

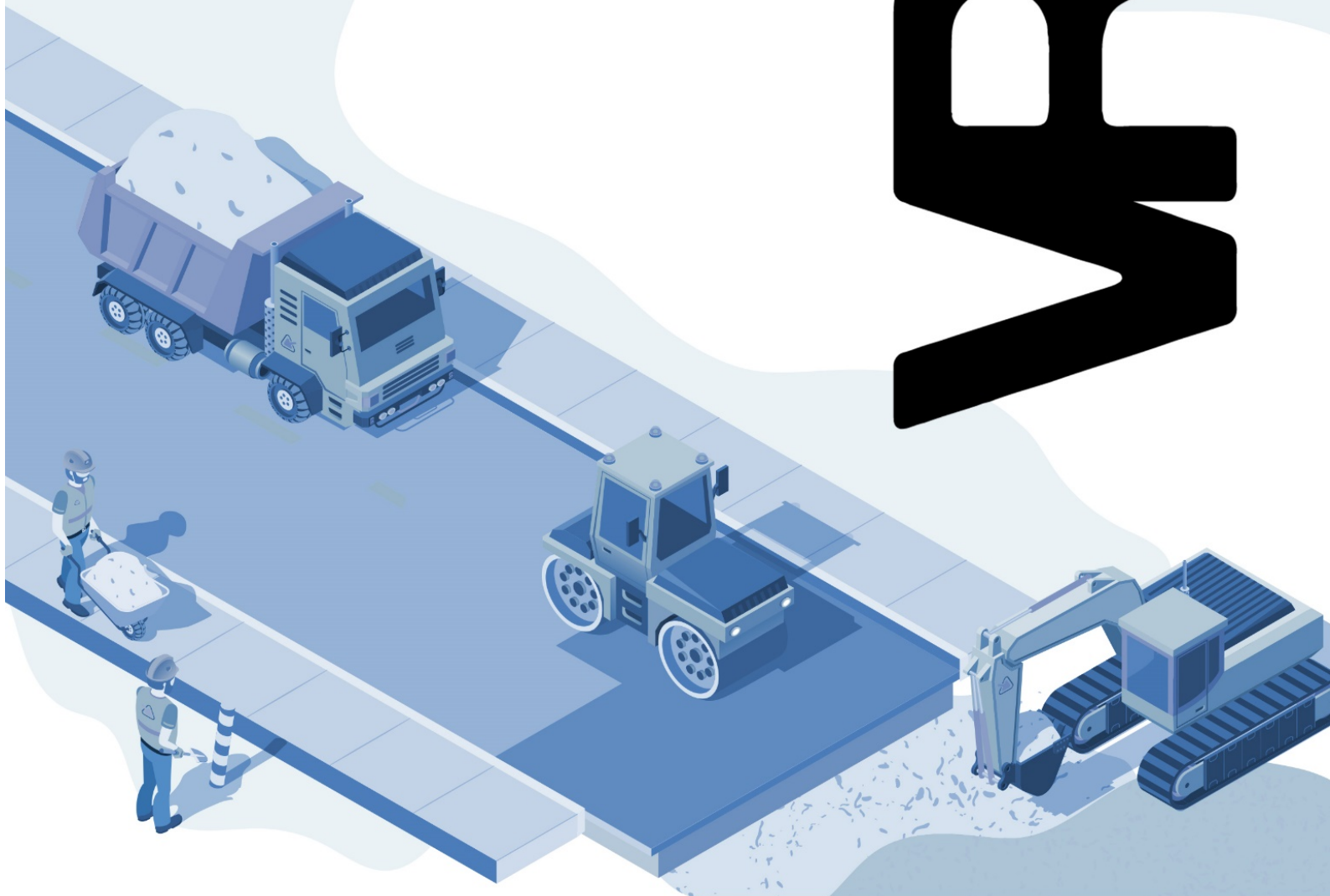


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Virtual Reality applied to road training in European construction

104. Experimentation_Validation.

A2 - A3. Virtual Reality Validation





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VRoad

The report that compiles all the opinions and experiences with Virtual Reality, developed over the two years of the project, has ended with the application of a survey to operators (in this section have been included both COEX operators and students, students of professional training); another survey passed to professionals and experts both in occupational risk prevention and training with new tools such as gambling (serious games) or Augmented Reality...; in this last case they were also invited to participate in a Focus Group that completes this task of validating the virtual reality experience with qualitative techniques.

The more technical profiles, in most cases professionals who have accompanied us throughout the project under the name of TaG (Technical Advisory Group), were also invited to test the virtual experience and then collect their impressions through a survey and specified or extended through a Focus Group or discussion group.

The pedagogical validation was done by means of an EXANTE questionnaire done before testing the virtual experience and another EXPOST questionnaire done after it. Both include identical questions posed before and after their participation in this pilot test.

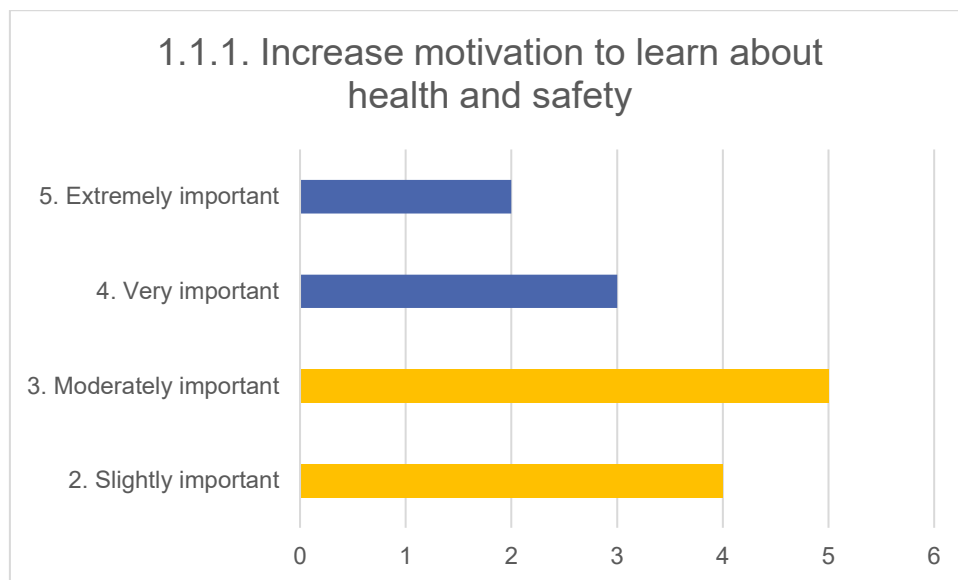
This report also includes that technical and technological validation for which we have had the second group of technical profiles proposed at the beginning of this report, a group to which we have passed a second type of questionnaire more focused on evaluating in terms of technological development, utilities, application to training, software characteristics...

Due to the importance of validation and detection of errors or deviations from the initial objectives, this consultation work has been maintained despite the difficulties and limitations arising from COVID 19 at the time when the validation was to take place. In two of the participating countries, it has not been possible, as a matter of force majeure, to fully develop tests and consult with operators, students and experts.

1. COURSE ASSESSMENT (PEDAGOGICAL VALIDATION). EX-ANTE

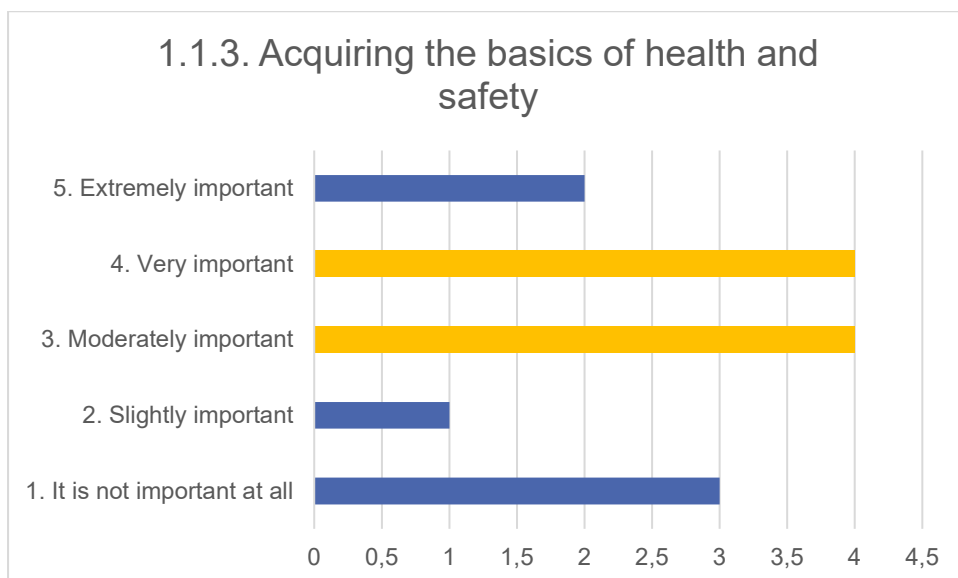
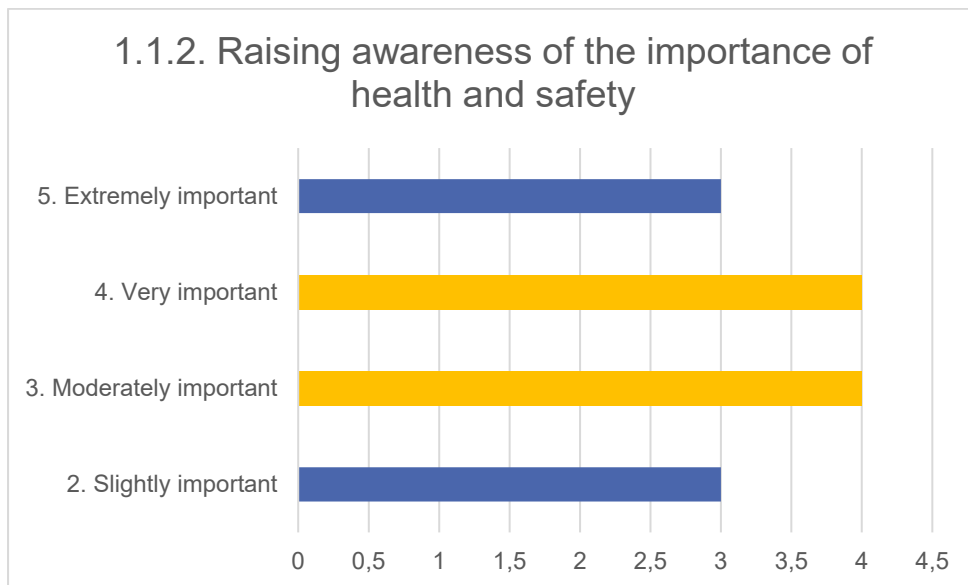
In this section is where the survey has been applied to road maintenance and operation operators

1.1. EXANTE. QUESTION 1. Is this learning important for...

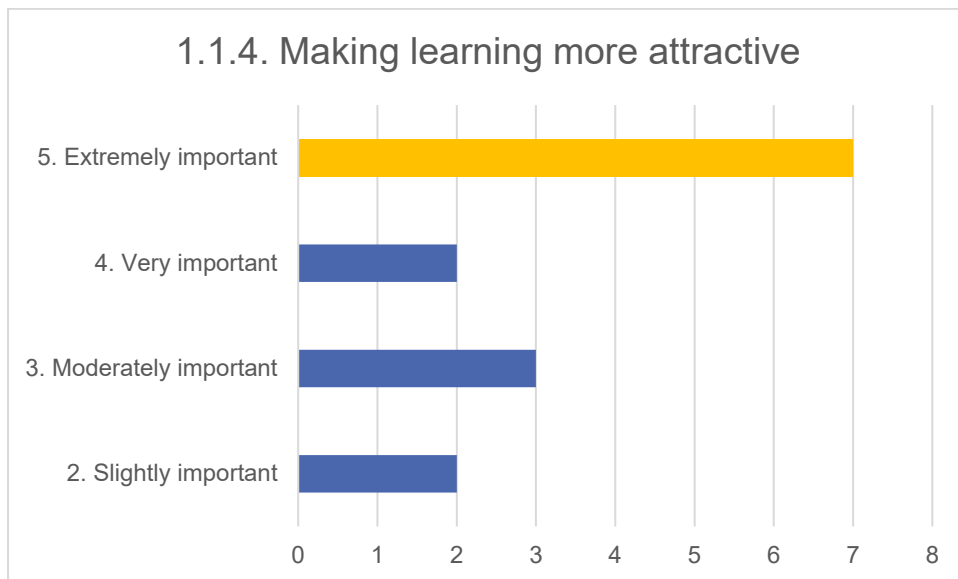


In view of this question, at least before trying out the virtual experience, the importance given to VR as a motivational element is not very high, bringing together the response options closest to the center, i.e. it is not considered very motivating or extremely important for learning in occupational safety and health. As mentioned above, it is necessary to take into account that the opinions expressed in the EXANTE questionnaire are not directly related to the VR experience, as this has not yet taken place.

It is reasonable that initially the perception of a greater motivation in preventive matters is not seen in a simple and direct way, especially because this type of training is identified as a training that is given in the work environment and for the performance of a work activity, therefore, it should not have the condition of playfulness or at least the workers do not expect that it is raised taking into account this circumstance.

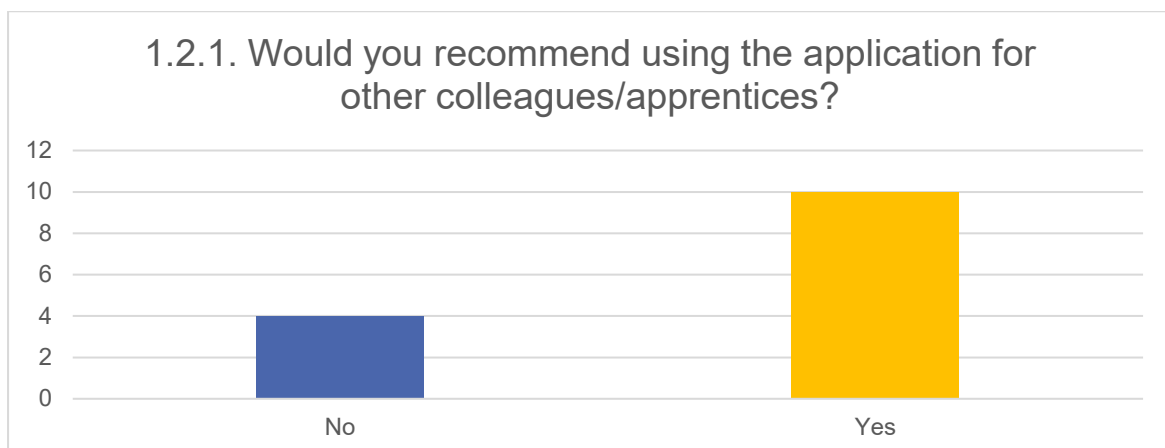


The responses both in terms of **raising awareness of the importance** of safety and health in road maintenance and operation work and those other responses related to the **acquisition of the fundamentals of safety and health**, most of the responses are between moderately important and extremely important. That is, they consider of special importance the learning accompanied by awareness (responsibility) of the importance of safety and health at work; likewise the acquisition of the fundamentals (knowledge) of safety and health for the tasks inherent to road maintenance and operation is considered to be of great importance.



The assessment of this item, directly related to the ability to **attract** learning, makes respondents recognize the importance of virtual reality for this purpose, ie, the fact of relating, from the beginning, virtual reality with leisure or video games leads respondents to interpret the experience as attractive, even if it is oriented learning. The conclusion drawn from this graph is not only the perception of the experience as attractive but also highlights the importance given by participants to the achievement of attractive learning.

1.2. Would you recommend the use of the application to other colleagues or students?



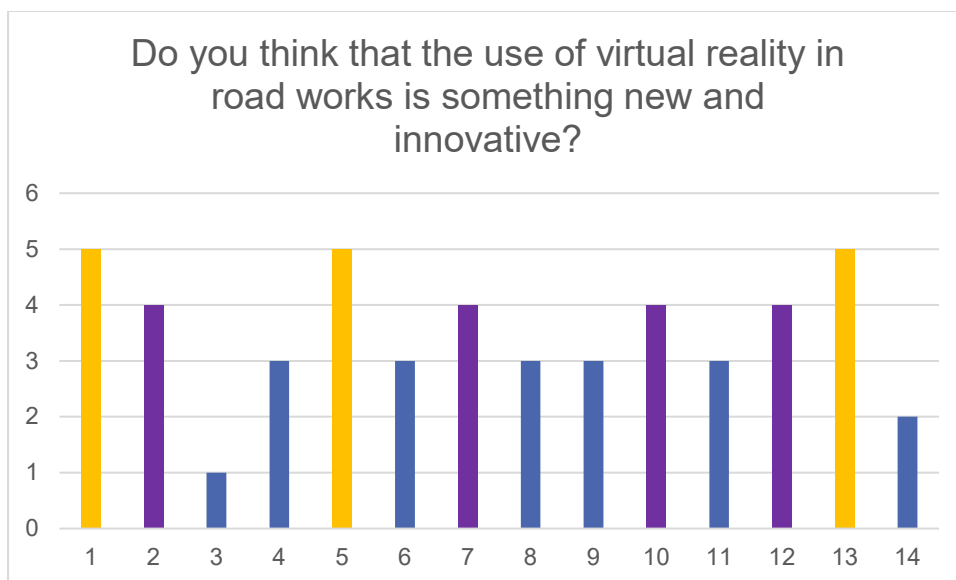
Why?

"It's a funny way to learn this way but it would improve many things"

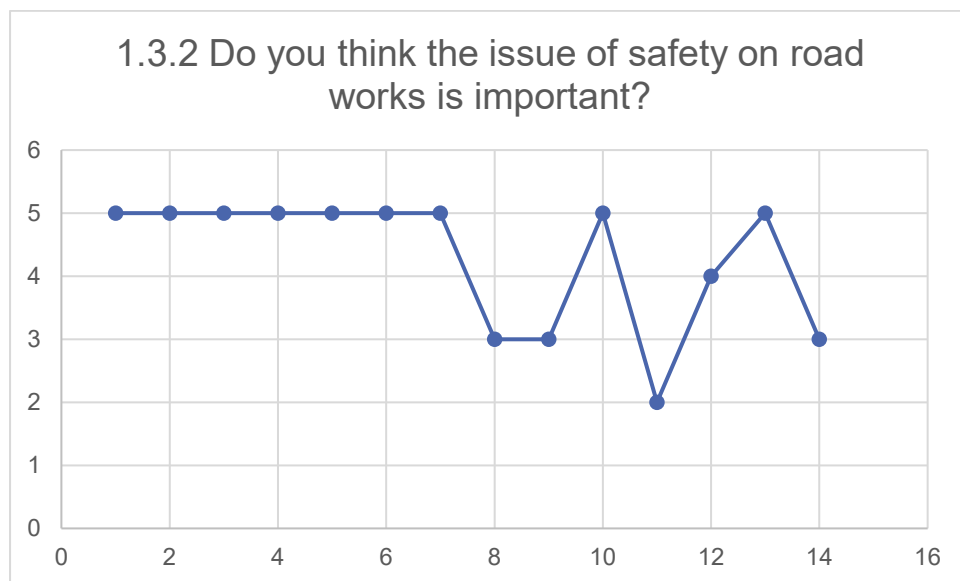
"In this section (ex ante) the VRoad experience has not yet been tested"

As to whether those who have participated in the pilot experience, already at the beginning, that is, even before trying the VRoad experience, had a clear idea that it is an innovative form of learning that facilitates the acquisition of skills by approaching the real work activity and the associated occupational risks. This is reflected in the graph, since from the beginning most participants would recommend this experience to other colleagues.

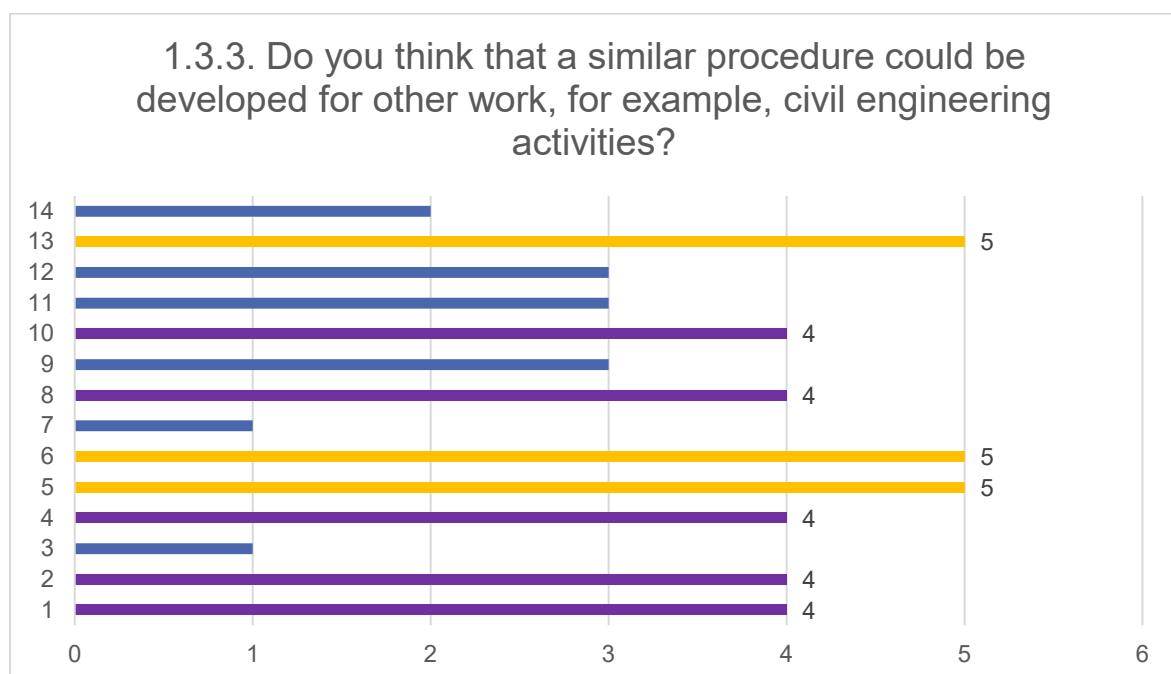
1.3. Mark your level of agreement (5 is the highest strongly agree) or disagreement (1 is the lowest strongly disagree)



The trend of the answers in this sense is clearly affirmative, with most of the answers on the "agree" side. That is, before the test with virtual reality, the participants of this test have the impression that, at least in road works, the use of this technology as a complement to the training in conservation and operation of roads is innovative. Virtual reality has been initially developed in the field of leisure and games, but almost in parallel or at least consecutively has been considered a very useful tool for use in the field of training and education.

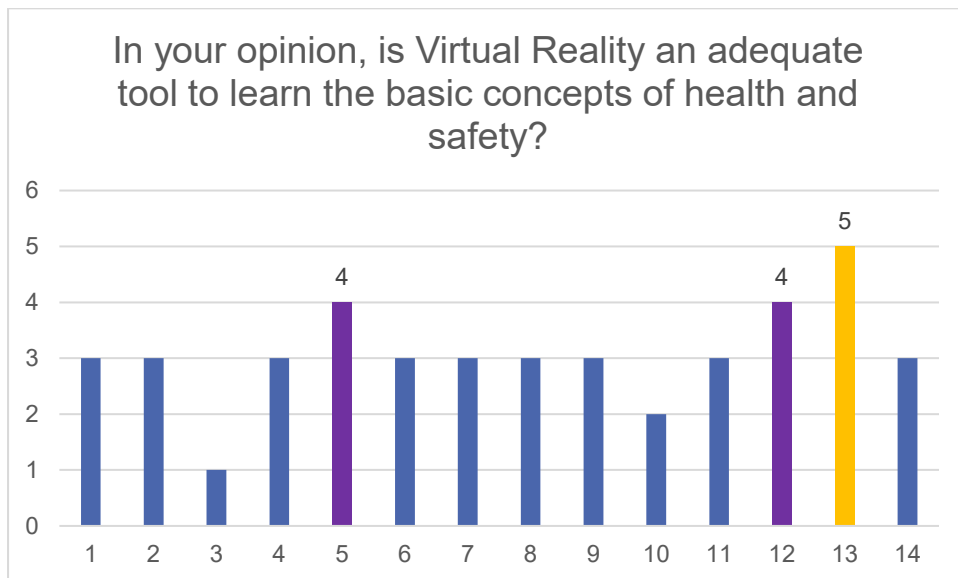


There is no doubt about the importance recognized, learned and assumed by the participants in the pilot test. That is, both students and operators or professionals more directly related to the field work and the risks associated with it (among which the risk of being run over in the most common operations such as cutting the lane should be highlighted) have a clear idea of health and safety at work and its importance for day-to-day work.



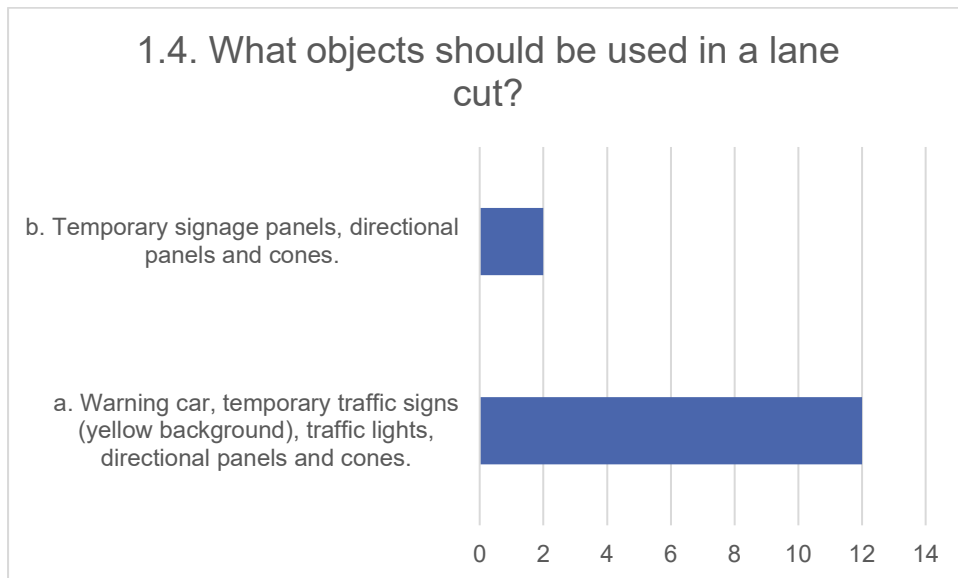
It is evident, again in this previous survey, that the participants in the pilot test recognize the benefits for on-the-job training and professional training of these playful training tools or in their more current

nomenclature serious games in which a technology such as Virtual Reality is applied. And they do it not only for their specific activity but for many others in civil works (and even recognize the application of these techniques in many other areas).

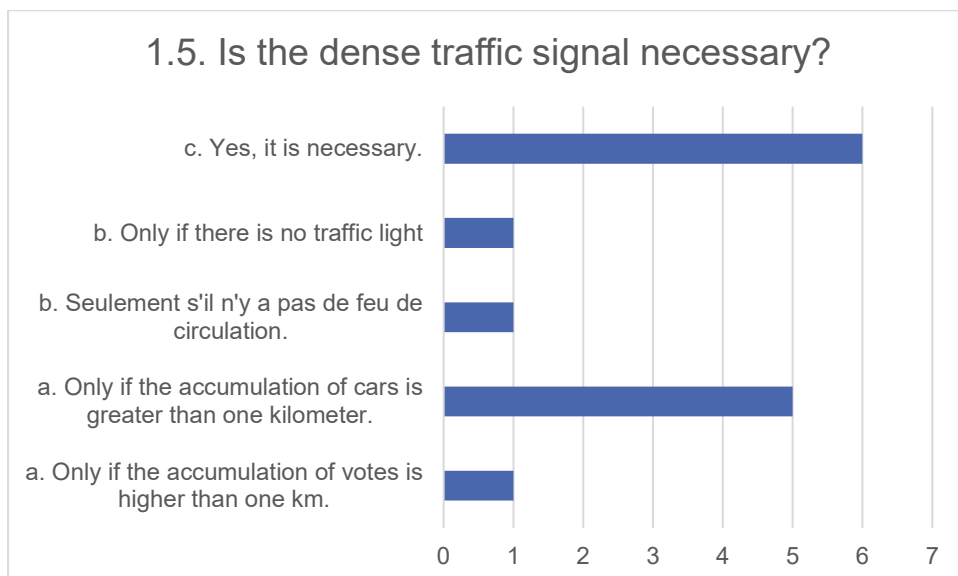


With a trend in the responses similar to that shown in the previous graph, it seems clear that the vast majority of participants see Virtual Reality as a very useful tool for learning.

1.4. What objects should be used in a lane cut?



1.5. Is the dense traffic signal necessary?



1.6. Are the cones sufficient to delimit the work area?

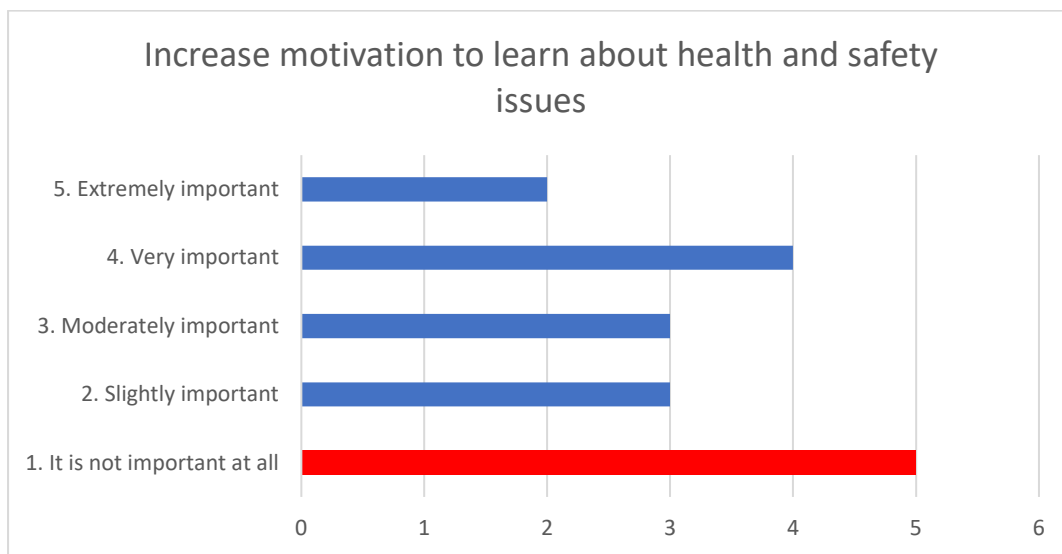
Are the cones sufficient to delimit the work area?
a. Yes, if the work area is outside the platform.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
b. No, signage panels are also required.
c. Only if there is no other signaling element.
a. Yes, if the work area is outside the platform.
b. No, signage panels are also required.
b. No, signage panels are also required.

Questions 1.4, 1.5, and 1.6 are intended to check the level of knowledge acquired with the virtual experience in relation to the activities developed by VRoad.

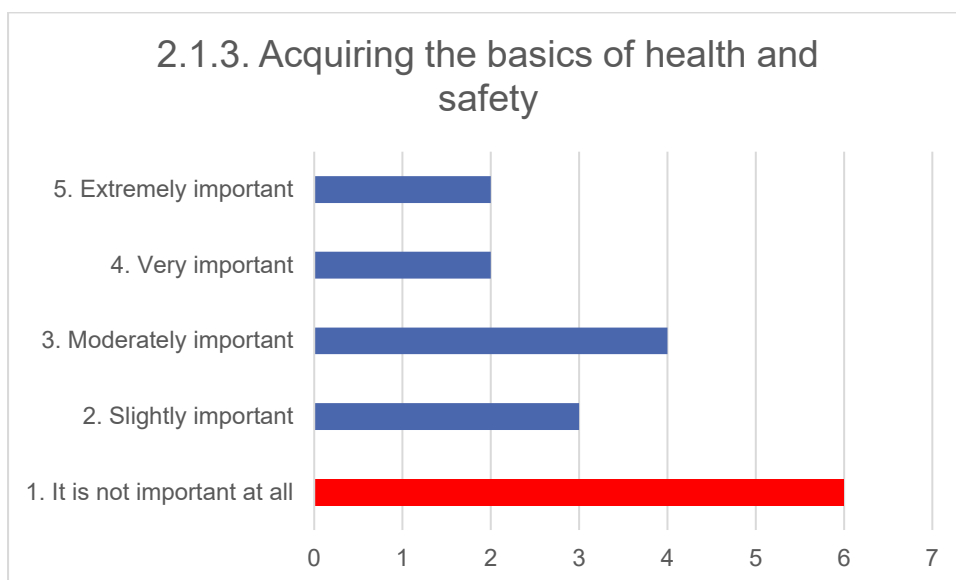
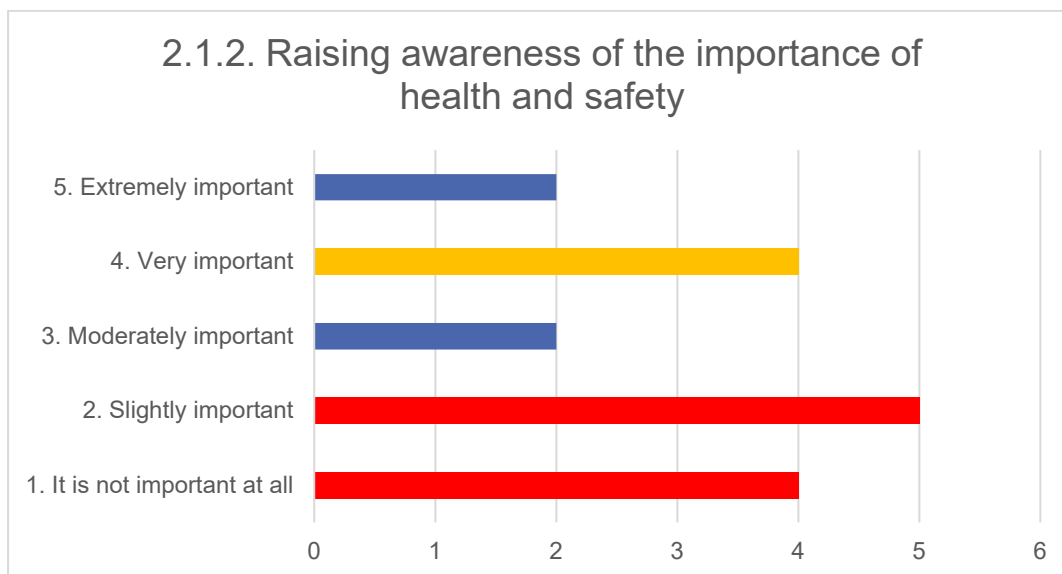
In other words, these answers have been taken into account in the second section of this report, where the answers are given once the pilot test has been carried out.

2. COURSE ASSESMENT (PEDAGOGICAL VALIDATION). EX-POST

2.1. . EXHIBIT. QUESTION 1. This learning is important for .

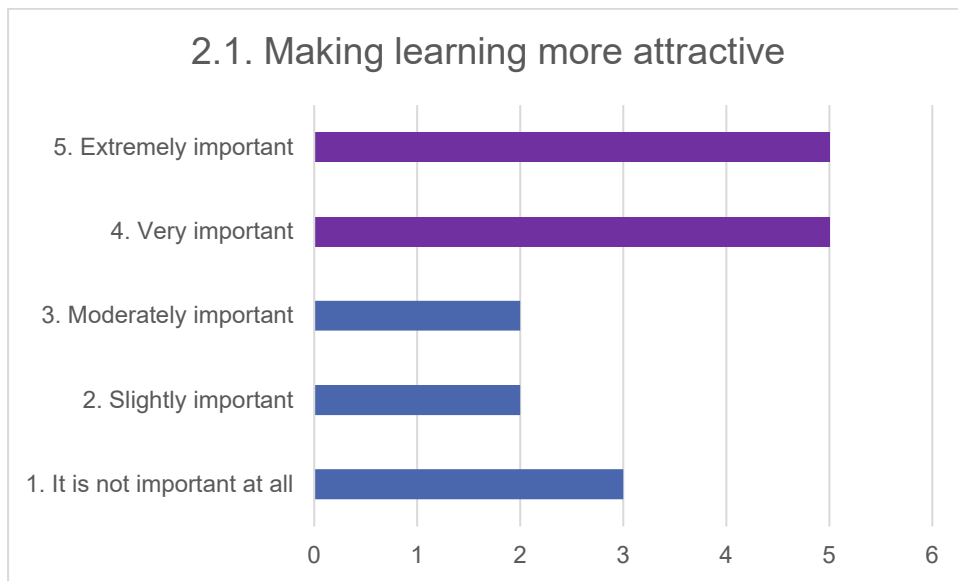


Interestingly, there is a polarization of responses after the test performed with the virtual experience (EXPOST questionnaire), that is, before the test none of the respondents chose option 1 (Not important at all) while this option was chosen by several participants

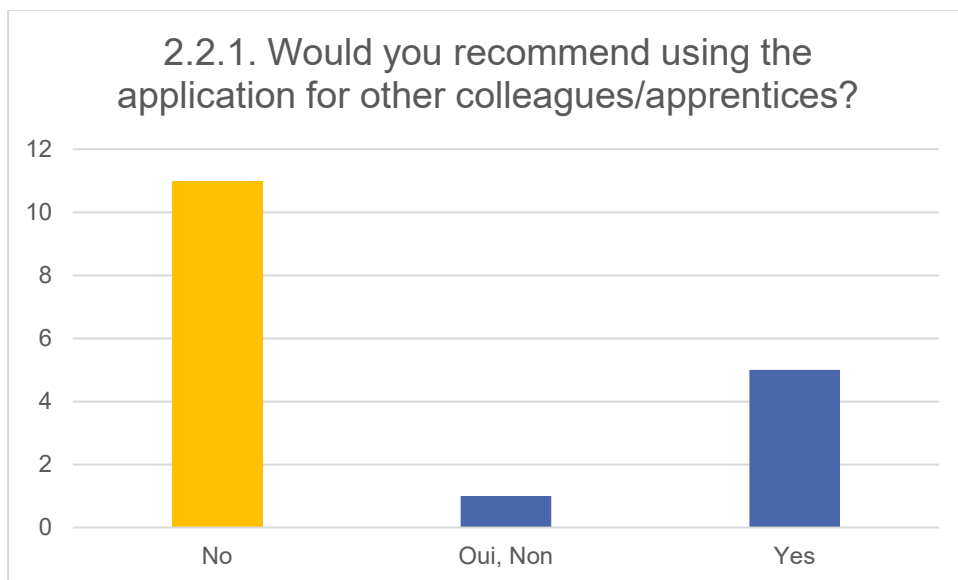


Something that has drawn special attention in the process of analyzing the results has been that in the consultation prior to the test with virtual reality both awareness and acquisition of the fundamentals of safety and health were not valued very positively, but in this section (EXPOST) these two points are valued less than at the beginning. In conclusion, the users who have tried the virtual experience have positively valued that learning is more attractive, although they do not consider that the virtual experience is capable by itself either of raising awareness or of transferring knowledge.

These two qualities are usually very directly related to the figure of the trainer and are thus recognized by the respondents, leaving them in the hands of the training professional. Thus, once the virtual experience has been tested, it is considered by the respondents (mainly operators and students of professional training) as a useful tool, but not as the only tool on which to base learning.



2.2. Would you recommend the use of the application to other colleagues or students?



Why?

It's a different way to learn.

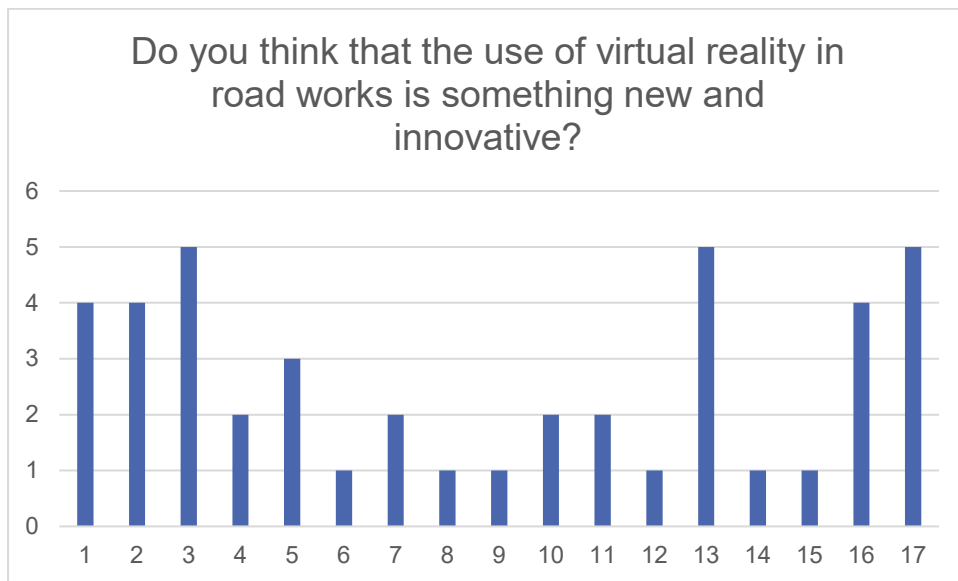
<i>There are many things to polish and if you could for people who have never been on the road it seems like a good idea to me before getting in front of traffic</i>
<i>some non-compliance must be addressed</i>
<i>of poor quality and not real</i>
<i>unrealistic</i>
<i>is not real at all</i>
<i>too complicated to use and inconvenient</i>
<i>gives a somewhat real image of the tp</i>
<i>unrealistic</i>
<i>Poor in terms of graphics. The gameplay of the jerky and the robotics. Game without any interest. Reality and virtual reality are far from being close. The game is quite annoying and stressful.</i>

Compared to the answers given to this question in the EXANTE questionnaire, in this case, the answers in the EXPOST are more negative, that is, more than half of the participants in the survey considered that they would not recommend the use of this application to other colleagues. The explanation for this difference in the responses given before and after carrying out the virtual experience could be based on the expectations generated by it. The expectation in this case depends on the previous experience, for example, in the case of students (younger and generally more related to video games and more up to date in terms of the qualities of these), who expect from virtual reality, an experience not only immersive but very close to the reality of this type of work; on the other hand we would have the experience of play by operators who already practice in the conservation and operation of roads and most are not in contact with the latest trends in video games, in which case the "immersion" offered by virtual reality and a more schematic view of the "game" has seemed useful and in his case the answer if it is aimed at recommending this experience.

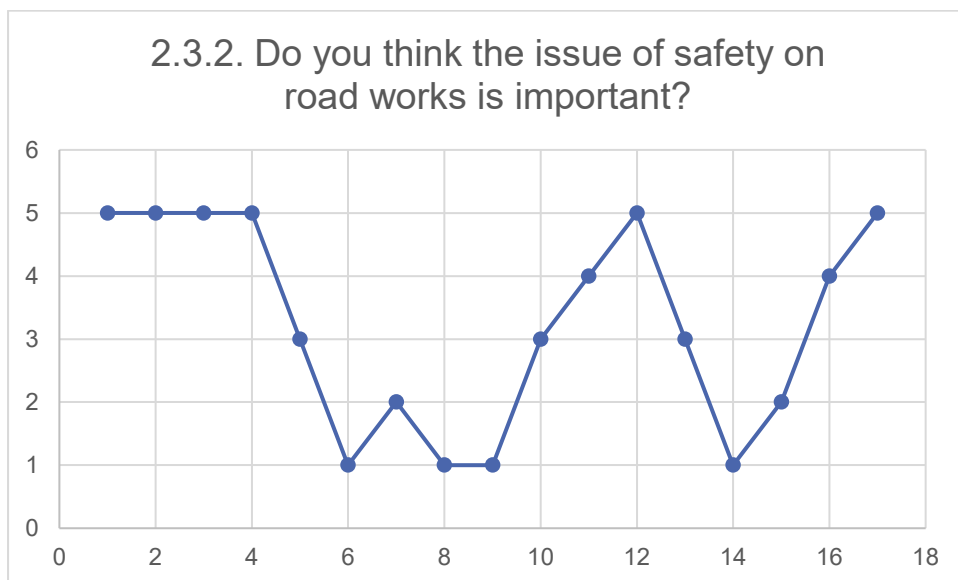
The first three statements in the open response are more related to the last profile described, while the remaining ones are very close to the profile of an experienced student in this type of games and much more demanding.

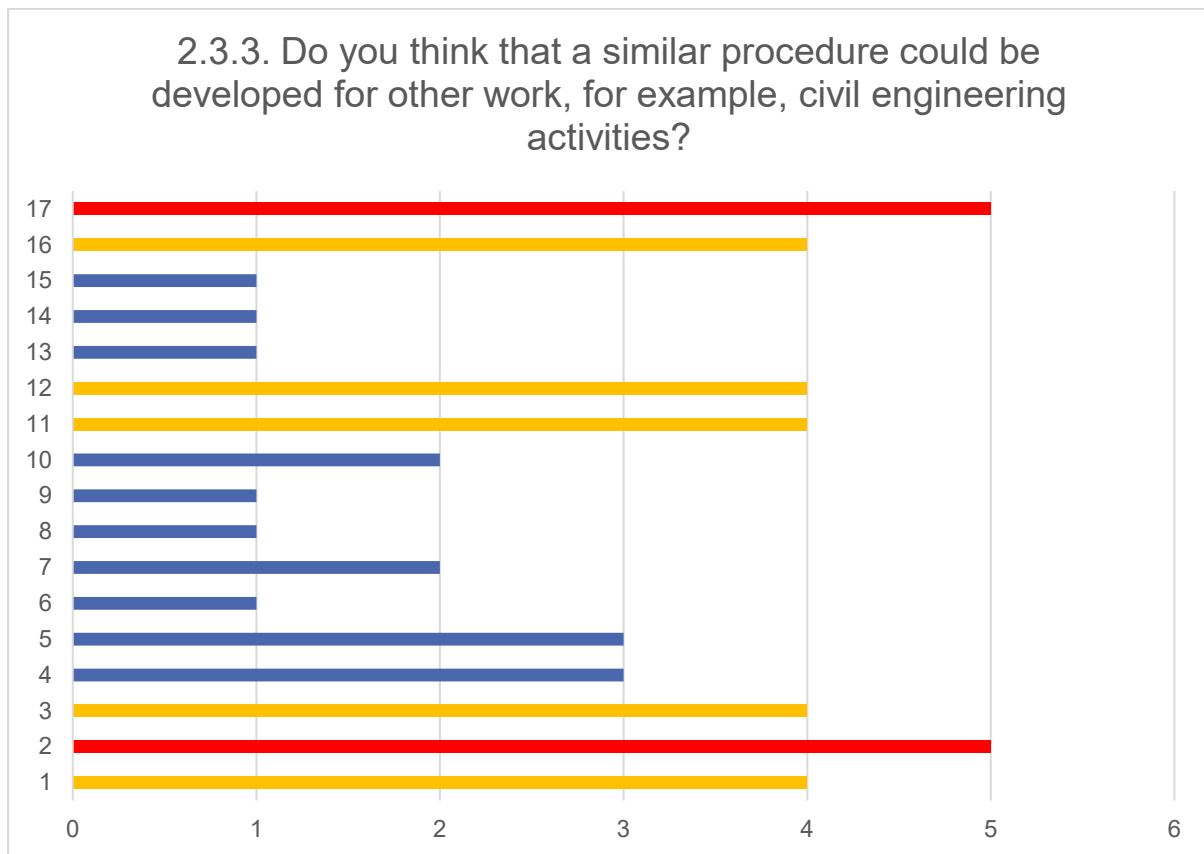
It is especially important to take into account this different perception that we have not been able to support on a sample not only larger but more heterogeneous due to the restrictions arising from the second wave of COVID 19 that has coincided with the development of this section of testing and validation of the virtual experience.

2.3. Mark your level of agreement (5 is the highest strongly agree) or disagreement (1 is the lowest strongly disagree)

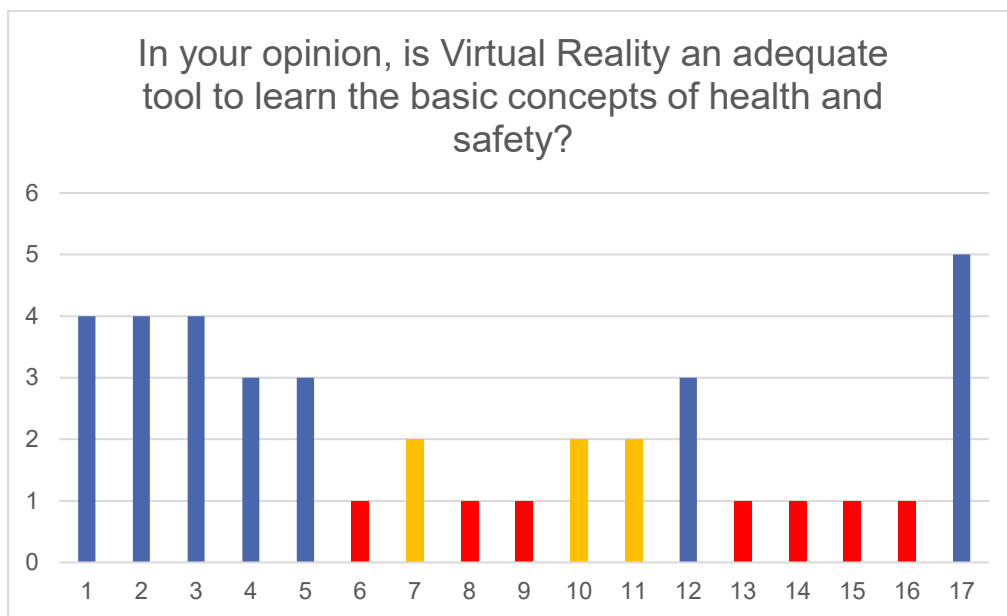


The answers collected in relation to this question differ from the answers given in the EXANTE section, considering before the test if it is innovative and not so much after the test. This explanation would be in line with the one given in the previous graph, that is, the fact that the quality and playability have not been as expected has caused at least part of the respondents to modify their answer in this EXPOST section.

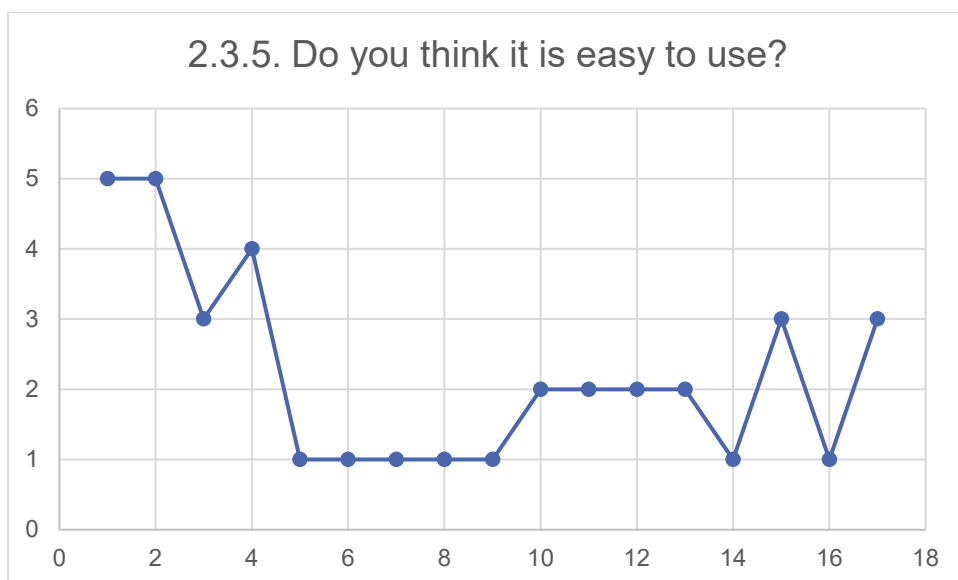




As for the versatility of this tool, that is, the possible use in other sectors of activity and in other training actions, it is maintained before and after trying the virtual VRoad experience. It has been mostly considered as a procedure that can be exported to other sectors of activity. The civil engineering activity was marked, due to its proximity to the professional profiles surveyed, but it has been mostly considered as a tool that **complements training and** this has been evidenced by the trend in the answers provided.



The assessment, once the test with Virtual Reality has been carried out, is somewhat more negative than before it was tested, i.e. the original idea is that virtual reality is a good tool for learning in general and for health and safety in particular. In this sense, some of the limitations of Virtual Reality with respect to the "reality" of work, conservation and operation of roads has generated a greater number of negative responses (worse value) with respect to learning options in terms of safety and health at work.



The ease of use of virtual reality has been rated below average. This is possibly due to the fact that it has been an initial experience in the case of the partners participating in it, with the exception of GA

Consultants, as they are the "technology partner" and therefore more familiar with this type of tool, which would be related to the use of hardware and software, as well as the availability of equipment suitable for Virtual Reality, equipment that requires, for example, a "powerful" graphics card.

2.4. What objects should be used in a lane cut?

2.4. What objects should be used in a lane cut? (select only one valid answer)

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Traffic cart, provisional traffic signs (yellow background), traffic lights, directional paneáis and cones, b. Provisional traffic signs, directional paneáis and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Traffic cart, temporary traffic signs (yellow background), traffic lights, directional signs and cones, b. Temporary traffic signs, directional signs and cones, c. Traffic lights only

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

a. Warning car, temporary traffic signs (yellow background), traffic lights, directional panels and cones.

With a greater number of answers and hits, a deeper understanding of the task is evident once the virtual VRoad experience is proven.

The same applies to table 2.5. in which the correct answers have also been increased in this second section of the survey (EXPOST).

2.5. Is the dense traffic signal necessary?

2.5. Is the dense traffic signal necessary?
a. Only if the accumulation of cars is greater than one kilometer.
a. Only if the accumulation of cars is greater than one kilometer.
c. Yes, it is necessary.
a. Only if the accumulation of cars is greater than one kilometer.
c. Yes, it is necessary.
a. Only if the accumulation of cars is greater than one kilometer.
a. Only if the accumulation of cars is more than 1 km., b. Only if there is no traffic light, c. Yes, it is necessary.
a. Only if the accumulation of cars is more than 1 km., b. Only if there is no traffic light, c. Yes, it is necessary.
a. Only if the accumulation of cars is greater than one kilometer.
a. Only if the accumulation of cars is greater than one kilometer.
c. Yes, it is necessary.
c. Yes, it is necessary.
c. Yes, it is necessary.
c. Yes, it is necessary.
c. Yes, it is necessary.
c. Yes, it is necessary.
b. Only if there is no traffic light

2.6. Are the cones sufficient to delimit the work area?

Are the cones sufficient to delimit the work area?

b. No, signage panels are also required.

b. No, signage panels are also required.

a. Yes, if the work area is outside the platform.

b. No, signage panels are also required.

a. Yes, if the work area is outside the platform.

b. No, signage panels are also required.

a. Yes, if the work area is outside the platform, b. No, traffic signs are required too, c. Only if there are no other signage elements.

a. Yes, if the work area is outside the platform, b. No, traffic signs are required too, c. Only if there are no other signage elements.

a. Yes, if the work area is outside the platform.

a. Yes, if the work area is outside the platform.

a. Yes, if the work area is outside the platform.

b. No, signage panels are also required.

a. Yes, if the work area is outside the platform.

a. Yes, if the work area is outside the platform.

c. Only if there is no other signaling element.

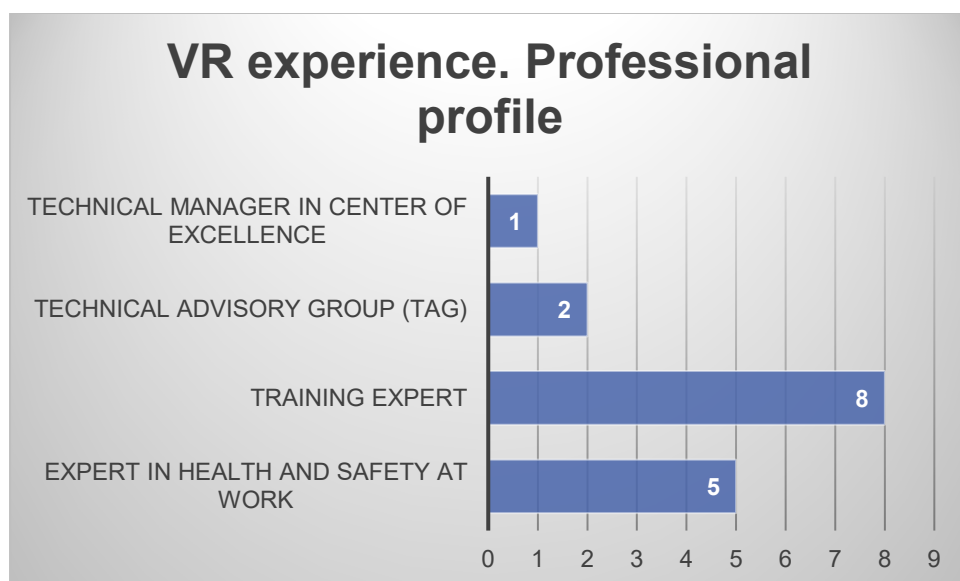
b. No, signage panels are also required.

b. No, signage panels are also required.

In the EXANTE section it has already been mentioned that these questions are formulated as a control and verification of the knowledge acquired by those users who have tried VRoad.

3. TECHNICAL AND TECHNOLOGICAL VALIDATION

3.1. Professional Profile

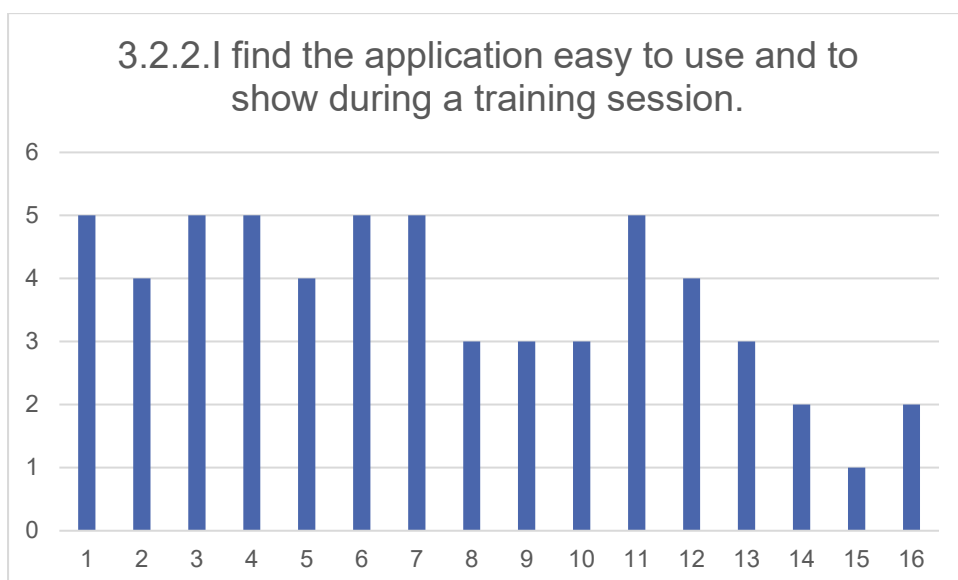
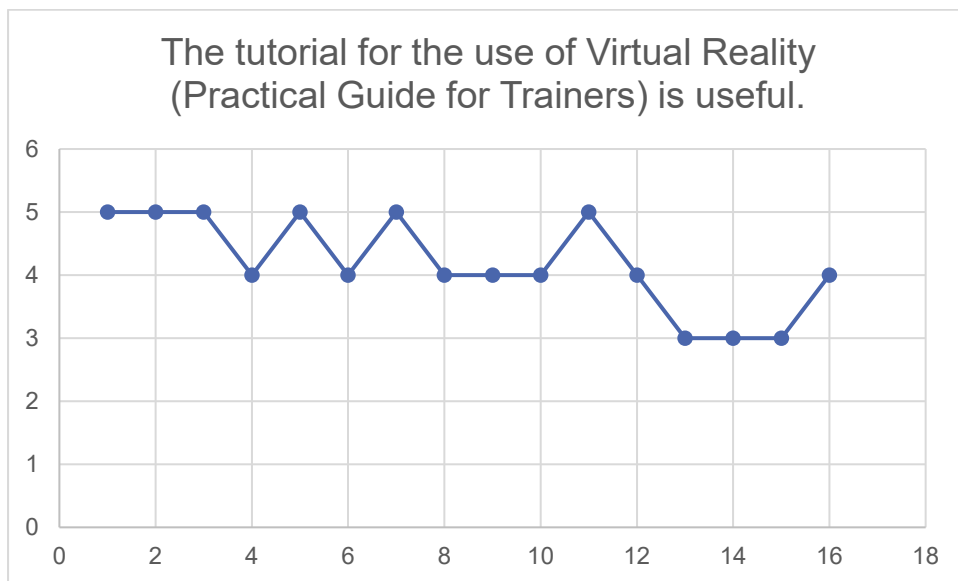


In this third section of the report and second survey, we have sought a professional profile that would be able to evaluate the virtual experience, as already mentioned in the introduction to this report. In the previous graph, two preponderant profiles can be seen:

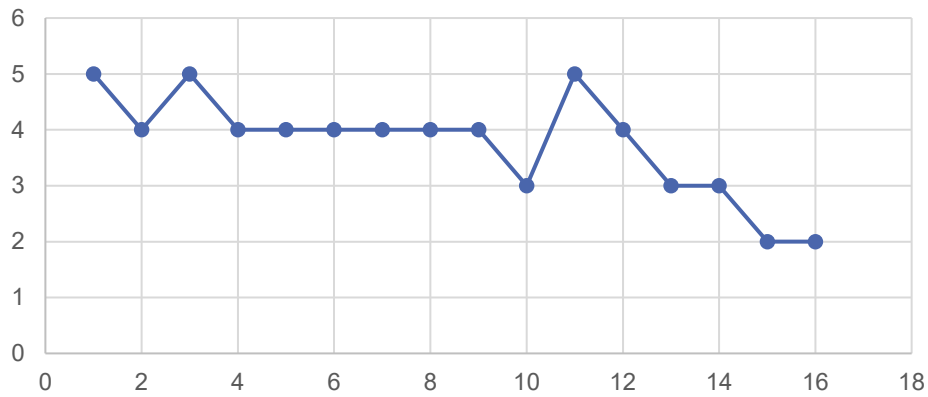
- Experts in training:
- Experts in health and safety at work.

Within the professional profiles, these two have been the most sought after for their possible contributions, for their technical capacity in relation to the object of study, as well as for their critical capacity due to their greater knowledge of the subject and the application of didactic resources.

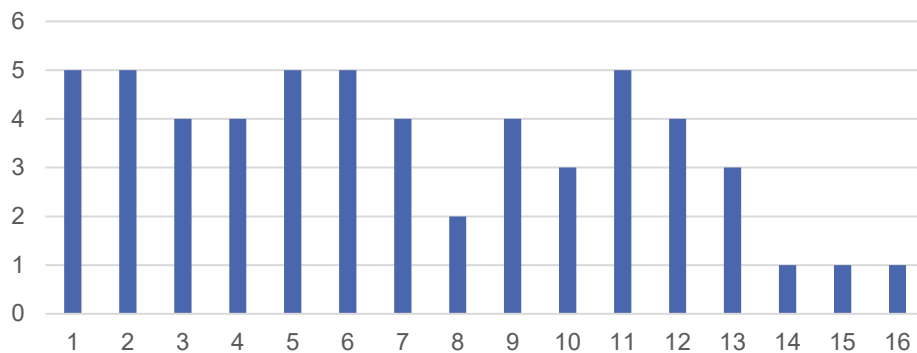
3.2. Please evaluate if the content of this course is innovative and useful to improve or understand the risks and measures related to road works. Mark your level of agreement (5 is the highest strongly agree) or disagreement (1 is the lowest strongly disagree)



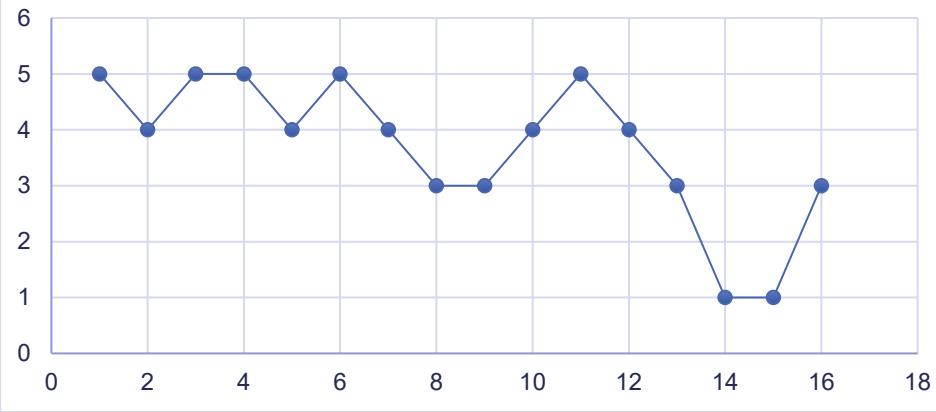
The situation in the activity resembles the real world or real situations of safety and health at work



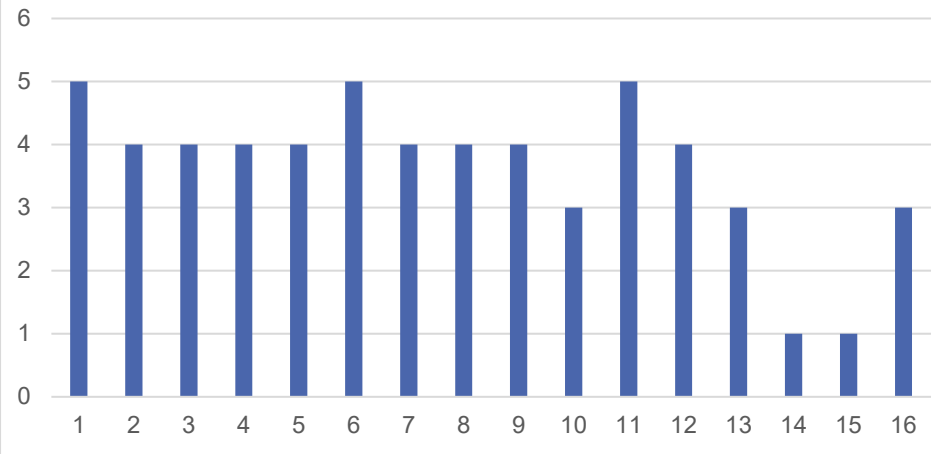
3.2.4. The experience of Virtual Reality is broad enough to cover the full scope of health and safety risks in all three proposed activities.



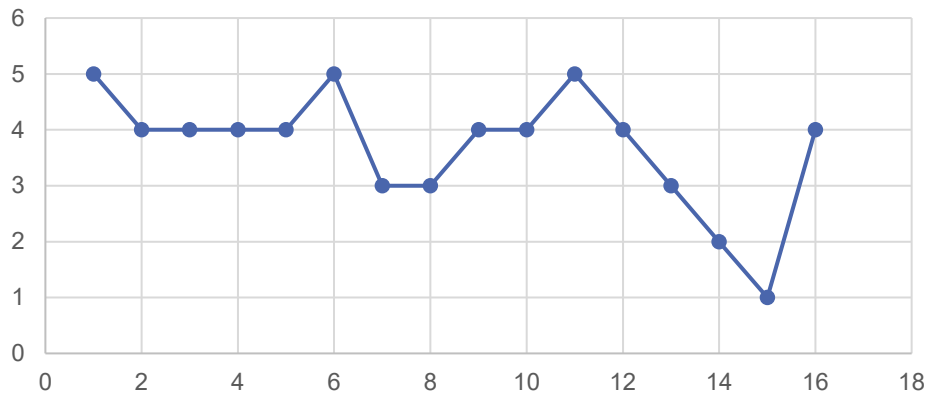
3.2.5. I would use this Virtual Reality experience to train health and safety in road work.



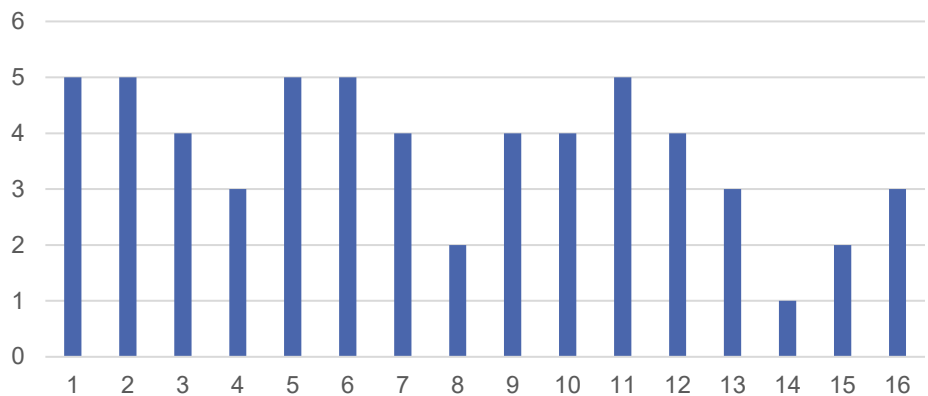
3.2.6. I found the various functions of this Virtual Reality well integrated.



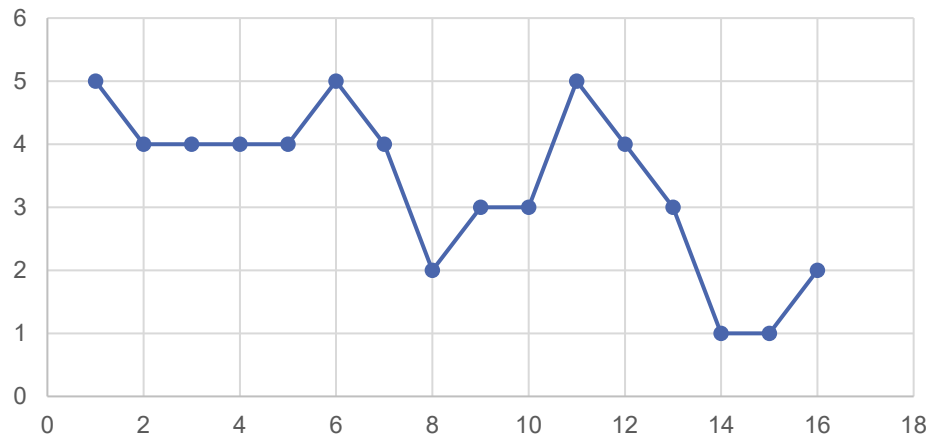
3.2.7. The questions are relevant to most of the issues/activities undertaken within the road works.



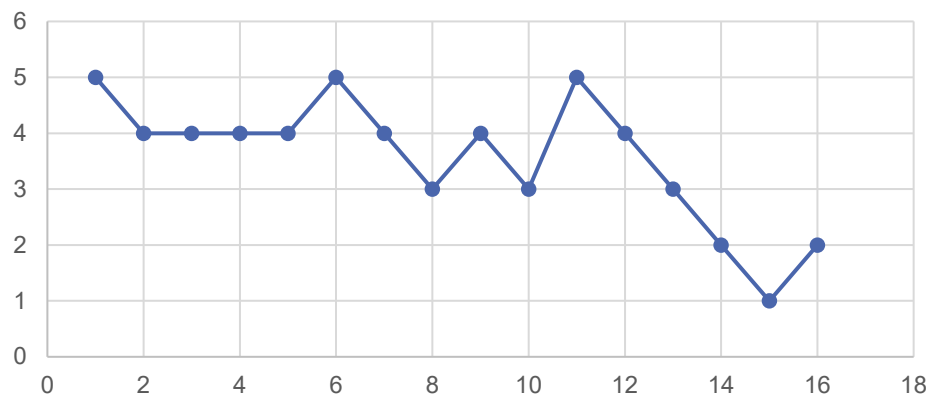
3.2.8. The level of difficulty is correct, i.e. neither too difficult nor too easy to impact on the student's health and safety knowledge.

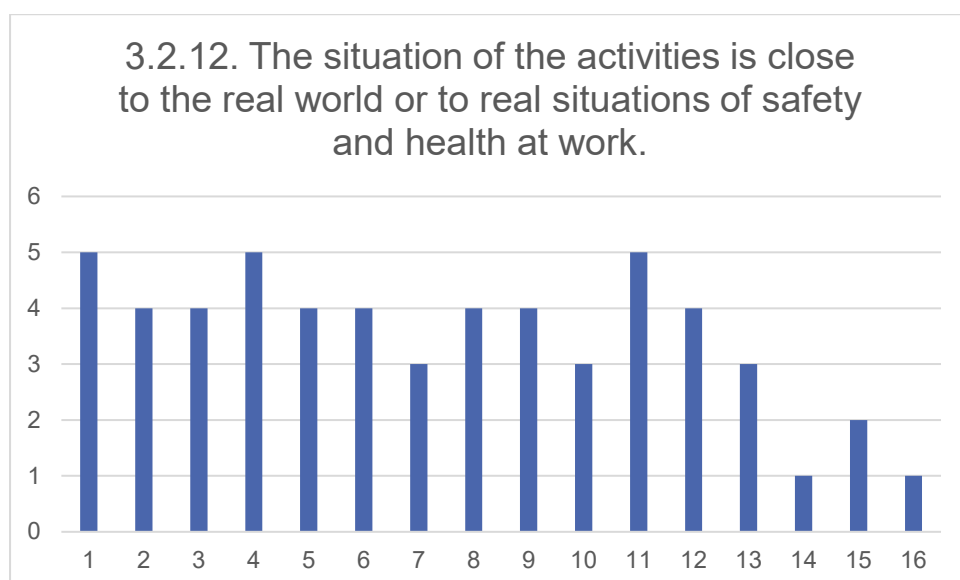
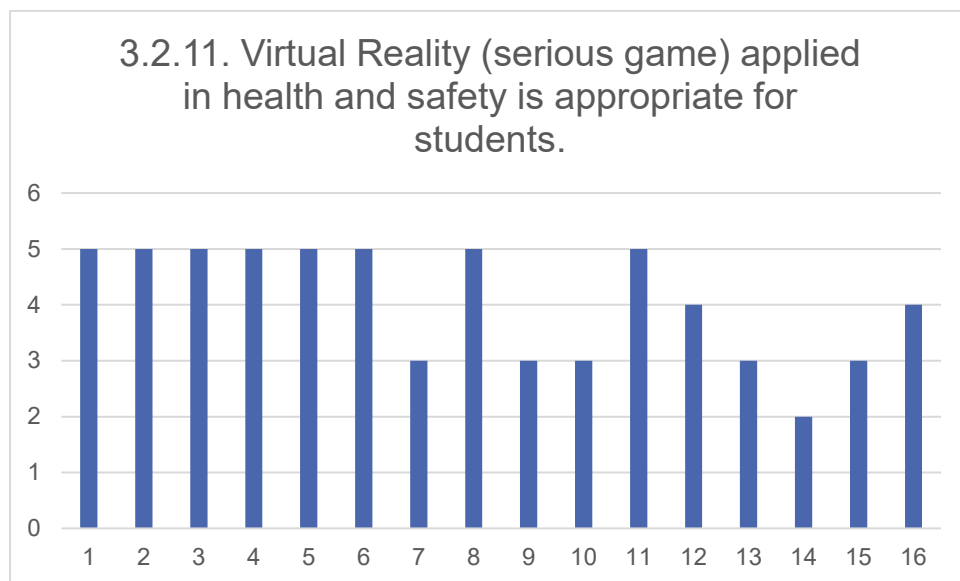


3.2.9. There is sufficient content to cover the basic principles of health and safety.



3.2.10. Virtual Reality questions are relevant to most of the themes/activities undertaken within the works.





The series of items in the questionnaire aimed at assessment from the tutorial to start the virtual experience, through its applicability in training, to health and safety at work in the activities of conservation and operation of roads, have been very well evaluated.

For example, in relation to the ease of use the answers are positive, when asked about the guide, the user's manual. All answers range from 3 to 5 (5 being the highest possible rating).

For its application to a training action, there are also very positive responses; for the application of Virtual Reality to the three tasks designed in this virtual experience most of the responses are positive, except in three responses out of 16 total, the assessment has been largely positive; also included is an item to assess the application to health and safety on the three activities developed again with the exception of 4 responses the rest are positive.

When asked about their usefulness in occupational safety and health skills training, positive or neutral responses were received in all but 3 of the 16 responses given

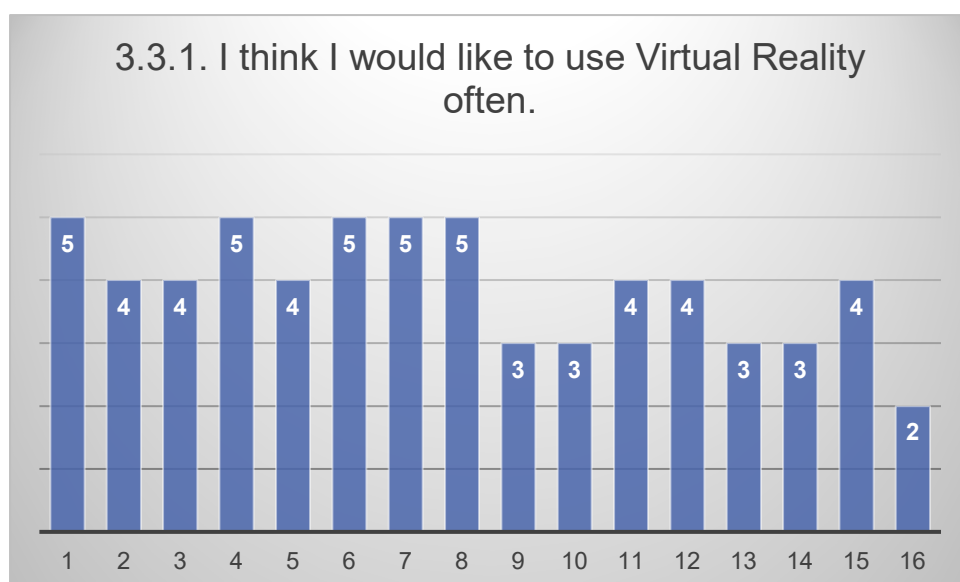
As for the questions included or the game's functionalities, again, the answers were positive.

The level of difficulty proposed has been positively evaluated by the experts, that is, when asked if the level of difficulty is adjusted to the students' abilities, again the answers accumulated on the side of a very positive evaluation of what we can deduce that the level of difficulty proposed is not excessive, but neither excessively low.

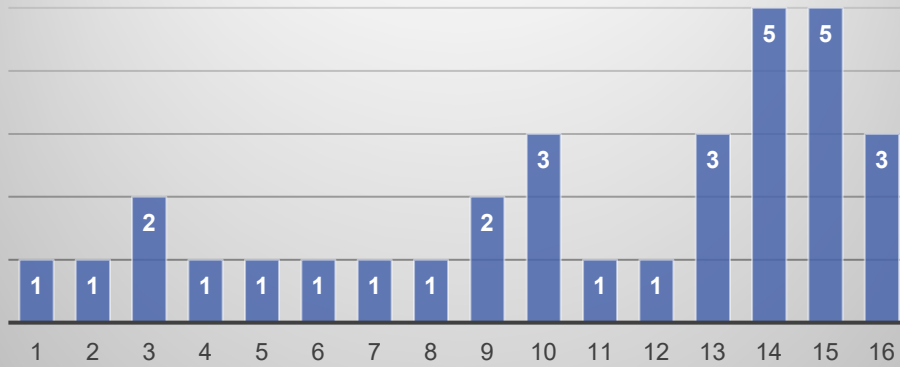
Preventive or health and safety concepts are well supported by this virtual experience. Most of the respondents (except for three) answered yes to this question.

Finally, one of the questions about the proximity between the virtual reality presented and the "real" reality is raised. Again and that if in contrast to this question asked to students and operators of conservation and exploitation of roads, in the case of more technical or professional profiles their responses have been positive or neutral in the worst case, with only three answers below the neutral.

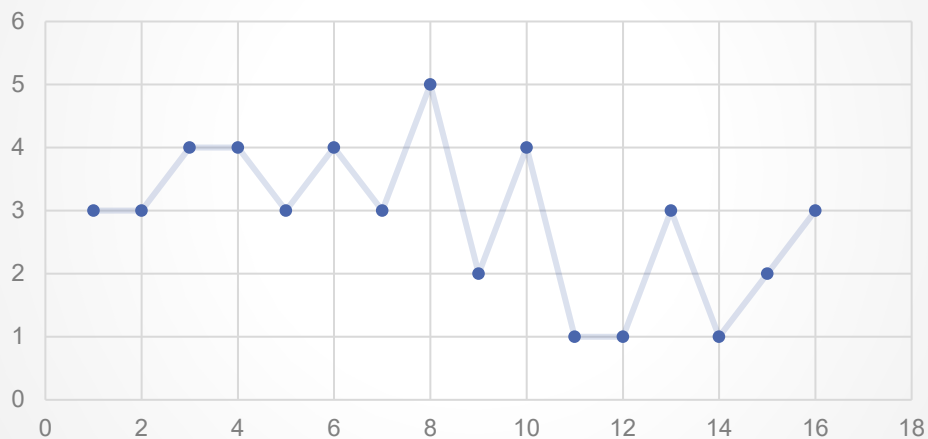
3.3. To evaluate the innovation and usefulness of the learning outcomes derived from the content (lessons and exercises) Mark your level of agreement (5 is the highest, strongly agree) or disagreement (1 is the lowest, strongly disagree)



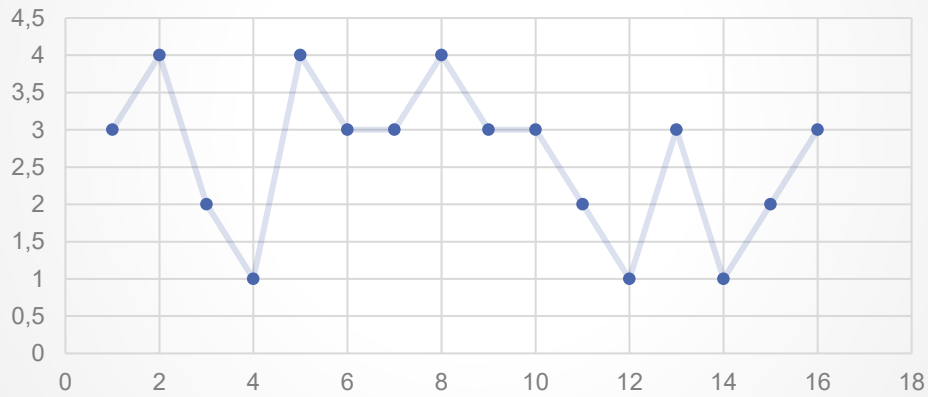
The virtual reality of the VRoad seemed to me an unnecessary complex.



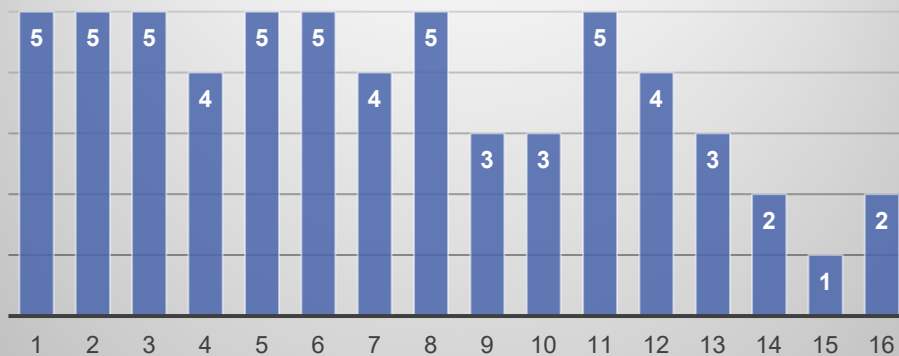
I thought Virtual Reality was easy to use.



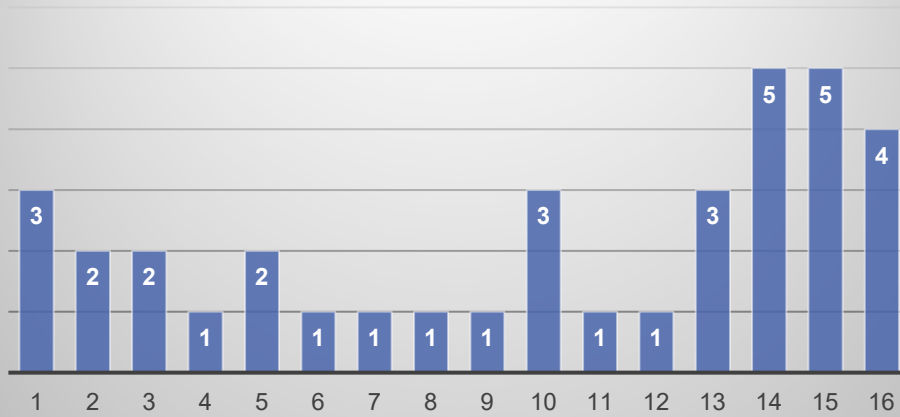
3.3.4. I think I would need the support of a technical person to be able to use this application.



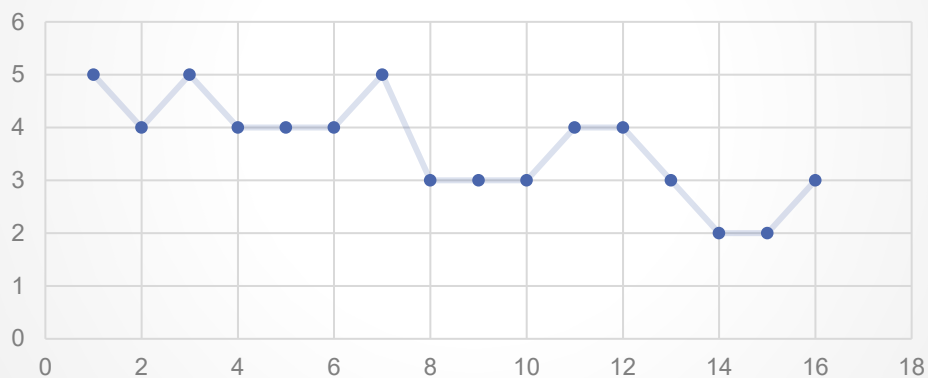
3.3.5. I found that the various functions of this application were well integrated.



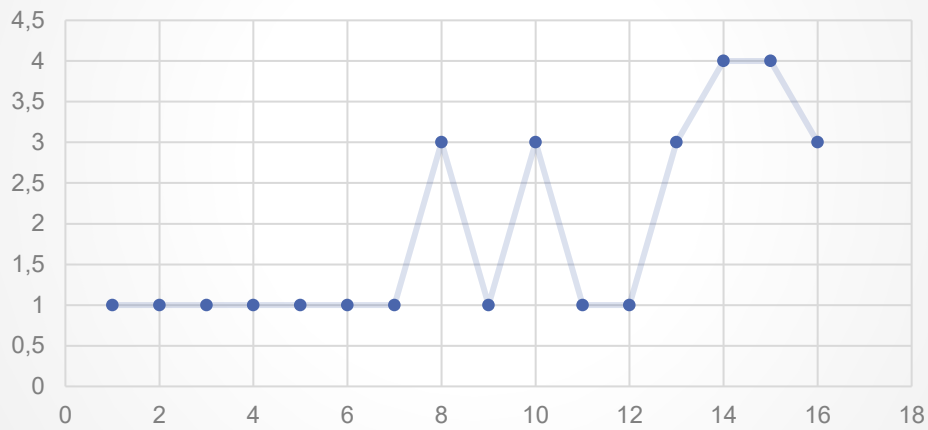
3.3.6. I thought there was too much inconsistency in this application.



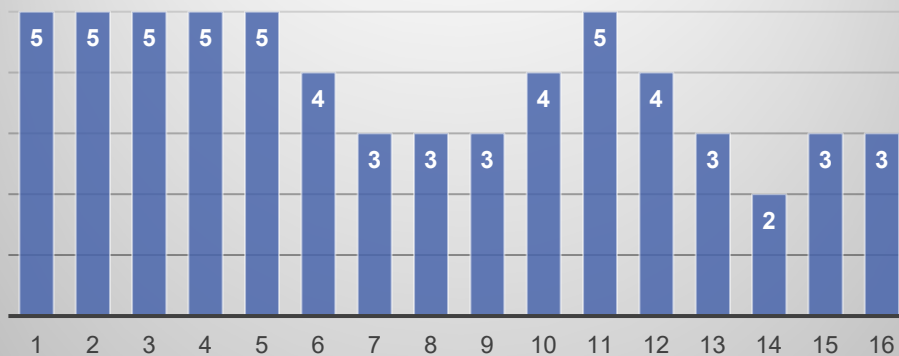
3.3.7. I imagine that most people would learn to use this application very quickly.



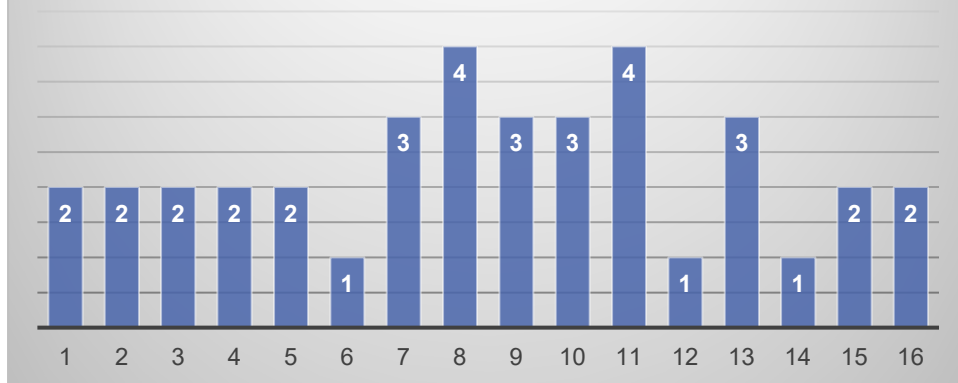
3.3.8. I found the application very difficult to use.



3.3.9. I felt very confident using the application.



3.3.10. I needed to learn many things before I could start with this Virtual Reality.



In this third block, innovation in evaluation and the usefulness of the learning results derived from this experience are analyzed. The first two questions would show an intention or not to use this application fundamentally in relation to innovation and the usefulness of the result to be obtained by the students and the answers were chosen by VRoad as a transferable and useful experience without the need of a complicated or convoluted interaction with the students.

Although within these questions it is possible to observe some of the difficulties in the implementation of tools complementary to training and technologically advanced and is the lack of knowledge of that technology for their adaptation or even development by the profiles more directly related to teaching.

The consistency of the virtual experience is visible in the graphs 3.3.5 and 3.3.6. It seems that the way of linking the activities included in it, a detailed tutorial, the way in which the activities are presented or how the "clues" are received in case of doubt...The evaluation has been positive as far as the consistency of the game and the three activities in which its development is divided.

In the two following graphs (3.3.7 and 3.3.8), the ease or difficulty of use that VRoad could imply for trainers and experts is evaluated. Again the result of the answers is positive in terms of the "usability" of the virtual experience and the answers were negative when proposing the item in negative (I found the application very difficult to use).

Finally, this third block of questions focuses on trust and ease of use. With very positive answers in both cases.

3.4. What aspects of this course are most useful or valuable?

Pleasant and useful training environment for training tasks.
The learning experience.
I would highlight the magnificent reproduction of reality in a virtual environment, with all the possibilities that this offers, in terms of the different risk scenarios in road maintenance work.
Students are exposed to real work situations.
The learning experience.
I believe that learning to perform a risky activity in a safe environment is its main virtue
I believe that making use of virtual reality is an effective tool to make workers aware of the risks that exist on the road before they get on the real stage, but also to make virtual reality similar to the real conditions of the road.
Representation of a scenario with traffic but in safe conditions for learning.
Virtual reality approach
The order in which the panels (signs) are placed

3.5. How would you improve this training?

Establishing training indicators to evaluate performance.
I am satisfied.
Introducing more interaction of the different agents that are usually present in this type of work (e.g. vehicles, other workers, weather, etc)
Developing more varied work environments. For example, there is the possibility of working behind barriers and the normal thing in a real situation is that this does not happen so the operators must walk on the road. Varied use of the application.
I am satisfied.
To be able to count on success metrics would be a great advance. The placement of the signage should be done following the highest protection of the user
I believe that it is necessary a support or minimum technical knowledge for the practice of this virtual reality experience, but you "play" with it as with a video game and you do not reach the essence you want to convey to the user of the application
Including an initial explanation/teaching of the concepts to be taught, and then letting the student put them into practice, but without guidance, so that it can be evaluated if the knowledge has been assimilated correctly.

I don't know much about this type of training

Correcting all inconsistencies related to the placement of the panels (left and right of the roadway for example)

4. QUALITATIVE ASSESSMENT. FOCUS GROUP

From this qualitative assessment, the following conclusions have been drawn directly related to the experience lived by both NaG and TaG as well as by experienced professionals in the field of training, health and safety at work, and road maintenance and operation:

In this part of the qualitative assessment, we have counted on the participation of actors involved in the project from the beginning. This circumstance has meant that some of them have attended to the explanations during the first phases of the project and their original perception regarding the final result of the virtual experience has been positive, with the conviction at the beginning of the project that the result could not be of real use due to the limitations of virtual reality with respect to the real work situation. This skepticism finally disappeared when testing VRoad.

The opinions of these professionals and actors collaborating in the project have already been collected in the technical and technological survey but it was sought that they could express their doubts, the inconsistencies in the game if any ... using a qualitative technique and open questions that gave them the opportunity to discuss and criticize what they identified as incorrect or insufficient in the final outcome of the VRoad project.

Several of the participants had already had previous experiences with Virtual Reality and in both cases, that is, with and without previous experience, the conclusions after the use of the virtual experience would be as follows:

- The graphics-pictures and elements included in the different scenes are of good quality.
- Although the three scenes do not exactly reproduce reality, they do lead to the development of a realistic virtual experience (for example, by means of the constant circulation of vehicles while the work is being done).
- Although it is true that there is a route for the improvement of these three activities (cutting the rail, replacing the guardrail, and action in case of emergency) by means of elements that reinforce the learning with vibrating controls, with the design of more complete scenarios, through the integration in the experience of other auxiliary equipment such as trucks with self-supporting cranes, elements for the preparation of the mortar that would hold the vertical signal ...
- Also included in this section was the inclusion of new scenarios such as one on pavement reinforcement.
- From the point of view of training it has been considered a very good tool that will complement the more theoretical and classroom training.
- Finally, the potential development of the critical spirit of the students was highlighted with respect to the scenes included in VRoad and with respect to the theoretical training received in its comparison with the practical training carried out through virtual reality.
- Another element especially highlighted by the participants in the focus group was the need to continue with other scenarios so that the training of road maintenance and operation operators can be completed with the practical application of the knowledge acquired through Virtual Reality.

- A last point was directed to the capacity that tools like this have to achieve a change of attitude on the part of the workers and not only that but even the integration of the security and health in the work in all the phases and sections of the company.

ANNEX 1. EXANTE - EXPOST. PEDAGOGICAL VALIDATION

QUESTIONNAIRE EXANTE - EXPOST


THIS QUESTIONNAIRE WILL BE PASSED TO THE STUDENTS ATTENDING THE PILOT COURSE BEFORE STARTING THE VIRTUAL REALITY EXPERIENCE AND ONCE IT IS FINISHED

1. This learning is important for (score from 1 to 5)					
	1 Not important at all	2	3	4	5 Very important
Increase motivation to learn about health and safety issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Raise awareness of the importance of health and safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acquiring the fundamentals of health and safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Making learning more attractive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Would you recommend the use of the application to other colleagues/apprentices?	
Yes	<input type="checkbox"/>
No	<input type="checkbox"/>
Why? _____	

3. Mark your level of agreement (5 is the highest agreement score) or disagreement (1 is the lowest agreement score)					
Ask	1	2	3	4	5
Do you think the use of virtual reality in COEX works is something new and innovative?					
Do you think the issue of safety on construction sites is an important one?					
Do you think that a similar procedure could be developed for other jobs, for example, civil works activities?					
In your opinion, is Virtual Reality an adequate tool to learn the basic concepts of health and safety?					
Do you think it's easy to use?					

4. What objects need to be used in a lane cut? (select only one valid answer)	
a.	Pre-warning car, construction site signs (yellow background), traffic lights, directional panels and cones.
b.	Building site signs, directional panels and cones.
c.	Only traffic lights.

	
5. Is the dense traffic signal necessary?	
a.	Only if the accumulation of cars exceeds one kilometer.
b.	Only if there is no traffic light.
c.	Yes, it is necessary.

Are the cones sufficient to delimit the work area?	
a.	Yes
b.	No
c.	Only if there is no other signaling element.

ANNEX 2. TECHNICAL AND TECHNOLOGICAL VALIDATION

TECHNICAL VALIDATION BY TRAINERS/TRAINING EXPERTS						
Pilot tests: usefulness of the application						
Please evaluate if the contents of this course are innovative and useful to improve or understand the risks and measures related to road works.						
	Ask	1	2	3	4	5
1	The tutorial for the use of Virtual Reality (Practical Guide for Trainers) is useful.					
2	I find the application easy to use and to show during a training session.					
3	The situation in the games resembles that of the real world or real health and safety situations.					
4	The experience of Virtual Reality is wide enough to cover the Health and Safety risks in the three activities it proposes.					
5	I would use this Virtual Reality experience to teach COEX health and safety at work.					
6	I found the various functions of this Virtual Reality well integrated.					
7	The practices are relevant to most of the topics/activities carried out within the COEX works.					
8	The level of difficulty is correct, i.e. neither too difficult nor too easy to affect the student's knowledge of health and safety.					
9	There is enough content to cover the basic principles of health and safety.					
10	Virtual Reality questions are relevant to most of the topics/activities that are carried out within Road Maintenance and Operation.					
11	Virtual Reality (the serious game) applied to health and safety is appropriate for students.					

12	The situation in the activities resembles that of the real world or real health and safety situations.					
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TECHNOLOGICAL VALIDATION BY TRAINERS/TRAINING EXPERTS						
Pilot tests: usefulness of the application						
It evaluates the innovation and usefulness of the learning outcomes derived from the content (lessons and exercises).						
	Ask	1	2	3	4	5
13	I would like to use the application frequently.					
14	I find VRoad Virtual Reality unnecessarily complex.					
15	I thought Virtual Reality was easy to use.					
16	I think I would need the support of a person with technical training to be able to use this application.					
17	I found that the various functions of this application were well integrated.					
18	I think there is too much inconsistency in this application.					
19	I guess most people will learn to use this Virtual Reality very quickly.					
20	I found the application very difficult to use.					
21	I felt very confident using the application.					
22	I need to learn many things before I can put this Virtual Reality into action.					



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e Obras Públicas do Sul

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Construction Industry and Public Works in
the South (CENFIC). Portugal



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Le réseau de l'apprentissage BTP

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