of content and manage the learner profiles more easily.

6 Mandoulides Schools trials evaluation

Mandoulides Schools ran six pilot sessions in two courses, namely “Informatics” and “Maths” for primary education learners (9th grade).

6.1 Pilot 1 evaluation – Informatics (Cyberbullying, internet safety)

In total, learners from 9th grade (primary education) were able to complete four pilot sessions within the Informatics course. These sessions aimed to teach the learners important issues such as cyberbullying, internet safety, spam emails and phishing. Learners were able to replicate the hackathon that was carried out within Mandoulides Schools by using the FLIP2G pedagogical model to identify and understand the subject matter concepts and collaborate in order to apply the knowledge learned in real world settings.

The pilot ran for a short period of time, since because of the COVID-19 restrictions, many learners were absent due to illness scares and many sessions were not completed in order to cover all the necessary learning content that was missed in the previous academic years when schools were closed and ran fully online.

The teacher discussed with the learners in the classroom and gathered remarks with the main opinions they shared on the FLIP2G learning approach, as shown in Table 5.

Table 5 Informatics course- reflection remarks

Now that the course is over, what are your first thoughts about the learning approach that was followed? Are they mostly positive or negative? If positive, what comes to mind specifically? Similar with negative?

Learners really enjoyed that they were able work together with their friends and search on their own the topics of cyberbullying and internet safety. They could act as hackers similarly to the Mandoulides hackathon and learn how not to perform dangerous and unethical actions on the web and to identify possible internet dangers.

What were the most interesting moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises. Please provide information about all three.

All learners liked searching with their friends and learning about these topics that concern them and their parents. Learners also liked that they were given a problem they would solve, it increased their motivation and enjoyment of the course.

What were the most challenging moments about a) working in groups, b) studying the majority of the subject first at home c) trying to solve problems by applying what you were taught in practical exercises.

The fact that quite a few learners did not attend classes due to the pandemic hindered at times

learners' enjoyment of completing their tasks. Learners also sometimes felt overwhelmed when they were trying to search content on their own and needed more guidance.

Do you prefer the more traditional courses where lectures are taught during class and your participation and engagement is minimum or this new type of participatory learning experience? Please elaborate on the reasons for your preference.

Some learners still preferred the more traditional setting, mostly because they were reluctant to perform activities on their own or without the teachers' guidance. This can be attributed to their young age and their lack of familiarization with active learning. However, other learners really enjoyed this aspect of the course and wanted to continue being taught in this way.

All learners were positively inclined to continue with the reading from home format, as they are used to having a lot of content in different modes, since Mandoulides is very active and applies flipped classroom in their courses for years.

Tell us about the overall experience with the game. Was it positive or negative? Why?

Most learners really enjoyed playing the game. They have used different games before and are familiar with the setting and gamification elements, so they wanted to continue playing with the FLIP2G game.

What features of the game did you use? How often did you login in the game and for what purpose?

Learners could access quizzes that simulated the hackathon event of Mandoulides. They could login whenever they wanted and experiment with the quizzes.

What did you feel was interesting and lacking about the game?

Learners really liked the graphics of the game and that they could fight the robot to win. Some mentioned that they would like more dialog between their character and the other game features, and to have more gadgets to win.

Were there any technical issues while using the game? Did the technical issues prevent you from enjoying the gaming experience?

No major technical issues were encountered, since learners used the newest game version.

Would you be interested in playing an enhanced version of this game? What do you think would make the game better?

Yes all learners showed interest in using the game. They would like more collaboration in the game to play with their classmates, and more rewards.

Did you playing the game affect your performance in any positive or negative way? Please explain.

Learners said that their interactions with the game helped them understand the content better, as they enjoyed interacting with the quizzes and experimenting with the possible answers.

Did you find the quiz part of the game motivating for you to test your knowledge? What would change about the quiz process and what would you keep?

Yes all learners were motivated to complete their quizzes. Some suggested they would like to get more rewards in the form of gadgets (weapons, spells etc.).

Did you find the material access easy in the game for you to read? What would change about the material access process and what would you keep?

No issues were mentioned.

6.2 Pilot 2 evaluation – Maths (Advanced Excel features)

The second pilot ran for the Maths course of the 9th grade (primary education), where learners were taught advanced excel formulas so that they can perform different maths problems automatically (e.g. average, max, min, math equations, subtotals etc.).

Similarly to the Informatics course, the pilot ran with breaks in between due to the current circumstances. Learners showed a vast interest in the usage of the FLIP2G pedagogical model and the game, as they found it very innovative and were motivated to continue learning in order to play the game more.

The reflection remarks shown in Table 5 regard also learners' opinions on Pilot 2.

6.3 Instructors' perspective

The following section provides an overview of the Mandoulides Schools instructor's overall reflections for their pilots.

Did you have any previous experience in your courses with flipped classroom, PBL and gaming? If yes, please provide some examples.

Yes, Mandoulides schools have been using the flipped classroom model for years, we create video lessons that we upload on our Moodle e-learning platform and learners can access them from their homes. Learners have been taught on how to use Scratch as games in the class, but Mandoulides has not yet had any experience with serious games in their classes or PBL.

Did you apply the Concept exploration phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, we gave learners the opportunity to search for the topics of focus, which were cyberbullying and advanced Excel formulas.

How did you design your Concept exploration phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners searched for the topics we gave them from their homes and on their tablets at school. Learners could also read the learning content we gave them.

Did you incorporate any of the PBL stages within the Concept exploration phase of your course? If no, why? If yes, please explain.

Yes, learners had to analyze the problem of the pilot, which was to form a cyberbullying committee with instructions for anyone that is interested in the topic.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Concept exploration phase?

Learners discussed with us any findings they had and they also answered questions on the game so we could see if there were any misconceptions on the topics.

Did you apply the Meaning making phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, the educational goal was that learners had to be able to identify which of the information they read and studied was relevant and important for their course and make decisions on the data they had to keep or not take into account.

How did you design the Meaning making phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners had to understand all the concepts taught so that they could complete the tasks of each pilot, such as gather information on cyberbullying or execute different formulas on Excel for maths problems.

Did you incorporate any of the PBL stages within the Meaning making phase of your course? If no, why? If yes, please explain.

Yes, learners went through the Problem Design phase. They had to break down everything they read and understand which information they had to use for their tasks.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Meaning making phase?

We asked learners for feedback and we could check on their knowledge from the quizzes we gave them to complete.

Did you apply the Demonstration and Application phase in your pilot? If not, why? If yes, what was your educational goal?

Yes we did. The educational goal was to allow learners to show what they learned and how they applied this knowledge to the tasks we gave them.

How did you design the Demonstration and Application phase for your course? Please provide

examples of activities, data generated, and interventions made based on LA.

Learners had to run a hackathon in the form of multiple questions that showed how well they understood the pilot topics. Learners also discussed in the classroom the findings of the problems they solved (e.g. all cyberbullying facts that everyone should know, Excel formulas and how they can be used for Maths).

Did you incorporate any of the PBL stages within the Demonstration and Application phase of your course? If no, why? If yes, please explain.

Yes. Learners had to come up with a list of things to be careful about for cyberbullying and they had to perform formulas on Excel that solved different maths problems.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Demonstration and application phase?

I could monitor the way learners worked in the class and the progress they made by discussing it with them. This way, I could give them hints if their progress wasn't what it should be at that point or help them understand what they were doing wrong.

Did you apply the Experiential engagement phase in your pilot? If not, why? If yes, what was your educational goal?

Yes, learners will reflect on their findings in a final report that they will present at the end of the course.

How did you design the Experiential engagement phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

Learners will be able to present their final findings after they discuss with me in the classroom and after they correct any mistakes they have made until then.

Did you incorporate any of the PBL stages within the Experiential engagement phase of your course? If no, why? If yes, please explain.

Yes, Problem Evaluation and Problem Analysis PBL stages are relevant to this stage, since learners have to again analyze the problems for each pilot session and reflect on them based on the lessons they learned.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Experimental engagement phase?

I have not yet received the findings of the learners until our pilot sessions ended, but i plan to monitor learners' progress and give them extra material when they need it or change the quiz questions if they don't understand them.

What was your overall experience with the teacher dashboard? Positive, negative? Why?

I found the teacher dashboard helpful and easy to use. Sometimes the menu items took a long time to load.

Please let us know what the most positive feature of the teacher dashboard was and which the most negative. Provide some examples.

The teacher dashboard had all the different items that were necessary for me to design and deliver my courses. I could post questions, add tags, add learners, quizzes, courses etc.

At times I couldn't add content because the session would crash or I couldn't add many learners automatically but it wasn't a major issue.

Did you find the teacher dashboard user friendly?

Yes it was simple to use.

Did you manage to add learners from the Learners menu? Did you encounter any issues?

I added learners but sometimes they would not get saved so I had to repeat the process multiple times.

Did you manage to create questions in the Questions menu? Did you encounter any issues?

Yes I managed to create questions. I didn't encounter any problems, I just had to keep in mind the limitations in number of characters for the question and the possible answers, which was a bit time consuming. I also couldn't add images in the questions which limited the types of things I could ask my learners.

Did you manage to create quizzes in the Quiz menu? Did you encounter any issues?

Yes I created quizzes without issues.

Did you manage to add learning content from the teacher dashboard? Did you encounter any issues?

No issues with the learning content.

Did you manage to set up courses and sessions in the teacher dashboard? Did you encounter any issues?

Yes I set up courses and sessions with no problems.

What improvements do you think could add value to the teacher dashboard?

I would have liked to be able to upload more types of content (links, html, videos etc.).

What was your overall experience with the LA dashboard? Positive, negative? Why?

The LA dashboard was very helpful and provided interesting information for the course and the learners.

Please let us know what the most positive feature of the LA dashboard was and which the most negative. Provide some examples.

The most positive feature for me was the list with the wrong answers per learner. That way I could see which topics my learner was struggling with and I could adapt the course and the content.

Did you find the LA dashboard user friendly?

Yes it was user friendly.

Did you manage to make sense of your learners' progress using the LA dashboard?

I could yes, I would have liked more explanations on the charts' visualizations.

Which LA graphs did you find more useful and which more challenging to understand?

I liked the score vs engagement chart. I would have liked it they had learners' grades in a 10 grade scale and not based on the 500 scale so that I could easily calculate the grade my learner got.

Were you able to adapt your course based on information you gained from the LA dashboard? Please provide examples.

Yes, I changes some future questions for the quizzes when I saw some questions that were answered incorrectly by the majority of the learners. Also, when I saw learners were spending a lot of time on a quiz I asked them if it was because they were searching for content to answer the question or they needed help and guidance.

What additional features would you want to see in the LA dashboard?

More statistics on grades normalized on the 1-10 scale.

7 Revheim School trials evaluation

7.1 Pilot evaluation

The pilot ran by Revheim was carried out in social sciences course on the topic of Imperialism in 8th to 10th grade lower secondary education.

Learners that participated in the pilot answered the pre-course questionnaire; in total 27 answers were provided and the main points are as follows.

The preferred ways of studying and activities engagement documented include:

- Studying alone
- Competing for a task completion
- Studying with others
- Engaging in practical tasks compared to theoretical

Regarding the question of what types of participation were the learners involved in, the most prominent answers were as shown in Figure 43

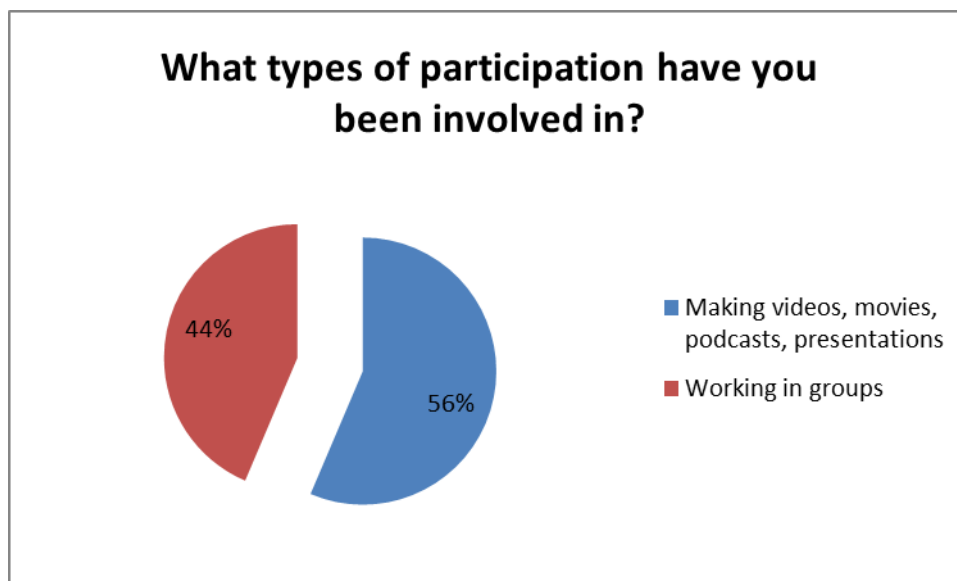


Figure 43 Types of participation in Revheim courses

Learners also answered questions regarding their view on games in education. Their answers are shown in Figure 44.

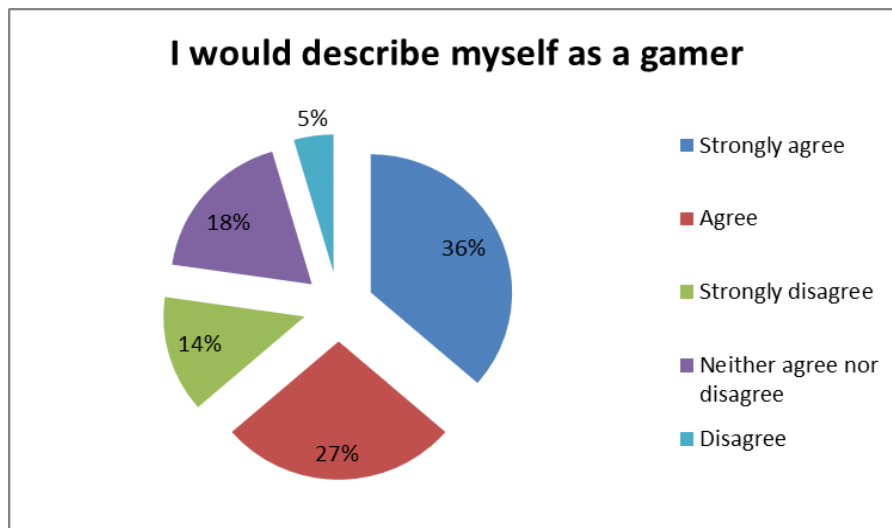
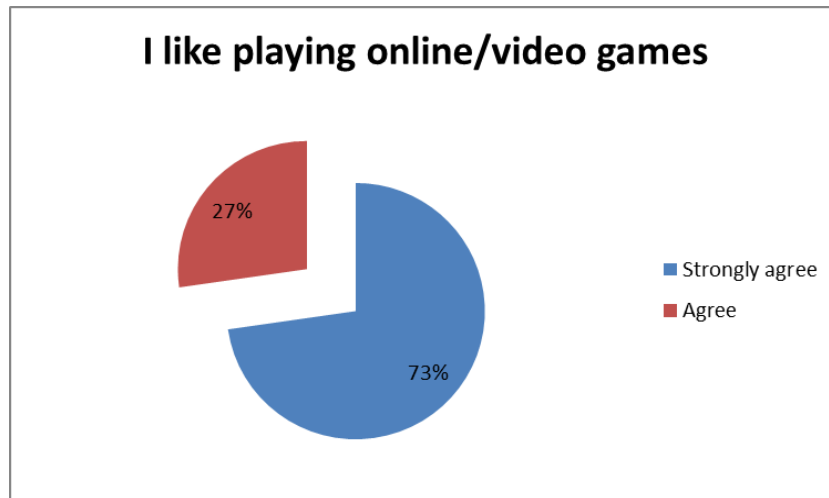


Figure 44 Revheim's learners' gaming experience

Based on the above Figure, it seems that the majority of the learners, even at young ages such as 14 – 18, are very familiarized with using and playing games in their everyday lives.

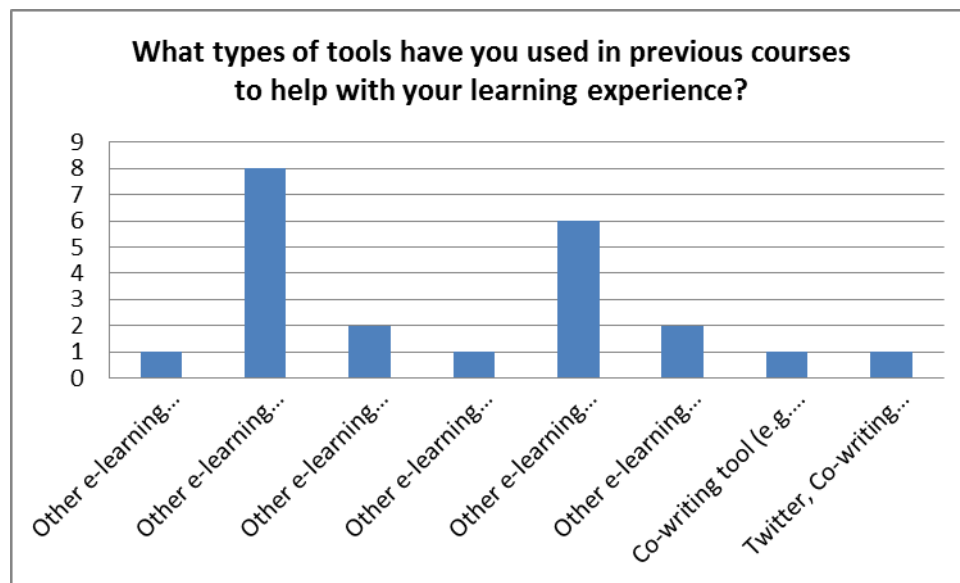


Figure 45 Technologies used in courses at Revheim

Figure 45 shows that the main tools learners have used in their learning experience are a combination of e-learning platform, Twitter, a co-writing tool (e.g. Google docs, Google sheets), some type of a discussion tool (e.g. forums, chats), quiz tools and games.

After the pilot, learners also answered questions on the post-course questionnaire regarding their learning experience. For example, Figure 46 shows that 65% of the learners agreed studying from home helped them take their time in learning the subject matter and 48% agreed that they could take notes while studying to ask the teacher their questions.

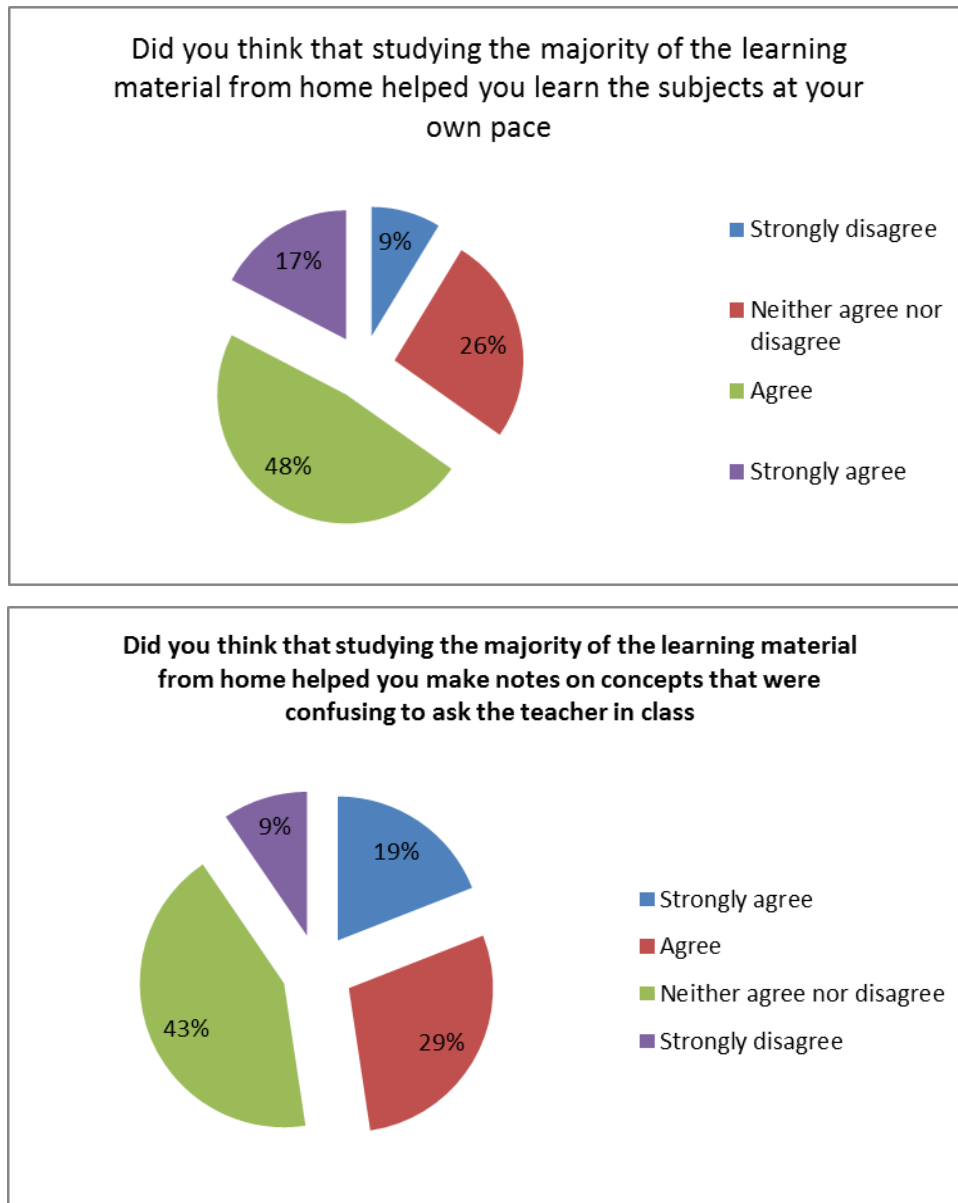


Figure 46 Studying from home views of learners

Learners also expressed their views on the FLIP2G's pedagogical model's aspect of practicing their knowledge in the classroom, as shown in Figure 47.

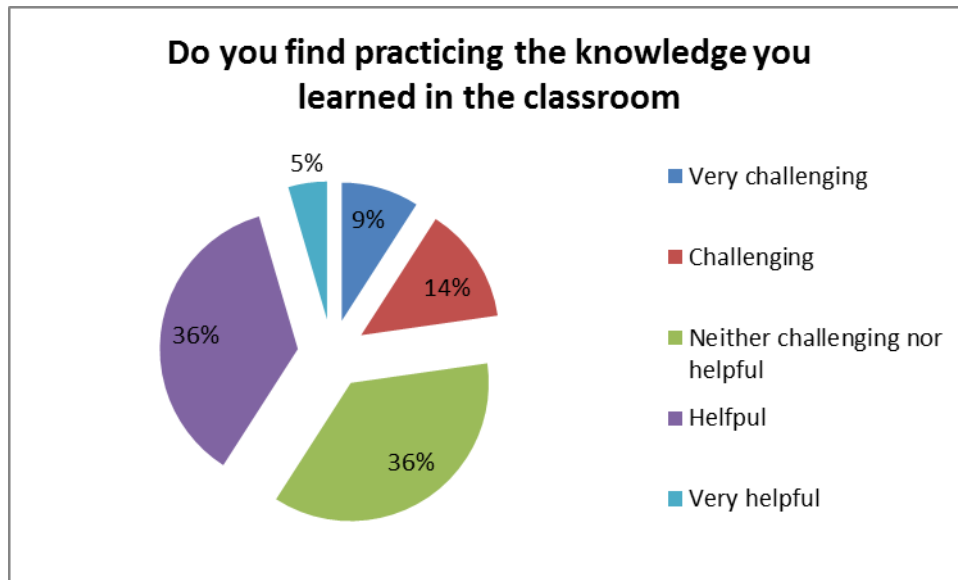


Figure 47 Practice in the classroom views of learners

According to Figure 48, the strong majority of the learners preferred working in groups, a very encouraging view for the future application of the FLIP2G project's results.

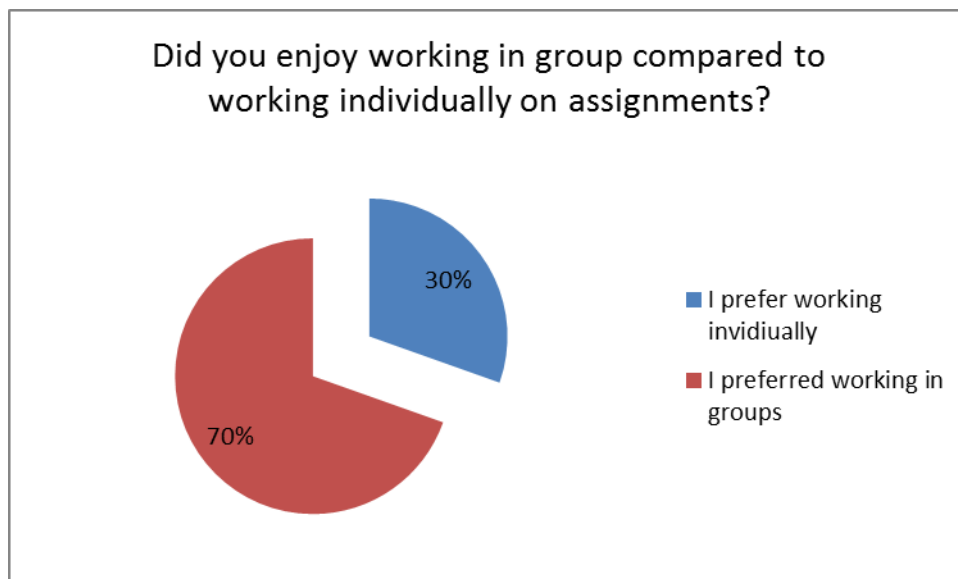


Figure 48 Collaboration views of learners

Regarding the learners' game experience, 40% found the game easy to navigate, while 47% had issues with the environment. This was due to the fact that the pilot ran at the start of the game's launch where technical issues were prominent.

Some suggestions mentioned about the game's improvement included the addition of interactions between the characters, other micro games to provide variety of learning experiences, more gadgets / rewards and limited technical difficulties.

7.2 Instructor's perspective

The following section provides an overview of the Revheim's instructor's overall reflections for their pilot.

Did you have any previous experience in your courses with flipped classroom, PBL and gaming? If yes, please provide some examples.

We have a lot of experience using commercial video games as part of our educational practice in social sciences. Among the games we have previously used are Frostpunk, This War of Mine, Assassin's Creed 3 and Unity, Battlefield 1 and 5, Limbo and Inside.

PBL has been used frequently before when we start working with a new time period in history or have a new theme in social sciences or geography. We have little experience with the use of flipped classroom, but have practised it sporadically in different classes.

Did you apply the Concept exploration phase in your pilot? If not, why? If yes, what was your educational goal?

Yes we applied a concept exploration stage in our Pilot, our educational goal with this was that pupils were to become more self-sufficient in their learning and getting a good understanding of how to start working with a problem or learning goal.

How did you design your Concept exploration phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

We designed it so that they would watch a video and write keywords on it, when they arrived at school they sat in groups and discussed what they remembered and then given different sources to try and learn more about the subject. A short quiz with Flip2G was then given to test if they had grasped the basic concepts. Here the LA gave us feedback on what the pupils needed help with understanding.

Did you incorporate any of the PBL stages within the Concept exploration phase of your course? If no, why? If yes, please explain.

No we did not incorporate a PBL in this stage, I wanted them to have a firm understanding of the basic concepts for the time period before they were given more advanced tasks.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Concept exploration phase?

While my pupils were doing their own research and exploring the time period I approached them while they were working and asked them how the tasks worked for them. I was then able to help the

pupils who did a poor job in researching on their own.

Did you apply the Meaning making phase in your pilot? If not, why? If yes, what was your educational goal?

Yes I applied meaning making in my pilot. My educational goal was that they were to learn how to find the most important information about a period and that they learned how to take notes based on that information which later could be applied in a presentation.

How did you design the Meaning making phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

They were given keywords and a working document in class where they wrote down explanations for the keywords along with information, they found relevant and interesting to the keywords. They then wrote some of their own reflections on the things they had found in the working document. They used this data they had collected to create their own questions for the Flip2G. The LA then provided insight into which keywords they struggled with and which pupils that needed extra help.

Did you incorporate any of the PBL stages within the Meaning making phase of your course? If no, why? If yes, please explain.

They were partially given a PBL approach in the sense that they were given keywords about the time period that they themselves needed to explore. They were not given a "problem", but rather the keywords that they used as help to identify what they needed to know about the time period. They then learned and wrote down explanations for the keywords which can be viewed as a form of "learning & applying to solve the problem" if you combine it with the next step in the demonstration and application stage.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Meaning making phase?

They all worked with their assignment in a document in google classroom which I had full access to so that I was able to see the progress of every pupil and give them feedback in their document about what they needed to write more about or clarify better.

Did you apply the Demonstration and Application phase in your pilot? If not, why? If yes, what was your educational goal?

Yes in order for the pupils to demonstrate and apply the research they had done they had to make a presentation about a given subject. The educational goal here was to show them that good research can provide one with a better understanding of a subject, but also help to lighten the load when they need to make their own presentations based on what they found. Most pupils experienced that a good foundation of researched made it 10x easier to make a presentation.

How did you design the Demonstration and Application phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

The pupils were tasked with creating an oral presentation about key concepts from the time period Imperialism. They were to present their findings and answer the questions they had made in the first task in the concept exploration and meaning making stage. This fused both the demonstration & application stage with the experiential engagement stage. The Flip2G quiz after everyone's presentation included questions from their presentation. This quiz after the presentations provided an understanding of how much they had learned from each other and working with the project themselves. The LA then gave me an idea about who needed to repeat certain aspects of the time period as homework.

Did you incorporate any of the PBL stages within the Demonstration and Application phase of your course? If no, why? If yes, please explain.

Yes. They were given a task to articulate a question about the time period, use their research to help identify what they needed to present in order to answer the questions, and finally find the relevant information and make a presentation about it.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Demonstration and application phase?

I constantly walk around and ask the pupils who are working how they are working to solve the given task. This makes it easy for me to intervene if someone needs help or if they have misunderstood the assignment.

Did you apply the Experiential engagement phase in your pilot? If not, why? If yes, what was your educational goal?

Yes it was coupled with the demonstration and application stage. After the presentations they were given a Flip2G quiz to see if they had learned anything and the LA gave them feedback as to what they needed to re-read and study.

How did you design the Experiential engagement phase for your course? Please provide examples of activities, data generated, and interventions made based on LA.

A Flip2G session which gave them feedback on what they needed to read more into, but also gave them questions they could ask other classmates.

Did you incorporate any of the PBL stages within the Experiential engagement phase of your course? If no, why? If yes, please explain.

Yes, they were able to evaluate themselves and then reflect upon the matter with classmates.

How did you plan to engage with / intervene with your learners in order to adapt the course during the Experimental engagement phase?

I intervened with feedback from the LA and told them what questions they needed to work more with in order to improve their understanding of the subject.

8 Conclusions

The current report presented all the evaluation results from the execution of trials performed by the partners. Twelve different pilots have been completed, aiming to test the project results' validity in different sectors and fields, and assessing their mainstreaming abilities.

A variety of interesting conclusions were drawn from all evaluation reports which will be taken into consideration in future trials and during the policy recommendations specification. More specifically, from each phase of the evaluation process a set of conclusions were drawn.

It should be taken into consideration that some specific limitations and circumstances were present during the pilots WP of the project. More specifically, COVID-19 led to lockdown restrictions in all partner countries and institutions, which led to the majority of the pilots being designed and delivered for fully online learning. This had multiple consequences on the pilots' execution, such as:

- Learners had to attend their courses from their homes, using their personal computers and internet connections. This caused issues for a large number of learners to have technical issues when they tried to access the game due to its graphical interface and resource requirements.
- There was a lot of emotional and psychological pressure for the learners which led to a general negative attitude towards learning with the new circumstances. This led to an increasing dropout number and a reduced participation in general.

However, despite the above limitations, all pilots were carried out as planned, and the assessment of the FLIP2G results derived a set of interesting remarks that can help any future game developer, instructor or instructional designer that wants to exploit our outputs. The conclusions are divided into the three main evaluation axes presented and analysed in D5.1.

FLIP2G Pedagogy

The FLIP2G pedagogy was assessed through reflection remarks posted by the instructors, where they commented on how they applied the different steps of the FLIP2G learning model and how they applied the model to their course designs. The pedagogical aspects were also assessed by the learners of each pilot, either through the quantitative questionnaire or through qualitative methods such as focus groups and reflection discussions. Learners of different educational levels (adult education, postgraduate, undergraduate, secondary, primary) shared their opinions from their experience with the new model of learning they were introduced to.

The most prominent remarks from the teachers are presented as follows:

- All teachers designed their courses using the FLIP2G learning model. They applied all model's stage (concept exploration, meaning making, demonstration and application and experiential engagement) and based the course's structure on the PBL's steps, i.e. they

designed assignments, projects and tasks where learners had to work together in order to solve a problem.

- Each stage in the FLIP2G model was designed by applying a set of learning activities that helped learners achieve their goals.
- Activities included in the learning designs were reading learning content, searching for additional resources, identifying relevant and accurate information, answering quizzes, brainstorming to perform the assignments, creating prototypes and outputs such as applications, reports etc.
- Tools included in the learning designs were the FLIP2G game, e-learning platforms of each partner, social media platforms for communication, project management tools, co-writing tools and reflection journals.
- Teachers did not experience any issues with adapting their courses to the FLIP2G model. They followed each stage's main objective and the learning design guidelines and could apply these guidelines to different courses.
- Teachers had a more clear understanding of the learners' progress or misconceptions by allowing them to work in groups and monitoring their performance.

The main points from the learners were:

- The majority of the learners enjoyed reading the learning content before the course and at their own pace.
- The majority of the learners enjoyed practicing the learned knowledge in the classroom.
- The majority of the learners enjoyed working together with their classmates towards common goals.
- Some learners found it challenging to adapt to the new course model (especially adults), but by the end of the course they understood the benefits of self-directed game based learning.
- The majority of the learners found it interesting that they had to demonstrate their work and present their findings. A lot of them were challenged by the fact they had to find ways to apply the knowledge to realistic contexts but with guidance they managed to fulfil their assignments.
- Learners mentioned that they would prefer additional guidance in the first two stages of the FLIP2G model, where they try to understand the main concepts and identify which resources are valid and accurate. They kept notes to ask questions to the teachers but they would prefer more direct communication to clear out any confusion.

The technology axis assesses the game's aspects and effectiveness (e.g. teacher dashboard, ease of use, technical stability, environment, motivation etc.) and the LA dashboard. These were assessed by the learners through reflection and the questionnaire and also by the teachers through reflection of their experience.

The main points from the teachers were:

- The teacher's dashboard was very easy to navigate and use. Teachers had no problems with the different menus available and they could create all the different content without major issues (questions, answers, students, quizzes, courses, tags, learning content).
- The teachers did not have major issues accessing the LA dashboard. They managed to view all the different visualizations and download their learners' quiz answers for grading.
- Teachers recommended a few future changes for the LA dashboard, like additional graphs, further drill down and explanations on the insights provided in the graphs etc.
- Teachers also recommended future improvements in the learning content element, where they would like to be able to upload different types of content for easier access, and get relevant analytics on learners' interaction with the content.

The main points from the learners were:

- The majority of the learners experienced technical issues during their interaction with game.
- A significant percentage of the learners that participated in the courses and followed the pedagogical model were not able to participate in the technological elements of the project results due to the limitations mentioned within each pilot evaluation description and in the beginning of this section.
- The majority of the learners found the game easy to understand and navigate despite any technical problems they might have encountered.
- Based on the pre-course survey, the majority of the learners have some to significant experience in playing computer games in their everyday lives. This also should be taken into consideration during their assessment of a game that is used for educational purpose and does not have the variety and complexity of the narratives, gadgets and game levels that are available in traditional computer games.
- All learners expressed an interest in re-using an improved version of the game in the future, and provided several recommendations that would increase the game's added value and learners' willingness to participate and interact with the game.
- Recommendations provided by the learners for future game improvement include more attractive and interesting narrative, additional gadgets, additional game types apart from quizzes and minor to no technical issues that affect the game's stability and learners' interactions with it.

FLIP2G learners' performance

Learners' performance was assessed in terms of the LA visualizations and the insights they could provide to improve performance and understanding, and in terms of the learners' reflections in regard to what extent they were able to comprehend the material, understand their misconceptions and practice the knowledge taught.

Each teacher had access to the LA visualizations and could assess their learners' progress, adapt the course accordingly and provide scaffolding by adding more content, changing the assignments or re-arranging the course structure.

Representative forms of learners' performance related insights are:

- Overall overview per session on numbers of students, correct answers, wrong answers.

Sessions

Sessions information.

Sessions	Game/Quiz	Session students	Started	Finished	Passed	Questions	Correct answers	Wrong answers
session_1	3o Quiz eGov 21-22	34	No	Yes	Yes	405	270	135
session_2	4o Quiz eGov 21-22	34	No	Yes	Yes	381	297	84
session_3	5o Quiz eGov 21-22	29	No	Yes	Yes	310	236	74
session_4	6o Quiz eGov 21-22	27	Yes	No	Yes	269	254	15

Figure 49 Example of assessing learners' performance: Session statistics

Figure 49 helped teachers have a perspective on how many of the enrolled students participated in each session, and how many questions were answered as a total. Additionally, teachers could assess whether the majority of the class performed sufficiently based on the correct answers / wrong answers percentage. For example, in session 4 of the above figure, the number of wrong answers is very small, which shows that the majority of the learners understood the material in depth. On the other hand, in session one, the wrong answers are significantly high, which showed the teachers that they could communicate with the learners and see which parts of the content confused them in order to adapt the course accordingly.

Another example is shown in Figure 50 regards the teachers' ability to assess learners' progress evolution. That way, they could identify if the course is progressing as should, or if there is a gradual decrease of performance. This may be easy to detect in the cases of a few sessions, but when the courses run for a full semester on a weekly basis or a full academic year (for primary and secondary education), the high number of sessions would make it very difficult for teachers to identify those with the lowest scores that need adaptation and scaffolding.

Score Evolution

Evolution of the group score during the course. Each right answer has a score of 500 points.

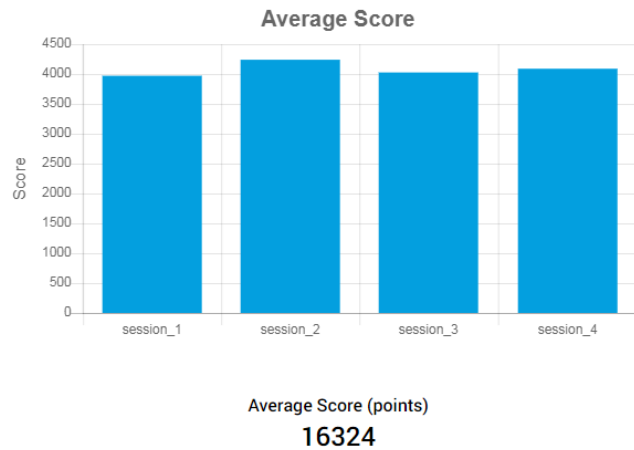


Figure 50 Example of assessing learners' performance: Score evolution

All aforementioned results have been taken into consideration by all partners for their future iterations of the pilots even after the project's end. The findings were also documented in this report in order to ensure that any future stakeholders that want to exploit the FLIP2G results, make improvements and apply them in their own settings can receive the proper guidance from the pilots' experiences and findings.

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