EFFECT OF INTERMEDIARY OBJECT USE DURING COLLABORATIVE DESIGN ACTIVITIES OF IMMERSIVE APPLICATIONS: FOCUS ON PROFESSIONAL TRAINING APPLICATION

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ABSTRACT

Industry 4.0 introduces innovative ways of professional training thanks to new technologies such as Virtual Reality and Augmented Reality. Despite improvements, there's still a lack of a good user experience and connection between user needs and these applications. To tackle this problem, designers of such applications must work in a collaborative way integrating final users. It's specifically true during design phases such as scenario creation. But the co-creation of scenario is a difficult task for designers and final users who don't have enough expertise with IT. A solution seems to stand in intermediary objects (IOs) which are well known for their characteristics of mediation, transformation, and representation. We have studied the use of different IOs during a project consisting in designing an immersive professional training application for risk hunting for Stäubli company. We used an IO1 made of an excel sheet and an IO2 made of 360 views of the workshop. Two ideation sessions with two groups of designers were conducted to propose a scenario consisting of several risks to spot in the future application. Results show that the scenario was improved using the IO2, and final users and designers were more collaborative.

Keywords: Virtual reality, Collaborative design, Training, User centred design

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1 INTRODUCTION

In the context of industry 4.0, new production technologies use constantly evolving industrial resources and processes. Faced with such development, manufacturers must think about the most up to date physical— and virtual—training methods that will allow their employees to improve their skills and adapt to new modes of production.

To reach this objective, some companies choose to take advantage of Immersive Technologies (IT), including Virtual Reality (VR), Augmented Reality (AR), or other Mixed Reality technologies. In the field of training, it has been accepted for many years that IT offers real benefits (Arnaldi et al., 2018; Burkhardt et al., 2003). Despite the maturity of these technologies and their visible industrial applications (Gartner, 2018), there are still obstacles to their full integration in the industrial field, particularly in professional training (PT).

The biggest issues related to IT applications are the lack of usability, utility, and good user experience (UX) (Akçayır and Akçayır, 2017; Arnaldi et al., 2018; Burkhardt, 2003). UX covers all aspects of how people use an interactive product—the way it feels in their hands, how well they understand how it works, how they feel about it while they're using it, how well it serves their purposes and how well it fits into the entire context in which they are using it (Alben, 1996).

To tackle these issues, we must focus on immersive professional training (IPT) design process. Indeed, many professionals and experts from different disciplines can contribute to this design process: the VR/AR designer, as an expert in 3D application design and IT, the ergonomist as an expert in understanding the activity, with the aim of making product design compatible with the needs and limitations of human beings, and finally the pedagogical engineer, expert in learning methods, he improves the learning performance of users. They take part in the integration of users during the design process which represents all the activities carried out in IPT design.

All these professionals and experts must work in a collaborative way "for and with" the end-users. But it remains difficult for both experts and end-users (professional trainer) to achieve together some activities such as scenario definition. It is challenging to propose a scenario as rich and complete as necessary and well adapted to user need. In fact, IT are still emerging ones for many firms and their staff. As such, designers and end users have a lack of expertise and use experience concerning these new technologies. It is difficult to forecast future use of such technologies especially for training activities. However, scenario definition is a crucial step for the design success of such applications (Bisson et al., 2022).

This paper deals with the problematic of improving scenario definition of IPT applications during the early design phases. We propose a preliminary study of the interest of Intermediary Object (IO) (Vinck and Jeantet, 1995) and their impact on the scenario definition. As such, we have studied the use of different IOs during a project consisting in designing an IPT application for risk hunting for Stäubli enterprise. We used an IO1 made of an excel sheet and 2D plan of a manufacturing workshop and an IO2 made of 360 views of the workshop. Three ideation sessions with two groups of designers and final users were conducted to propose a scenario consisting of several risks to spot in the future application. Preliminary results seem to show that IO2 improve collaboration between members of groups during the scenario definition step. As a result, it also seems to allow designer to propose richer scenarios.

The second chapter presents a state of art about (i) several design processes of IPT, (ii) their common point, which is scenario definition and (iii) IO and their interest in a general collaborative design context. The third chapter explains the demand of the Stäubli Company, previous work, and the design steps of the scenario definition. The fourth chapter presents the IOs comparison procedure and the associated results for the scenario definition.

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2 STATE OF THE ART

2.1 Design processes of IPT

The work of Loup-Escande et al. (Loup-Escande et al., 2013; Loup-Escande, Jamet, Ragot, Erhel and Michinov, 2015; Loup-Escande, Jamet, Ragot, Erhel, Michinov, et al., 2015) on the VirtualiTeach Project shows that it is possible to apply a user-centred approach in educational context. The authors take precautions regarding the establishment of a favourable climate of communication between designers and end-users. They also take precautions concerning the articulation to be found in the design and in the involvement of users. The authors target development meetings at times that allow designers and users to better understand each other. During scenarios definition, Loup-Escande explains they conducted brainstorming sessions with sixty-five participants (high school managers and teachers). From the brainstorming sessions, they selected six pedagogical concepts associated with scenarios. This selection was made based on educational content and relevance of using virtual reality. Loup-Escande highlights the importance of a collaborative and user-centred approach to the educational concept but does not detail how they defined the scenario. However, this work is limited to the educational context and does not deal with professional training.

The work of Lourdeaux (Lourdeaux et al., 2002), dealing with the design of a virtual environment (VE) for training, states that each step must be carried out in collaboration with different experts: experts in the field (the professional activity to be reproduced in the VE), human and social science experts (ergonomists, psychologists, cogniticians, etc.), and technical experts (VE designers). This method is very interesting because it seems to highlight a 'concurrency' which approaches the characteristics of collaborative design and the user-centred character. However, this approach is limited in the collection of expertise during the phase of specifications of educational objectives. In the proposed steps, no tools are given to the users to involve them in the design process. In addition, this methodology is still quite limited with the notion of coordination of the different professions that must take part in the process of designing training using IT. It does not provide information on the role of each profession involved in such a project. Lourdeaux's work explains that the preparation of the scenario must allow the trainer to define the tasks to be carried out by the trainee according to the pedagogical objectives. And that for each task the trainer must be able to specify whether he can intervene during the scenario in terms of events and in terms of pedagogical assistance. However, it does not propose any tools for generating the scenario or even how he can formalise it. Furthermore, no details are given to do it in a collaborative way.

Other works that refer to the design of IPT are those by Boccara and Delgoulet (Boccara, 2018; Boccara and Delgoulet, 2015; Delgoulet et al., 2015). Boccara in 2018 suggests positioning the methods of ergonomics and didactics at the same 'crossroads' level. The aim here is to identify relevant reference situations (Samurçay and Rogalski, 1998) in the anticipation of probable future situations in order to guide the design process (Boccara and Delgoulet, 2015). These reference situations are "work in production" and "work in training". They can help to guide the design choices of a training VE demonstrator. The approach proposed here is very interesting because it provides the ergonomist with reference frames of situation (Boccara and Delgoulet, 2015). However, the method stops at a first definition of scenarios and does not show how these scenarios can be co-constructed with all these actors (ergonomist, didactician, trainer, learner), or even the involvement of these actors in the design stages which follow the definition of the scenarios.

These works show us that many improvements have been made to existing methods in past years. Methods have evolved to emphasize the participation of different actors to make the design process more collaborative. Another notion has been added, that of the user-centred design (UCD), by proposing additional steps such as the use of the ergonomist's tools to better consider the user's need. Few of the works clearly specify how and when to collaborate.

Among the works described, few show how the different experts work together to define the scenario and the lack of method to help them to collaborate. It confirms our interest on IO and their impact on the scenario definition. The next chapter will present a brief literature review about scenarios.

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2.2 Scenario definition of IPT

According to (Charlier et al., 2002), an educational scenario is "the result of the process of designing a learning activity, a process that takes place over a given period of time and leads to the implementation of the scenario. Thus, a scenario includes objectives, planning of learning activities, a timetable, a description of learners' activities, assessment modalities which are defined, arranged and organised during a design process". A pedagogical scenario allows the trainer-designers to structure the learning context and to organise it in the virtual environment and over time.

Marfisi-Schottman et al. (2009) proposes to formalise the different steps for serious game design by describing the actors, tools and documents used. They also propose a system for sharing generic activity models and editing tools. For the scenario edition, they propose as a first step to extract the knowledge of the "target domain" by a cognitive scientist and one or more experts of the target domain to formalise the knowledge and know-how. Once formalised, the educational expert identifies the main knowledge and defines the educational objectives of the serious game. Next, the educational objectives are scripted with stimulating entertainment.

Abed et al. (2016) is mainly focused on the design of pedagogical scenarios for trainers in continuing and professional education. Some of the training he has designed use IT. He proposes a methodological approach of gamification for the creation of the scenario. However, his approach assumes that the trainers have an existing contents such as course, sequence of learning activities, etc. This is generally the case in initial or continuing education. Therefore, the gamification process is not a creation process but a transformation process.

Oubahssi et al. (2018) proposes at the beginning of her process that teacher-designers express their needs according to their learning context using a VR-oriented instructional scenario model. First, it asks teachers to formalise their needs using a pattern-based approach. Then they suggest creating instructional scenarios that define an orchestrated sequence of instructional activities. They propose a VR-oriented scenario editor with which the teacher dialogues.

All these works deal with scenario generation, but it often assumes that the teacher designers have already defined the learning situations. They do not talk about upstream phase, which is to generate ideas to define the objectives and the pedagogical content. Several works suggest involving the teacher designer in the scripting task in order to formalise the content. None of them involve stakeholders, like professional trainer, who often do not have pedagogical skills (Boccara and Delgoulet, 2015). Their difficulty lies not only in the transformation of the pedagogical scenario but in its creation. Moreover, these works do not deal with the fact that they are not familiar with IT and have difficulties in collaborating with the VR designer. It is therefore complicated for them to imagine what the learning situation could look like in a virtual context. To tackle these limitations, we propose the use of Intermediary Objects (IO) (Vinck and Jeantet, 1995). The next chapter proposes a brief definition.

2.3 IO in design context

Intermediary objects are intermediate representations of the future product throughout the project from the first stages of design (Jeantet, 1998). Initially, the notion of intermediary object appeared in the context of research on the study of scientific cooperation networks in the health field (Vinck, 1992). In the 1990s, through the initiative of Serge Tichkiewitch and Alain Jeantet at the G-SCOP laboratory, sociologists and mechanics came together to develop research on design processes and tools (Jeantet et al., 1996). In this context, the notion of IO has been taken up and used in the field of product design in order to analyse design activities (Jeantet et al., 1996; Vinck et al., 1996; Vinck and Jeantet, 1995; Vinck and Laureillard, 1996). The design process produces many IOs which may differ from one product to another but also from one organisation to another. These objects include all the artefacts produced and mobilised during the design process. They can be immaterial (digital CAD models, virtual prototypes, software, etc.) or material (technical drawings, texts, physical models, etc.) (Boujut and Blanco, 2003; Jeantet et al., 1996). Intermediary objects of design are identified as vectors of communication that are becoming more and more relevant to study in the context of integrated design (Tichkiewitch, 1997).

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Boujut et al. (2003) has identified three main characteristics of IOs for coordination or cooperation of the actors of the design :

- Mediation: IOs play a mediating role in the product design process because they transfer the intentions of one actor to other actors
- Transformation: the creation of IOs also indicates the evolution inherent in the design process.
- Representation: IOs represent part or all the product identity.

IOs must be modifiable in the sense of Broberg (2011) in his expression "object-in-the making", which we understand as "an object that is constructed in action or in collaboration". This expression used for border objects can be used for IOs and reflects the following observation: according to Broberg, IOs "do not come ready made". The aim is for the IO to be more interactive with the designers so that they can make it evolve (through modifications, evaluations, annotations, etc.).

3 CONTEXT

3.1 Demand of the company

Stäubli is a global mechatronics solution provider with four dedicated Divisions: Electrical Connectors, Fluid Connectors, Robotics and Textile, serving customers who want to increase their productivity in many industrial sectors. The context of this project concerns safety training at the assembly stations of the textile products of the company. At the beginning of the project, this training is addressed to the new operators of the company upon their arrival by a supervisor. The training lasts between one and two hours and takes place in a room. New operators are provided with resources in PDF format, and they consult the documents with the supervisor. The content concerns common risks in assembly workshops, such as traffic rules, the use of pallet trucks, the wearing of Personal Protective Equipment (PPE) such as safety glasses, etc. The initial request is to develop the training so that it raises the awareness of new operators by making it more immersive.

3.2 Previous work

Before the scenario definition, we achieved several steps of a IPT design process proposed by (Bisson et al., 2022). First, we analysed the demand and the training. Several interviews were conducted with the production manager, the trainers and people who were trained. Several issues emerged from the initial training. Few people remembered the training and its content. One of the reasons is that it is carried out on the first day which has an overloaded agenda (company presentation, the discovery of the job and the machines, etc.). According to them, there is too much information on the first day and they have difficulty remembering everything. Another reason is the lack of interaction in the training. Indeed, the training is considered as minimalist and lacks real-life situations in relation to the workplace. The people attending the training have not yet discovered the workstation, so it is difficult for them to find their way around all the safety instructions related to the work to be done. Finally, there is no feedback on the follow-up of the training. There is no evaluation, so people would be less motivated to retain the information.
Following the analysis of the training and a technology review, the project group decided to use virtual reality to conduct a risk hunt in the workshop. This is created from 360° pictures in order to have a very faithful representation of their working environment. The use of several pictures allows the trainee to simulate several working environments. What is expected is that the person doing the exercise finds the hidden risks by clicking on them. The advantages of using this technology are that it puts the trainee in the work environment, it evaluates their knowledge, and the tool is interactive. Other advantages are that the creation of a virtual reality application from a 360° picture is quicker and less expensive to develop than an application with a 3D environment. To develop our solution, we use an Ista360 camera, the 3DVista software and Oculus Quest (HMD).

3.3 Design of the application scenario

Following the analysis of the training and once the technological solution has been chosen, the next step according to the methodology presented in (Bisson et al., 2022) is to create the pedagogical scenario of the application. Before generating the scenario, we listed the initial risks encountered in the workshop from the existing training documents. To create the scenario, the objective is to choose

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the different places in the workshop concerned and the risks to be integrated. Then to assign the risks to the locations on the shop floor, we used two IOs (fig.1). The IO1 was an Excel file in which there was a table including the list of initial risks and a map to determine the most suitable places to place them. The IO2 was based on 360° photos printed in A3 size and this time the designers were asked to use post-it notes to place risks.

Nb cliché	Titre de la consigne	Risques	Commentaires
1	Règle de gerbage	Hauteur d'empilage mauvaise d'une zone de stockage à côté du poste	
1	Règle de gerbage	Opé qui ne respecte pas la zone de travail d'un engin de manutention	
1	Règle de gerbage	Hauteur d'empilage mauvaise d'une zone de stockage à côté du poste	Empilage de 3 machines au contrôle croisé
1	Utilisation transpalette	Tâche d'huile au sol	Près d'un engin
1	Utilisation transpalette	Transpalette mal stationné	
2	Produit absorbant	Tissus au sol ou sous un plot	
2	Circulation sur le poste	Opé qui marche à côté d'un chemin bleu	
2	Circulation sur le poste	Circulation sur un poste sans EPI	Personne en visite sur l'ilot
2	Emballage	2 opé qui travaillent	A l'emballage
2	Plot de test	Opé qui utilise un palan mais ne gère pas la charge	Sorti d'une machine d'une cabine
3	Plot de test	Opé qui cherche la panne avec ses mains et l'autre qui utilise l'homme mort	
4	Bons gestes	Plot de montage trop élevé/bas (ex travaille les coudes en l'air)	
5	Bons gestes	Montage ratière : utilisation du pignon outillage	Avec un 2ème opé qui a les mains dans la machine
6	Circulation sur le poste	Opé à un croisement avec des engins de manutention et qui ne regarde pas dans la direction du cariste	
7	Alerte évacuation		

Figure 1. IO1 on the left and OI2 on the right

4 IO COMPARISON FOR SCENARIO DEFINITION

We compared the two IOs that were used for the scenario definition step: to choose the different places in the workshop and then to assign the risks to the locations.

4.1 Participants

Seven participants took part in this study, they are the stakeholders of the project. There was one production manager, four supervisors (who are the end users of the application because they are the trainers), one operator and the VR designer. They were divided into two groups of four people (for morning and afternoon shift rotation constraint): two supervisors in each group, the production manager in one group, the operator in the other group and the VR designer was assigned at each group.

4.2 Equipment

For this study, the materials used were the two IOs. IOs were called "tool" for the people involved in the project. All the documents related to the initial training were also available. They were placed in a meeting room.

4.3 Procedure

Participants were asked to use the IO provided to define the content of the scenario. The sample was divided in two groups, and they worked in asynchronous way. One group worked in the morning and the other group in the afternoon (fig.2). The aim was that each time one group would continue the work that had been done beforehand. There were six project reviews (PR): three reviews per group. PR1 aimed to (i) find places to take in picture and (ii) start to integrate the first initial risks with IO1. PR2 was devoted to the integration of the remaining risks with the IO2. PR3 aimed to reorganise all the risks in each picture with the IO2. At the end, the participants had to answer a survey.

	Objectives	Morning	Afternoon
PR1 OI1	To find places to take pictures and start to integrate the first initial risks	G1	G2
PR2 OI2	To integrate of the remaining risks	G2	G1
PR3OI2	To reorganise all the risks in each picture	G1	G2

Legend :
PRX : Project Review X
GX : Group X

Figure 2. Procedure of Projects Reviews

4.4 Data collected

The data collected are the answers to the survey (Appendix 1). For each item, we asked the participant to judge the IO (named "tools" in the survey) between 1 (strongly disagree) and 5 (strongly agree).

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The questions are taken from (Khatib, 2015) and (Kobenan, 2016). We also collected every data and documents used or produced during the PR and we made observations. At the end of each PR, we saved decisions of the group. In the Appendix 2, for each PR we have listed: "risks already placed" in the previous PR, "risks added from the initial list" (from initial training documents), risks of the previous PR that have been "moved", risks of the previous PR that have been "deleted", new risks "added" to the initial list and risks "placed" in the pictures at the end of the PR.

4.5 Results

4.5.1 Common representation

PR1 started with the use of IO1 (Excel file). First, we chose the areas where the trainee would be and the risks that might be present. We noticed the difficulty that the participants had in imagining the workshop environment to choose the areas and the risks to be integrated. They validated few risks because they were unable to represent the same scene. They lacked a common representation. According to Appendix 2, only 14 risks were validated during the reviews using the Excel file (sum of the two groups). For PR2, we used IO2, and we noticed a big improvement. The 360° photos are faithful to the workshop environment, so it was easier for them to make decisions together. At the end of PR2, there were 43 risks placed on the IO2 according to the appendix 2. The IO2 was also a good communication tool between all the designers, within the same project group and with the designers of the other project group. Indeed, they were asked (CE item) whether the tools/IO helped to foster communication and exchange. The answers based on a Likert scale (1: strongly disagree to 5: strongly agree) seem to show that IO2 is better than IO1 (average of 4/5 for IO1 and 4.9/5 for IO2). In their opinion, IO2 has fostered communication and the exchange of ideas between the project group. According to them, IO2 also had a greater influence on the cohesion of the project group (Average IO1 = 3.6 and IO2 = 4.6 for CH item) and the participants felt more credible in sharing their ideas (Average IO1 = 3.7 and IO2 = 4.9 for CR item). However, both IOs received the same ratings for allowing them to collectively construct ideas (Average 4.7 for CL item) and for having problems collaborating with other group members during the reviews (Average = 1.7 for CO item).

4.5.2 Choice of training content

Regarding the choice of training content, we noticed that IO2 was more beneficial. Each participant could easily participate in the choice of content by placing or moving the post-it notes on the pictures. It was therefore possible for the participants to make the content homogeneous by integrating the same number of risks per zone and dispersing them so that they were not all grouped in the same place to enjoy the 360° view in virtual reality. It was quite easy for them to reorganise the content simply by moving the post-it notes around. From appendix 2, with IO2, we can see that between PR 2 and 3, they moved 10 risks. We can also see that during PR3 many risks have been removed (16). The questionnaire also seems to show that the participants found IO2 more "useful" than IO1 (average IO1 = 4 and IO2 = 5 for US item). IO2 would also appear to have had a greater impact on the number of ideas generated (mean IO1 = 3.6 and IO2 = 4.9 for IG item) and decisions made (mean IO1 = 3.7 and IO2 = 4.4 for DT item). The questionnaire also seems to show that IO2 had a greater influence on the motivation of the group to work together (mean IO1 = 2.9 and IO2 = 4.3 for MO item). We noticed that the use of IO2 made all participants act in contrary to IO1 where they were more passive.

Another advantage of IO2 is that the use of the pictures from the workshop brought out risks that were not mentioned in the initial list of risks. According to Appendix 2, this represents 25 additional risks. This phenomenon made the participants aware of the risks they had at the workshop, and we think that this would not have been possible if we had only used IO1.

4.5.3 Satisfaction and achievement of objectives

After all PR, we presented the designers a prototype of the application. During a test, several comments were made such as "the solution looks like what I imagined". Their comments seem to show that the use of IO2 allowed a good representation of the final solution. From the questionnaire, it seems that IO2 was more suitable than IO1 in projecting participants onto the future training medium (IO1 average = 3 and IO2 average = 4.9 for PU item). This is an important point concerning the acceptability of the solution because it seems to show that the final solution is close to what they wanted to conceive and to what they expected to use (despite not being experts in the field of virtual reality). Moreover, according to the survey, most participants felt that the project objectives had been achieved, as the average score was 4.3 for AO item.

4.5.4 IO Transformation and final application

The final advantage of IO2 over the IO1 is that once they validated the scenario, the pictures with the posts-it notes have been transformed into a story board. IO2 has become a new intermediary representation of the solution. During the shooting, the preparation of scenes was very quick because we recreated what was done on the 360° pictures.
The final VR training application is based on four 360° pictures that were taken in the workshop at different locations. Twenty-eight risks have been set up in pictures that the learner has to find.

5 CONCLUSION

Our preliminary study seems to show that using the right IO to design a virtual reality training exercise has advantages specifically for scenario definition. IO help to understand how the application would work and how the trainees would experience it. IO help people who are not experts in this technology to make design choices and imagine the content.

In our case, the use of a suitable IO is a success factor for our projects as the design is carried out by people who are not experts in the technology and who show reluctance to adopt the technology. IO2 has motivated people to work together with their own resources and to feel that the final solution corresponds to the decision choices they have made.

The limitation of this article is that the results are drawn from a first study with a small sample of participants. It is due to industrial and time limitations. The survey results represent some preliminaries evidence, but they must be completed with a more robust protocol. For instance, we can plan to compare other type of IOs as physical prototypes, drawings, or texts in different context of professional training. Our perspective is to give generic recommendations for defining the most suitable IO so that future designers of IPT application can define their scenario in a more collaborative and efficient way.

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APPENDIX

Subject	Categories	Measured items	Sources
Ressources	Usefulness	US : The tools used is usefull for my project	*Al Khatib et al, 2015*
	Ideas generated	IG : The tools used has an impact on the quantity of ideas generated	*Al Khatib et al, 2015*
	Decision taken	DT : The tool used has an impact on the quantity of decisions taken?	*Al Khatib et al, 2015*
	Project understanding	PU : The tool used allowed me to project myself on the future training solution (with VR headset)?	*Al Khatib et al, 2015*
	Communication and exchange	CE : The tool used allowed me to promote communication and exchange of ideas between the project group	*Al Khatib et al, 2015*
	Motivation	MO : The tools used influenced the motivation of the project group to work together	*Al Khatib et al, 2015*
	Satisfying	SA : I was satisfied of the project reviews	*Al Khatib et al, 2015*
	Collaboration	CO : I encountered any problems in collaborating with other group members during the project reviews (Problems of understanding, disagreements, …)	*Al Khatib et al, 2015*
	Cohesion	CH : The tools used influenced the cohesion of the project group	*Kobenan, 2018*
	Credibility	CR : I felt more credible when I was using the tool to share my ideas	*Kobenan, 2018*
Coordination	Restart	RE : The group often needed to go back and start again during the project review when you used these tools	*Kobenan, 2018*
Objectives sharing	Achievement of objectives	AO : The objectives of the project was achieve	*Kobenan, 2018*
Integration of expertise	Knowledge of its domain	KD : I acquired knowledge about my field during the project reviews where I used the tool	*Kobenan, 2018*
	Knowledge sharing	KS : I feel that I have provided knowledge to other team members through the tool	*Kobenan, 2018*
Decision making strategy	Solidarity	SO : I feel a sense of solidarity with the team's decisions thanks to the tool	*Kobenan, 2018*
	Collectivity	CL : Decisions were made collectively when using the tool	*Kobenan, 2018*
Others		O1 : What tool(s) or support(s) did you miss during the project reviews? For what reason(s)?	*Kobenan, 2018*
		O2 : Do you have any comments?	*Kobenan, 2018*

Appendix 1. Survey

	Already placed	Added from the initial list	Moved	Deleted	Created in addition to the original list	Total placed
PR1G1	0	10			0	10
PR1G2	10	4	0	0	0	14
PR2G2	14	7	5	2	15	34
PR2G1	34	0	0	0	9	43
PR3G1	43	0	4	15	0	28
PR3G2	28	0	1	1	1	28

Legend :
PRX : Project Review X
GX : Group X

Appendix 2. Integration of risks in 360° pictures

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