D4.2. Post-training Analysis

Video gamEs foR Skills trAining (VERSA)

EU Horizon 2020 SWAFS project (topic 8)
Grant agreement No. 101006420

Document creator team	Stichting VU	**Work Package**	4
Participating partners	All	**Delivery date (according to calendar)**	January 2023 Updated: May 2023

This project has received funding from the European Union's Horizon 2020 Science with and for Society Call (Swafs-2020 Topic 8) under grant agreement No. 101006420.

A. Introduction

In this report on deliverable 4.2 of the VERSA project, we present the post-training analysis of the soft skills of the PhD students that completed three modules. First, we will briefly elaborate on the methodology that is used for this report. Second, we will give an overview per module in which it will be made visible how many students completed the module and what the results of the completion of the soft skills training have been.

B. Methods

To illustrate the post-training skills completion, this report sets out the outcome of the data analysis against the baseline skillset of each participant that completed any of the modules. It is important to note that the *baseline skillset* referenced here is different from the *baseline analysis*, which is documented in the report *WP4 D4.1 D7 Deliverable Baseline Analysis.* In the latter, we presented baseline statistics about the interests of the participating PhD students. The baseline that is meant in this report regards the *baseline skillset*, the set of soft skills with which the PhD students started, and which was measured by the standardized surveys that they had to take at the start and at the end of each module.

Another important distinction is to be made between this report and the data analysis report which is carried out by GeCon. Although the results of this report represent the outcomes of their analysis, this report is put together in order to give an overview of the general data of how many students completed the modules, which ones dropped out, and what the results of their participation were, in combination with the conclusions of the data analysis. This way, it provides an overview of the post-training progress of soft skills of the group of students that completed each module. For the specific graphs and details of the statistical analysis, we refer to GeCons 2nd data analysis [*D3.3. 2nd Data analysis*].

The method used for this report is quite straightforward. For each module, there is a brief introduction of the content of the module: the video game that was played, the soft skill that was trained, and how the two relate. After this general introduction, a table is presented which gives a general illustration of the number of participants, the completion rates, and reasons for drop-outs. This is followed by a short conclusion based on the data analysis of GeCon. Below, we present a short summary of the findings.

Short Summary

In the last two years, 182 students were enrolled in eight different modules of the VERSA project. In this deliverable, we provided an overview of every module's progress and add the concluding results of the second data analysis, together forming the post-training analysis. One by one, all modules were covered, describing the number of participants, drop-outs and completion rates.

In module 1, Cognitive Flexibility, a rather large number of participants joined. Completion rates were average, around three-fourths of the total number of participants. A unique reason for drop-outs was the occurrence of motion sickness during game-playing. The results of the statistical analysis show a significant increase in the perception of improvement of cognitive flexibility. There was one gender difference: men perceive a greater post-training achievement than women do.

Module 2, Creativity, is comparably similar to module 1 with regard to participant numbers and completion rates. There was again a significant difference in perception of soft skill improvement. There were no differences witnessed with regard to gender or field of study. Fewer students started with module 3 Critical thinking, and the completion rate was significantly lower as well. It is not clear whether this reflects the interest in the game (Anomaly 2) or if there were different reasons, as most students did not specify their reasons or

even communicated that they would not continue with the module. The results again showed a significant difference in critical thinking skills pre-training and post-training.

The participatory data differed quite a lot amongst the three universities in module 4. URV had a rather low completion rate, with almost 50% of the participants not attending the coaching session, whereas UIBK had a higher completion rate, with the VU being situated in the middle. Students self-reported to have improved their complex problem-solving skills after finishing the module. This perception of improvement was again independent of the qualitative variables (gender, field of study). Module 5, People/Team Management, progressed quite similarly to the previous modules. The average completion rate was again a bit low at the URV. The results were similar as well. Module 6 had generally average completion rates and an average number of participants. The results of the statistical analysis demonstrate that there is a perceived improvement in the development of time management. There was a significant difference in perceived self-improvement between male and female, indicating that men have a higher perception of self-improvement than women.

Modules 7 and 8 were the lowest in attendance. Module 7 had varying completion rates: average at the URV; high at the VU; and low at UIBK. Participants perceived an improvement in their development of judgment and decision-making skills and the coaching session was evaluated positively. There was a significant difference in between genders in the preliminary analysis, showing women to have a higher perception of judgment and decision making before the training. Module 8 had low attendance rates and an exceptionally low completion rate at the URV (47%). Again, it could be concluded that there was an increase in the self-perception of soft skills, in this case goal setting. Overall, most students participated in modules 1 and 2 (103 and 118), probably because those were the first and closest to the kick-off meeting. The final two modules were lowest in students (79 and 51 in total), which could be for the same reason: some of the students who participated in the VERSA project already graduated or finished three earlier modules. All coaching sessions were well-perceived by the students. The general conclusion is thus that all modules helped in terms of self-reported soft skill improvement, with differing results with regard to qualitative variables such as gender. It would be interesting to look into the reasons for drop-out per module and see how the project's structure, materials, methodology and communication could be improved so as to be able to have higher completion rates and keep students better engaged.

C. Results

In this section, the results will be discussed. For the entire length of the project, from January 2021 to December 2022, 182 students enrolled in the VERSA project: 109 of the UIBK, 26 of URV, and 47 of the VU.

In the paragraphs below, each module is first briefly introduced by elaborating on the soft skill and the video game that belonged to the module. For each module, the following data of the participants is included: the number of participants that initially started the module; the number of drop-outs (including reasons); the number of participants that completed the module; the completion rate for that module*; and some observatory remarks. This introduction provides a general overview of the module. The module evaluation concluded by stating the results of GeCon's data analysis (*D3.2. 1st Data analysis* and *D3.3. 2nd Data analysis*), thereby displaying the post-training results.

*The average completion rate of all modules is as follows:

University	**Average Completion Rate**
UIBK	74%

URV	64%
VU	75%
General	71 %*

*Average of the three numbers above (73 % if we consider all students/all completed, as URV has fewer total participants

Within a 10% difference from the average completion rate, the completion rate is still deemed average.

All information and graphics related to the specific modules are gathered in deliverable 3.3, the second Data analysis. The specific data of each VERSA module and a summary of the results are shown below.

Module 1. Cognitive Flexibility

On 1 April 2021, the first module *Cognitive Flexibility* started. Cognitive flexibility is the ability to see different patterns or generate different options to solve or analyze new situations. Along with other skills, Cognitive Flexibility plays an important factor in the ability to adapt to new situations as well as the ability to think "outside the box" and keep an open mind in front of new and unexpected events or problems.

The corresponding game for this module was Portal 2, a first-person shooter puzzle game that puts the player in a puzzle-solving context where the traditional solutions are not effective. The player must have high levels of cognitive flexibility in order to discover the underlying rules behind each puzzle and solve it only with the portal creation tool. Besides, the more the player advances in the game, the more complicated the puzzles become, adding more variables to keep in mind that they will require even more levels of cognitive flexibility to switch between rules, among other soft skills as problem-solving, spatial skills, or persistence.

This module ran for two months from 1 April to 1 June and was initially selected by more than a hundred participants. Below is the table displaying the participant data.

Table 1.1 Participant data module 1

MODULE 1	**URV**	**VU**	**UIBK**
Nº of Participants	15	37	52
Drop-outs	4 participants: • Switched module (1) • Absent at coaching session (3)	9 participants: • Motion-sickness (2) • Not enough hours (5) • Absent at coaching session (2)	10 participants: • Motion-sickness (1) • Not enough hours (1) • Absent at coaching session (4) • Personal reasons (4)
Completed the module	11 participants	28 participants	42 participants
Completion rate	73%	75%	81%
Observations	Average completion rate	Average completion rate.	Average completion rate. Reasons for drop-out were

	One participant who changed modules was replaced by another student, so we could use the license of the video game.	A few people experienced symptoms during the game. Some were too busy or not invested enough.	similar to VU. Participants who dropped out for personal reasons had other obligations which prohibited them from completing.

Results Second Data Analysis:

The results related to the first module are promising. The statistical analysis of the information extracted from the standardized tests (see deliverable 3.3) shows that there is a significant increase in the perception of the improvement of the level of cognitive flexibility by the participants. This gives weight to the hypothesis that Portal 2 is a complex and stimulating video game to be understood as an improvement tool for the perception of cognitive flexibility. In turn, the coaching session was very well received, as it generated very positive feedback and provided new change management tools to the participants. At a qualitative level, no significant differences were observed in relation to the qualitative variables "gender" and "field of study". Except for the fact that men seem to perceive a greater post-training achievement than women do. This line of investigation remains open to explore future differences and causes.

Module 2 Creativity

The second module directly followed the first, starting on 1 May 2021, this time proceeding for three months and ending on 1 August. Creativity is the ability to provide unusual or intelligent ideas about a given issue or situation or develop alternative ways to solve a problem. It is part of the innovation competence that involves contextualizing creativity with a goal, either adapting to change or improving an existing process. The video game that was played to stimulate creativity was Cities Skylines, a game that offers the player an empty virtual space so that s/he can build the city as s/he imagines it. Besides the fact that the player has to offer different creative solutions to different types of problems that may appear in his/her cities, the number of options and possibilities offered by the selected video game as options regarding the type of building to be built, communication channels, energy, and other urban variables, make it the ideal tool to measure and train creative aspects of the players.

Table 1.2 Participant data Module 2

MODULE 2	**URV**	**VU**	**UIBK**
Nº of Participants	21	48	49
Drop-outs	8 participants: • Lack of time (1) • Absent at coaching session (7)	10 participants: • Citrix error (1) • Absent at coaching session (4) • No response (5)	12 participants: • Absent at coaching session (3) • Not enough hours (3) • Personal reasons (6)

Completed the module	13 participants	38 participants	37 participants
Completion rate	62%	79%	76%
Observations	Average completion rate Some participants complained in relation to the difficulty of the game and because the game ran slowly on their computers.	Average completion rate. The dropouts were often the same as in module 1. After this, we decided to send an email to all participants to either drop-out now or keep attending.	Average completion rate. While the game was popular with most students, some had difficulties with it and therefore did not meet the required hours.

Results Second Data Analysis:

The results of the second module, in the same way as the first, indicate that there is a significant difference in the perception of improvement of the soft skill, in this case Creativity, thereby giving more weight to studies that relate the use of Cities Skylines with the development of this soft skill. The coaching session was also deemed a very positive point in the development of the module, since again, the participants highly valued the experience as well as the tools provided. Regarding the qualitative variables, this time without exceptions, no significant differences were found either in gender or in the field of study. By this it is concluded, positively, that any gender or student of any field of study can benefit in the same way from training with video games.

Module 3 Critical Thinking

Critical thinking ran in October and November 2021. It revolved around the skill of critical thinking: using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems. Critical thinking requires analyzing the situation or the problem in depth, identifying the different elements that make up the system, and questioning its role or need, including missing elements.

This skill was trained by playing the action-strategy game Anomaly2, a video game that requires specific strategic thinking. There are a lot of elements inside the game and the ability to filter or prioritize them will be a clear indicator of critical thinking as they require a critical analysis of the problems shown to the players.

Table 1.3 Participant data module 3

MODULE 3	**URV**	**VU**	**UIBK**
Nº of Participants	14	27	46
Drop-outs	6 participants: • Finished PhD (1)	11 participants:	9 participants:

	• Not enough hours (1) • Absent at coaching session (4)	• Did not meet requirements (6) • Computer not compatible with the game (1) • Absent at coaching session (4)	• Absent at coaching session (1) • Personal reasons (8)
Completed the module	8 participants	16 participants	35 participants
Completion rate	57%	59%	76%
Observations	Average completion rate After defending his thesis, one participant moved back to his country. The coaching sessions were at midnight in his local time, so he could not attend which put an end to his participation.	Lower completion rate. A few of the reasons provided by the students that dropped out are above shared under 'did not meet requirements', since these were personal reasons. For some, it was the amount of time they had to play the game that was too much.	Average completion rate. At UIBK students sometimes sign up for more courses than they want or can attend to assure a place in some of them. This (in part) explains the high number of dropouts at the beginning of the semester.

Results Second Data Analysis:

Regarding the development of critical thinking, the statistical analysis of the applied behavioral test shows a significant difference before and after the training. It can thus be affirmed that the students in this module have managed to improve the levels of said soft skill. This supports preliminary research that associates the use of video games with critical thinking. The coaching session was also well received, providing a non-gaming context that can help to make sense of the skill outside of the game. Finally, regarding the qualitative variables, as has happened with the previous module, the data shows that there are no significant differences, cataloging the development of critical thinking as independent of the gender or field of study of the participant.

Module 4 Complex Problem Solving

Module 4 ran from November to the beginning of January 2022. Complex problem-solving is the ability to solve ill-defined problems. It involves identifying the elements of the problem, devising possible solutions, and carrying them out taking into account the immediate feedback of each application to modify the solution.

This skill was trained by the simulation-strategy-puzzle game Train Valley, which presents different train puzzles to the players, who have to manage all the trains outputs and build train tracks with money earned in the game. This video is essentially presenting spatial and time-related problems in a train station in which players have to analyze management-like elements in order to solve those problems and have a good performance. Some elements that appear in the video game and are part of the group of problems to be solved are simultaneous train trips, optimal construction of train tracks, saving travel time, solving train crashes, etc. The

complexity of problems is defined and typified so each could be measured and related to the player's complex problem-solving skills.

Table 1.4 Participant data module 4

MODULE 4	URV	VU	UIBK
Nº of Participants	14	31	43
Drop-outs	6 participants: • Absent at coaching session (6)	10 participants • Absent at coaching session (2) • No response (3) • Not enough hours (5)	7 participants • Absent at coaching session (1) • Not enough hours (1) • Personal reasons (5)
Completed the module	8 participants	21 participants	36 participants
Completion rate	57%	68%	84%
Observations	Average completion rate	Average completion rate	Average completion rate. Sending multiple reminders, offering three coaching sessions and allowing the participants to decide on a date on short notice reduced the number of students who were absent at the coaching session.

Results Second Data Analysis:

Regarding module 4, we found statistical data that support the hypothesis that students seem to perceive an improvement in their ability to solve complex problems thanks to the use of Train Valley, again in line with previous findings in the scientific literature (bibliography presented in deliverable 3.3)]. The coaching session was very well received by the students. Finally, as regards the qualitative variables, it was once again shown that the perception of the improvement of the ability is independent of the qualitative variables.

Module 5 People/Team Management

The final module of 2021, module 5, ran from December 2021 to March 2022. People/team management is the skill to motivate, develop and direct people as they work, identifying the best people for the job. It involves conflict and emotional management of the group itself as well as orientation to global results. Students developed this skill by playing Fallout Shelter, a game that puts the player in control of a state-of-the-art

underground Vault. Activities include building the perfect Vault, managing and keeping the workers happy, and protecting them from the dangers of the Wasteland. The main mechanic of this video game which allows players to develop their management skills is the hiring and assignment of the workers. Besides that, the player will have to take into account the strengths of each worker in order to assign them to their best workplaces or missions without forgetting to keep them happy. Normally, leadership or social skills training is done through the application of cooperative video games or video games that force players to get together or meet to play together. However, such a training model has methodological limitations (since users have to coordinate themselves), so this training course focuses solely on solo play.

Table 1.5 Participant data module 5

MODULE 5	URV	VU	UIBK
Nº of Participants	14	29	40
Drop-outs	5 participants: • Absent at coaching session (5)	8 participants • Computer incompatibility (1) • No Response (4) • Lack of time (2) • Absent at coaching session (1)	10 participants • Computer incompatibility (1) • Personal reasons (6) • Absent at coaching session (3)
Completed the module	9 participants	21 participants	30 participants
Completion rate	64%	72%	75%
Observations	Average completion rate One participant answered the post-test after the deadline, but we accepted it.	Average completion rate	Average completion rate

Results Second Data Analysis:

Continuing with module 5, the results follow the same pattern as the previous modules presented up to this point, showing a significant improvement of the skill in question at a perceptive level, as well as very positive feedback from the coaching session. The results in relation to the qualitative variables were repeated as well, again granting independence to the improvement of skills.

Module 6 Time Management

Module 6 revolved around time management, which can simply be defined as managing one's own time and the time of others. The module ran from March to June.

An addictive fast-paced hybrid of Card games & Tower-Defense, Minion Masters allowed players to play alone or bring a friend for a game of two versus two. In the game, the player has to take into account this macro time in order to manage the micro time of each unit that s/he deploys into the battleground. Since the battle is automatic the player "only" has to deploy units that will advance by themselves at the determined speed. This is the micro time that the player will have to manage to anticipate efficient attacks and defenses and thus win the game.

Table 1.6 Participant data module 6

MODULE 6	URV	VU	UIBK
Nº of Participants	25	23	39
Drop-outs	• Not enough hours (4) • Absent at coaching session (1)	• No response (1) • Absent at coaching session (1)	• Personal reasons (4) • Absent at coaching session (1) • Lack of time (1)
Completed the module	20	21	33
Completion rate	80%	83%	84%
Observations	High completion rate	Average completion rate	Average completion rate

Results Second Data Analysis:

Module 6 shows similar data to the previous modules. The results of the statistical analysis demonstrate that there is a perceived improvement in the development of time management. We received positive feedback on the coaching session. Although this improvement seems to be independent of the gender and field of study variables, a preliminary analysis of the levels of time management before training shows significant differences between genders. This indicates that men perceive that they have better time management than women before the training.

Module 7 Judgment and Decision Making

How does one best take into account the relative costs and benefits in order to choose the most appropriate action? This was the topic of module 7 judgment and decision making, which ran in May and July. Judgment and decision making is a meta-competence that encompasses different skills such as critical thinking, problem-solving, resource management, and organization.

This was trained by Gems of War, a match 3 game where the player has to make combinations of pieces in order to attack and defend a combat led by several creatures. This game exposes the player to a series of decisions (some more relevant than others), stimulating and improving in several cases the decision making soft skill. In fact, this game presents three levels of decision making to the player: 1) a more strategic part where the player will have to decide which units to take into battle; 2) another more frenetic part that consists of making micro-decisions within each battle (decide which pieces of the board to move, more related to spatial skills and pattern recognition, affecting the previous strategy); and 3) one last line of decisions related to the upgrade of the units in order to optimize the warlike performance relating the macro strategy.

Table 1.7 Participant data module 7

MODULE 7	URV	VU	UIBK
Nº of Participants	24	17	38
Drop-outs	• Absent at coaching session (5) • Not enough hours (2)	• No response (1)	• Absent at coaching session (5) • No response (1) • Not enough hours (11)
Completed the module	17	16	21
Completion rate	71%	94%	55%
Observations	Average completion rate	High completion rate	Low completion rate

Results Second Data Analysis:

The data relating to module 7 is reminiscent to the data of module 6. There is an improvement perceived by the participants in terms of the development of judgment and decision making skills. We received positive feedback about the coaching session. In relation to the qualitative variables, the same pattern is shown as in the previous module, showing independence of the improvement of the soft skill vs gender and field of study, but showing significant differences in the preliminary analysis. It shows that women seem to perceive that they are better than men in decision making before the training.

Module 8 Goal Setting

The very final module of the VERSA project was about goal setting. This skill is also known as results orientation, which is the process of deciding what you want to achieve and devising a plan to achieve it. For entrepreneurs, goal setting is an important part of business planning. Goal Setting is part of a meta-competence called self-determination. This module introduces goal setting skills as a determinant in the construction of the user's identity, as well as being the main driver or support to generate behaviors to achieve something. In any goal or achievement completion, there must be a previously defined objective and linked actions.

Alien Swarm: Reactive Drop is a Tactical co-op 3rd person shooter for up to 8 players with a top-down perspective offering cooperative campaigns and different roles to perform. Each player chooses one of the 4 unique classes and 8 different characters of the IAF Marines available: Technical, Medical, Heavy Machinery,

and Official. By definition, (video) games are made up of problems, missions, or challenges, which end up in the completion of certain objectives or achievements. Regardless of the video game genre, every player shares that orientation to results, since they will always be oriented to meet such a goal. Softskills.games methodology is perfectly synchronized with the measurement of the goal setting skills, since achievements are first-degree indicators of such soft skills. The complexity of Alien Swarm Reactive Drop makes this video game the perfect tool to end any soft skills training since each behavior of the players within the virtual world will be destined to set and meet a goal, which will eventually lead to achievements measured by the softskills.games platform.

Table 1.8 Participant data module 8

MODULE 8	**URV**	**VU**	**UIBK**
Nº of Participants	19	14	18
Drop-outs	• Absent at coaching session (6) • Not enough hours (4)	• Not enough hours (2) • No response (2)	• Absent at coaching session (4) • Lack of time (2)
Completed the module	9	10	12
Completion rate	47%	71%	67%
Observations	Low completion rate	Average completion rate	Average completion rate but very low number of participants.

Results Second Data Analysis:

The results obtained through the analysis of the information from module 8, it can be concluded, once again and thus completing the entire project, that training with video games seems to improve the perception of soft skills. In much the same way as the rest of the modules, there also seems to be little influence of the qualitative variables on said perception or skills themselves.