

AN EXPERIENTIAL APPROACH TO IMPROVING THE INTEGRATION OF KNOWLEDGE DURING EIA IN TRANSPORT PLANNING

In red colour the main changes incorporated during the revision of the manuscript

Abstract

The integration of knowledge from stakeholders and the public at large is seen as one of the biggest process-related barriers during the scoping phase of EIA application in transport planning. While the academic literature offers abundant analyses, discussions and suggestions how to overcome this problem, the proposed solutions are yet to be adequately tested in practice. In order to address this gap, we test the effectiveness of a set of interventions and trigger mechanisms for improving different aspects of knowledge integration. The interventions are tested in an experiential study with two sequential cases, representing “close-to-real-life” conditions, in the context of two cities in Andalusia, Spain. In general terms, the participants perceived that the integration of knowledge improved during the simulation of the EIA scoping phase. Certain shortcomings were also discussed, fundamentally related to how the time spent during the scoping phase was crucial to lead an effective learning process between the involved people. The study concludes with a reflection on the effectiveness of the tested interventions according to similarities and differences obtained from the two experiential case studies, as well as with a discussion of the potential to generate new knowledge through the use of experiential studies in EIA practice.

Keywords: scoping phase; infrastructure; sustainability; communicative planning

1. Introduction

In the context of a communicative approach in the transport planning sector (Bertolini et al., 2008; Beukers et al., 2014; Curtis, 2011; Pfaffenbichler, 2011; Willson, 2001), instruments grounded in instrumental rationality have come under strong attack. The Environmental Impact Assessment (EIA) is a case in point (Fischer, 2003; Richardson, 2005; Saarikoski, 2000). To increment the EIA effectiveness, academia has traditionally focused more on solving content-related problems with EIA (e.g., technical measurement of environmental impacts) and paid only limited attention to process-related barriers (e.g., stakeholder involvement). However, focusing on overcoming content barriers, in the face of the emergence of communicative planning approaches, will not be sufficient to improve EIA's effectiveness in the transport sector (Soria-Lara et al., 2015a). In this context, the academic literature identifies a number of EIA issues that underlie this challenge: the participating professional groups seem to focus heavily on securing a dominant position during the assessment process, which impedes the creation of constructive dialogue and transforms EIA into a non-transparent process (Richardson, 2005); stakeholders are not always structurally involved during the assessment, affecting the scope of the

EIA (Soria-Lara, 2012); public participation is not addressed in a way that provides effective support to the experts (Lidskog & Soneryd, 2000).

In the particular case of EIA application in transport planning, recent research among EIA developers and transport planners in Spain has ranked specific process-related barriers, highlighting the integration of knowledge based on unstructured stakeholders involvement and inefficient public participation as key bottlenecks in the early phases of EIA (Soria-Lara et al., 2015a). The so-called scoping phase, the process of identifying the content and extent of the EIA, is heavily affected. It provides key relevant information on the impacts that should be assessed, system boundaries, potentially mitigating and enhancing measures for project alternatives as well as recommendations about assessment methods (Lee, 2006). If this barrier persists EIA may become biased or subverted, with certain forms of knowledge unduly dominating the outcome (Richardson, 2005 p. 352). On the other hand, if this barrier is overcome, EIA would enhance its credibility as an inclusive collective process.

To address the abovementioned issue, this paper aims to explore the following research questions: *Which are useful interventions and mechanisms for improving the integration of knowledge during the scoping phase of EIA, and are they effective in the context of transport planning?* First, the research briefly presents a literature review of specific interventions and mechanisms to improve the integration of knowledge in EIA. The review is distilled into a specific approach to inform our research approach. Second, and most importantly, we test the effectiveness of the adopted interventions in the context of their intended use (transport practice), examining whether they function well (or not) and why. The paper essentially aims to develop “field tested abstract knowledge”. The generation of “new knowledge” should not be seen as a prescription, but as a “design example of grounded technological rules” to address the indicated problem of knowledge integration (Van Aken 2004). The implementation of two Light Rail projects in Granada and Seville provides the empirical focus of the research.

While Section 2 details the set of interventions and mechanisms adopted to improve the knowledge integration as well as the methodological design of the research, Section 3 presents the obtained results from the two case studies, examining whether the interventions were effective (or not) and why. Finally, Section 4 closes with several concluding remarks and recommendations for further inquiries.

2. Conceptual framework and research design

2.1. Pursuing effective interventions to improve the knowledge integration

In order to find interventions and mechanisms to improve the knowledge integration, a review of scientific articles in the Scopus database was conducted (Soria-Lara et al., 2015b). Most of the consulted articles focused on describing problems and proposing general recommendations for stakeholder involvement and public participation during the EIA process (e.g., all interested groups should be included in the assessment; the participatory process should be implemented during earlier assessment phases etc.). However, a limited number of articles contained applicable interventions and mechanisms in practice.

Based on similarities in argumentation found in the literature, three main directions for improving knowledge integration were identified: (i) finding a balance between too much and too little information and complexity (e.g. Balasubramaniam & Voulvoulis, 2005; Bojórquez-Tapia et al., 2002; Kolkman et al., 2007; Wood et al., 2007); (ii) using EIA as learning process (e.g. Karjalainen et al., 2013; Kennedy & Ross, 1992; Liu et al., 2013; Saarikoski, 2000); (iii) adapting the participatory process to the EIA characteristics in the context of its application, in our case the transport planning field (e.g. Higgs et al., 2008; Lawrence, 2007; Ramanathan, 2001; Richardson et al., 1998; Sutheerawatthana & Minato, 2010).

Taking the literature review into consideration, a specific approach for the scoping phase of EIA in transport planning was distilled (see Table 1). It follows the CIMO-framework: *in a problematic Context (C), use this Intervention type (I) to invoke these generative Mechanisms (M), to deliver these Outcomes (O)* (Denyer et al., 2008). The CIMO framework was translated to the domain of planning research by Straatemeier et al. (2010). It offers a useful framework to identify and assess the practical potential of interventions and mechanisms suggested in the literature. In this research, Context (C) would include the surrounding factors (e.g. institutional structure; legal framework; etc.) and the characteristics of the human actors who participate in the scoping phase. Interventions (I) would refer to the specific methods or artefacts that influence the behavior, perceptions and interactions of the participating actors, for example, creating a dialogue space supported by multi-criteria decision-making techniques. Mechanisms (M) would be the processes invoked by the interventions. For instance, this might entail the articulation of the participating actors' values through multi-criteria decision-making techniques. Lastly, Outcomes (O) would be the expected effects, which in our case refers to improving knowledge integration between the involved agents during the EIA scoping phase in the transport planning field.

With the suggested direction of improvements previously signaled, we have structured and translated the identified insights into a specific CIMO approach for the context of the scoping phase of EIA in transport planning. The approach is presented

through three sequential interventions and the associated trigger mechanisms (Table 1). The first intervention is *the creation of rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers*. This intervention aims to find a balance between too much and too little information and complexity, considering that the mentioned information is useful for EIA actors. This means that the information provides EIA agents key insights to proceed during the evaluation process (e.g. information related to boundaries of the evaluation). The second proposed intervention is the *creation of a multilateral dialogue space, facilitated by a mediator*, in order to use the EIA to lead a learning process between participants. The third and last intervention is *the use of dialogue modes that focus on specific and tangibles objectives* in the transport planning context.

Table 1. Interventions and mechanisms for improving knowledge integration

2.2. Experiential case studies: context and testing conditions

Our research methodology is based on the “experiential research design”, as proposed by Straatemeier et al. (2010), which sees planning as a social science that is uniquely oriented towards change. The typical products are not just explanations, but rather prescriptions that are tested in practice and grounded in scientific knowledge. In experiential research design the causal model is not the central concern, focusing instead on responding to questions such as: which planning innovation work (or do not work) in practice? and Why? Its real aim is to test in practice planning innovations proposed by academia, see for example Beukers et al. (2014), Hoetjes et al. (2006), Te Brömmelstroet & Bertolini (2008), and Te Brömmelstroet et al. (2014).

This approach allows practitioners and researchers to experience and reflect upon planning interventions by applying them in academically constructed cases, representing “close-to-real-life” situations, here called “experiential cases”. This is the central part of our research, testing whether the interventions and mechanisms distilled in Section 2.1 are effective in experiential cases of transport projects. Based on the experiences and reflections of the participants with the application of the set of proposed interventions in the first experiential case, the interventions can be revised and tested again in a subsequent, different experiential case. A crucial issue is to find a balance between replicating real-life practice as closely as possible and maintaining enough distance for all participants to enable critical questioning and analysis.

Accordingly, two experiential cases were sequentially conducted in the cities of Granada and Seville (Spain). Inspired by Te Brömmelstroet et al. (2014), each experiential case study followed a four-step logic (see the full protocol in Appendix A):

- (i) *Step 1 - Pre-workshop*: Participants were contacted by researchers twice (via telephone, skype and a face-to-face interview). First, the research and workshop themes were introduced to them. Second, they filled out an “ex-ante” survey on the current state of practice during the scoping phase of EIA in transport planning.
- (ii) *Step 2 - Operationalization of the intervention 1*: Researchers met face-to-face with EIA developers and decision-makers to implement the first intervention based on creating rules for participation (see Section 2.1).
- (iii) *Step 3 - Operationalization of the interventions 2 and 3*: Mediators promoted the use of EIA to lead a learning process by creating a multilateral dialogue space (intervention 2). They utilized dialogue modes about specific and tangibles objectives, such as impacts and the treatment of transport project alternatives (intervention 3) (see Section 2.1);
- (iv) *Step 4 - Workshop evaluation*: it was based on “ex-ante” and “ex-post” surveys as well as on in-depth discussion among researchers and participants (see Figure 1).

Figure 1. Setup of experiential case studies

The two case studies were selected according to the following criteria: (i) they should be based on real situations from transport practice; (ii) they should be under the same environmental conditions (e.g. administrative requirements, legal framework etc.). The two selected experiential cases were based on real-life practice from Andalusia, Spain, with a reduced but still representative number of participants and shorter time frame than the real-life situation.

Experiential case 1 focused on simulating the scoping phase of the EIA on a Light Rail (LRT) project in the city of Granada. The local government decided to modify the original route for the LRT project. The new route has two major advantages, first, more multimodal stations, and second, higher accessibility of LRT stations. However, it also poses environmental challenges: (i) it would pass through the middle of one of the biggest park in the heart of the city; (ii) one important part of the new route was planned as an underground line, thus preserving the high car traffic on one of the city's main streets.

Experiential case 2 focused on simulating the EIA scoping phase in the new LRT project in the city of Seville. The city has two running LRT lines and a third one under discussion, which would connect the other two lines to the High Speed Train Station.

The environmental concerns were based on the fact that the new LRT project would primarily displace space currently occupied by soft transport modes (pedestrian and cyclists).

Andalusia's legal framework recommends administering a participant checklist during the scoping phase of EIA, which includes environmental authorities; other interested parties; and the general public. Based on both Andalusia's legal framework for EIA and previous experiences testing interventions in planning practice (Beukers et al., 2015; Te Brömmelstroet, 2013), our simulation of the scoping phase of EIA included 10 participants (see Table 2)

Table 2. Selection of workshops participants according to Andalusia's legal framework

2.3. How the effectiveness of interventions and mechanisms was assessed

Two complementary types of measures were employed: (i) an "ex-ante" and "ex-post" survey summarizing the participant's experiences of knowledge integration during the workshops; (ii) an in-depth discussion with participants about their perceptions of the process.

On the one hand, during the "ex-ante" survey (disseminated before the experiential workshops), participants were asked to indicate their perception on the knowledge integration during the scoping phase of EIA in real life, while the "ex-post" survey (disseminated after the experiential workshops) was orientated towards assessing if the perception of participants on knowledge integration had been changed as a consequence of the applied interventions and mechanisms. Both surveys had a similar structure based on four blocks. The first block focused on a global perception on knowledge integration. The second block was based on evaluating the effectiveness of the first intervention and trigger mechanisms to achieve the desired outcome of finding a balance between too much and too little information and complexity. The third block assessed if and how the second proposed intervention and trigger mechanisms achieved the desired outcome of using the EIA to lead a learning process. Finally, the fourth block focused on the capacity of the third proposed intervention and trigger mechanisms in achieving the desired outcome of adapting the participatory process to specific EIA characteristics in transport planning. Surveys mainly consisted of 9 rated statements on the participants' experience during the process (see surveys in Appendix B).

On the other hand, participants would be invited to discuss in-depth if, how and why they think the three tested interventions improved the integration of knowledge. The in-depth discussions were conducted in three blocks according with the three test interventions.

3. Results

3.1. Experiential Case Study 1: The modification of LRT route in Granada

In experiential case 1, the three theoretical interventions were operationalized as follows. After completing a pre-workshop with the participants, the simulation of the EIA scoping phase started with a face-to-face meeting between the mediator (an experienced consultant) and 1 EIA developer and 1 decision-maker to implement the intervention 1. During a different day-long session, interventions 2 and 3 were tested with all 10 participants.

The findings from experiential case 1 showed different results on the impact of the three interventions on knowledge integration (Figure 2). Intervention 3, which employed dialogue modes about specific and tangible assessment objectives in order to adapt EIA to the specific characteristics of transport planning, received the highest rating. In particular, during the focus group discussion at the end of the workshop participants perceived that *“they built and refined their knowledge about impacts and project alternatives through the mediator’s illustration of arguments, 3D animations, etc.”* Intervention 2, which focused on creating a multilateral dialogue space facilitated by a mediator with the aim to use the EIA as learning process, was rated less favorably. Specifically, participants highlighted during the focus group discussion that *“intervention 2 was hardly helpful for both reaching agreement between themselves and changing their individual views by learning from other participants”*.

Figure 2. Participant perception of the interventions’ effectiveness during experiential case 1

INTERVENTION 1: Creation of rules for participation and processing of information through face-to-face meeting between the mediator and 1 EIA developer and 1 decision-maker

The objective of this intervention was to achieve a balance between information and complexity during the scoping phase of EIA. The duration of the face-face meeting was approximately 1 hour and 20 minutes. The participants determined that (i) the main conflict to prioritize was the loss of green areas due to the rerouting of the LRT in Granada; (ii) the provided knowledge about impact should be distributed in different discussion packages (e.g. impacts on walkability, noise, urban landscape, etc.); (iii) the information provided by the other participants should be codified according to causes of impacts, their effects and possible solutions, and the information should be grouped according to the considered project alternatives; (iv) the duration of the dialogue space for interventions 2 and 3 should not be longer than 3 hours divided into two 1h 30m sections. The mediator summarized the main

agreements during the meeting into a dossier as “participation guidelines”, and shared them with the other participants 1 day before they took part in interventions 2 and 3.

Both the EIA developer and the decision-maker declared that *“the opportunity to meet each other face-to-face made them feel more open and able to achieve agreements about the rules of participation”*. The other participants highlighted that *“the creation of participatory rules was very useful during the workshop to systematize the dialogue about impacts and solutions according to each project alternative”*. During the ex-post survey, participants signaled that the most influential factor for achieving the desired outcome of finding a balance between too much and too little information and complexity was the predetermined length of the discussion as well as the agreement between the EIA developer and the decision-maker on how the information gaps should be covered, basically focusing the discussion towards identifying for each project alternative the causes of impacts, effects and solutions. While participants did perceive the effect of intervention 1 as positive, certain shortcomings were also highlighted. The EIA developer noted that *“the discussion between the participants sometimes veered off to topics not related to the central concern of the workshop (the impact on the new LRT route on the loss of green areas in the city)”*. Participants also agreed that *“the mediator should delineate the boundaries of the discussion more clearly during the presentation of the workshop as well as in the contents of the dossier with the “participation guidelines”*.

INTERVENTION 2: Creation of a multilateral dialogue space that is inclusive of all participants

The second intervention was implemented in order to promote the EIA as a learning process. Participants were seated in a circle facing each other. According to the participation guidelines established during intervention 1, at the beginning of the session the mediator explained that the workshop would be conducted in two parts/sessions. First, for 1 hour and 30 minutes participants would determine and discuss the impacts of each project alternative for the new LRT route. Participants were strongly encouraged by the mediator to indicate possible causes and effects for each impact. In the second part of the intervention, also lasting 1 hour and 30 minutes, the participants would propose and discuss the potential solutions for each project alternative.

During the focus group discussion at the end of the workshop, participants mentioned that *“this intervention did not sufficiently facilitate learning from each other as expected, due to the fact that they only had time to introduce their points and there was no time left for a substantive discussion”*. This fact was also highlighted by the EIA developer and the decision-maker. Both agreed that *“only a presentation of the views on impacts and solutions from each participant took place, with little to no discussion”*. Furthermore, they explicitly underlined that *“a more in-depth discussion about the participants’ views was strongly needed to achieve the objective of*

transforming EIA into a real learning process". The factor time was considered crucial during the open discussion to ensure an effective learning process during EIA scoping phase. The ex-post survey of participant perceptions showed that the most influent factors in achieving the desired outcome of using the EIA as learning process was that participants were free to express themselves as well as that they were listening to each other.

INTERVENTION 3: Using dialogue modes about specific and tangibles objectives

Intervention 3 was implemented together with intervention 2. The desired outcome was to adapt the participatory process to the transport planning field. The mediator during the first part of the intervention used photographs, 3Ds representations, simulation effects to introduce potential problems of the new LRT route on green areas in Granada (e.g. impacts on walkability, noise, urban landscape, air pollution etc.). In the second part of the intervention, the mediator illustrated the discussion on the potential solutions provided by each project alternative by presenting best practices from other cities and countries. A set of recommended impact thresholds (e.g. noise and air pollution levels) were also introduced to contextualize the effectiveness of the potential solutions during the discussion.

Participants were very optimistic about the effectiveness of this intervention, declaring that *"the used dialogue modes were crucial to focus the discussion on the particular context of transport planning and avoiding discussions about other secondary problems"*. The decision-maker was especially enthusiastic, highlighting that *"it helped to focus the discussion on transport impacts and solutions, providing very useful feedbacks to be considered during real-life decision-making processes"*. The ex-post survey showed that 3Ds animations and photographs were the most relevant factors behind the effectiveness of this intervention. In this way, participants declared that *"these dialogue modes helped them to clarify their views on impacts and potential solutions"*.

3.2. Lessons from Case 1: Refining the interventions

By analyzing the obtained results from the experiential case 1, two main directions of improvement were identified. The first and less significant is related to intervention 1 where participants signaled the need to clarify the boundaries of the discussion during the simulation of the scoping phase of EIA. The intervention should be revised by clearly indicating in the participatory rule dossier the boundaries of the discussion and the main topics. Also the mediator should be encouraged to clarify the topic for discussion at the beginning of the workshop and provide several reminders throughout the session.

Second, and more important, is the need to reinforce the use of EIA as a learning process in intervention 2. The main shortcoming identified by participants was the limited time available for discussing causes and effects and potential solutions of expected impacts. The proposal was to double the time spent during the

implementation of the intervention 2. During experiential case 1, this step of the workshop was operationalized as two sessions of 1h 30m each, held during the same day. The revised intervention in experiential case 2 was operationalized in two separate days of two 1h 30m sessions per day. The structure of the revised intervention can be consulted in Table 3.

Table 3. Operationalization of interventions for case 1

3.3. *Experiential Case Study 2: The implementation of a new LRT line in Seville*

In experiential case 2, the three theoretical interventions were operationalized based on the revisions adopted from experiential case 1. The simulation of the scoping phase of EIA also started with a face-to-face meeting between the mediator (again an experienced consultant in the field) and 1 EIA developer and 1 decision-maker. Interventions 2 and 3 were operationalized involving the same EIA developer and decision-maker as well as 2 participants from regional and local authorities, 2 participants from the Seville-well-being associations, and 1 landowner and 3 residents in the area.

The findings from Case 2 showed diverse results in whether and how the three revised interventions helped to improve the knowledge integration (Figure 3). First, intervention 1, based on creating rules for participation and information processing, was rated most favorably. In particular, participants shared during the focus group discussion that “*such participation guidelines were very effective to focus the discussion on relevant impacts of the project as well as the capacity to mitigate them*”. Second, the other two assessed interventions received similar evaluations of their effectiveness in facilitating knowledge integration.

Figure 3. Participant perception of the interventions’ effectiveness during experiential case 2

INTERVENTION 1: Creation of rules for participation and processing of information through face-to-face meeting between the mediator and 1 EIA developer and 1 decision-maker

As previously indicated, this intervention was revised by reinforcing the boundaries of the dialogue space in the participation guidelines as well as by encouraging the mediator to clarify the boundaries of the discussion at the beginning of the session. Permanent reminders were also incorporated during the sessions.

The duration of the face-face meeting between the EIA developer and the decision-maker was approximately 2 hours. They determined that (i) the simulation of the EIA scoping phase should focus on how the new LRT project in Seville is mainly affecting street space currently reserved for pedestrians and cyclists; (ii) the information regarding impacts provided by the other participants should be codified according to the identification of impacts and their potential to be mitigated as well as possible solutions; (iii) the information should be grouped according to the different project alternatives; (iv) the implementation of interventions 2 and 3 should take place during two different 3h session days. During the first day, participants would exclusively discuss the identification of impacts and their potential mitigation. During the second day, participants would exclusively discuss the potential solutions for the impacts identified on the previous day. The mediator translated the main conclusions from the meeting into a dossier, which summarized such agreements as “participation guidelines”, and distributed it to the other participants 2.5 days before the implementation of the intervention 2 and 3.

After the sessions, the EIA developer declared that *“achieving agreements with decision-makers on how to codify the information provided by the other participants was crucial to improving the utility of the provided knowledge in later phases”*. Furthermore, the decision-maker signaled that *“intervention 1 was key for reducing differences with EIA developers regarding which provided information could be useful to optimize the general process of EIA and how”*. The rest of participants, once received and used the guidelines for participation, highlighted that *“both the participation guidelines disseminated by the mediator and his efforts in conducting the meeting according to the dossier were really important for focusing the discussion on the impacts and their potential mitigation”*.

During the ex-post survey, most of participants signaled that the most influential factor for achieving the desired outcome of finding a balance between too much vs. too little information and complexity was the agreement on how to conduct the discussion on environmental impacts. They also highlighted during the ex-post survey the importance of establishing a predetermined length of discussion as a key success factor for achieving the expected outcome.

INTERVENTION 2: Creation of a multilateral dialogue space that is inclusive of all participants

Based on the lessons from case 1, the time for discussion was doubled. The second intervention was implemented during two separate days, in order to promote the EIA as a learning process. Participants were seated in a circle facing each other. According to the rules for participation established during intervention 1, at the beginning of the session the mediator explained to participants that the workshop would take two days. The first day, participants determined and discussed the

impacts of each project alternative as well as the capacity to mitigate the mentioned impacts during a 3 hour session. On the second day, again for 3 hours, participants discussed the potential solutions and corrective measures.

Afterwards, participants mentioned that *“this intervention permitted us to gain more insight than usually into what were relevant impacts and how to address possible solutions”*. In particular, they highlighted that *“meeting each other face-to-face triggered that participants felt more confident to participate as well as that they modulated part of their discourse hearing each other’s points”*. The EIA developer perceived that *“the information provided during the simulation of the scoping phase was richer than the information usually provided during real-life EIA scoping phases”*. Furthermore, the decision-maker highlighted *“the high-value of the discussion for determining priorities during the EIA process as well as for establishing the real scope of the EIA in the considered project”*. Certain shortcomings were also mentioned by participants. In general, most of participants agreed that *“the format of a multilateral dialogue space sometimes did not permit sufficient clarification of certain views on impacts and potential solutions, thereby providing EIA developers and decision-makers with potentially contradictory information on the assessment of the project”*. However, the decision-maker asserted that *“showing the different viewpoints was an excellent way to collect information, in order to take into consideration a wider perspective of the problem, which is in the end the real aim of the EIA scoping phase”*.

The ex-post survey showed that according to the participants the most influent factors were that participants were listening to each other and the fact that they felt free to express themselves. In addition, giving participants the opportunity to consider matters overnight and discuss them with family, friends or colleagues, could have a positive effect on the quality of their participation.

INTERVENTION 3: Using of dialogue modes about specific and tangibles objectives

The third and last intervention was simultaneously implemented with intervention 2. No improvements were proposed for this intervention from the case study in Granada. The first day the mediator used photographs, 3Ds representations, simulation effects to introduce potential problems of the new LRT line in Seville (in particular its effects on walkability and cycling). The second day, the mediator illustrated the discussion on potential solutions of each project alternatives by providing participants with best practice examples from other cities and countries. A set of recommended threshold for impacts (e.g. noise and air pollution levels) were also introduced, just like in experiential case 1.

The participants declared after the sessions that *“the intervention 3 helped to contextualize the scoping phase in the transport planning field, highlighting the most important problems in the sector”*. In particular, the EIA developer was really

optimistic with the intervention 3. In his opinion, “*the dialogue modes used by the mediators focused the dialogue among the participants on clear sustainability targets related to the project in discussion*”. However, certain potentials for improvements were also mentioned. Participants did not feel that “*the dialogue modes used by the mediator were a source of inspiration*.” They agreed that “*the illustration were not very inspirational for the participant (too obvious) in order to foster new (and additional) visions on the project*”.

3.4. Lessons from Case 2: Refining the interventions

Two main directions of improvement were identified. The first is related to the intervention 2 where participants highlighted the problems to achieve agreement on impacts and solutions during the dialogue space. The second is focused on intervention 3 where participants requested more inspirational examples during the dialogue phase (Table 4).

The intervention 2 could be revised by incorporating agreement techniques during its operationalization process (e.g. clustering points on a panel to focus the discussion, etc.). The mediator should be strongly encouraged to foster agreement process between participants as much as possible. On the other hand, the proposed revision of the intervention 3 is based on looking for non-conventional illustrations to provide additional sources of inspiration for the participants.

Table 4. Operationalization of interventions, limitations and improvements for case 2

4. Conclusion and discussion

The paper sought to answer the following research questions: *Which are useful interventions and mechanisms for improving the integration of knowledge during the scoping phase of EIA, and are they effective in the context of transport planning?* First, we presented a set of three specific interventions and trigger mechanisms, based on a review of scientific articles from EIA practice. Then, we tested whether the set of interventions worked in practice and why (or why not), in the context of two experiential case studies in Granada and Seville (Spain).

The problem of the knowledge integration in earlier phases of EIA in transport planning is severely under-researched in the academic field (Soria-Lara et al., 2015a). While the academic literature has produced promising theories for addressing these barriers (i.e. Gluker et al., 2013; O'Faircheallaigh, 2010 among others), they have rarely been translated into solutions applicable and testable in practice (see Section 2.1). Similarities and differences between the two experiential case studies offer insight into if the proposed interventions and trigger mechanisms worked (or did not work) and why. The participants in both case studies agreed on the effectiveness of intervention 1 – *creating rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers* – and the intervention 3 – *using dialogue modes about specific and tangible objectives*. The effectiveness of intervention 2 – *creating a multilateral dialogue space facilitated by a mediator* – was contingent on the time factor. According to participants from Granada, *“a real learning process was not conducted during the experiential workshop. Only a presentation of impacts and solutions from each participant was dealt with”*. The need to spend more time during the operationalization of intervention 2 was identified as the main problem, which was addressed during the second experiential workshop in Seville. In this case participants were quite enthusiastic about how *“they had modulated part of their discourse hearing each other's points”*, highlighting the use of the EIA as learning process.

The methodological design of the paper established two rounds of revising and testing proposed interventions. According to Straatemeier et al., (2010), the outputs and reflections from the first experiential case study in Granada were the inputs for the next experiential case study in Seville. This sequential process notably facilitated the improvement of the effectiveness of the intervention 2 during the second case study. New testing and revision rounds would contribute to continuous refining the interventions and could be the object of future research (e.g., how optimize EIA's capacity to lead learning processes). Accordingly, the generation of new knowledge from this research should not be interpreted as universal prescriptions in the field of EIA application for the transport sector, but rather as a design example of potential solutions for the challenge of the knowledge integration. Beukers et al. (2015) arrived at a similar conclusion in their study. In this case, the authors also used experiential workshops as a method to design possible solutions/rules to improve a set of

process-related barriers to the application of Cost-Benefit Analysis (CBA) in Dutch transport planning (fundamentally to improve communication and trust between CBA users).

Future research aiming to provide more robust results could focus on observing and reflecting on the presented interventions in real-life situation as well as on evaluating past EIA experiences (ex-post case studies) varying on input (interventions) and/or output (outcomes). More rigorously experimental settings (e.g. including control groups) could help isolate the impact of specific interventions. Furthermore, testing the proposed interventions in other geographical and institutional contexts would help harness more insight on the effectiveness of the interventions and trigger mechanisms.

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APPENDIX A: EXPERIENTIAL CASE STUDIES – ORGANIZATION

A common protocol has been designed to ensure a shared methodology and analytical framework for the two study-cases considered in the research. The workshop organization followed a four-step logic in which the three proposed interventions in Section 2.1 will be carefully implemented.

Step 1: Pre-workshop

After participants agreed to participate in the workshop, they were firstly contacted by the researchers by phone; skype or even through a personal interview. This first meeting with local participants provided the opportunity to introduce the research and the thematic that would be covered in the course of the workshops.

Participants would be contacted one-and-a-half months before the workshops. They have to agree on the importance of the Scoping Phase of EIA; its objectives; and the problems identified during the implementation of the Scoping Phase of EIA in the field of transport planning.

Just before the implementation of the workshops, participants would be encouraged to fill in an “ex-ante” survey (see Appendix B). The aim of the “ex-ante” survey was to gain insight into the current state of practice during the Scoping Phase of EIA in transport planning. Specifically, it aimed to know: how participants experience the present process (use of the EIA in the transport planning field)

Step 2: Intervention 1 based on creating rules for participation

The first proposed intervention by the research is the *creation of rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers* (see table 1). This intervention would be implemented during the Step 2. Through this is expected to find the balance between too much and too little information and complexity during the implementation of the Scoping phase of EIA.

On a separated day of the rest of interventions, the three mentioned actors (EIA developers; decision-makers and mediators) would meet face-to-face for approximately 1 hour. They would determine in a procedural way:

- How the environmental issues will be addressed during the Scoping Phase;
- How the information gaps should be covered;
- How can conflicts be prioritized to be discussed and how;
- The duration of the participatory process;
- How to codify the information provided by stakeholders and the public.

At the end of the meeting, the researchers -who act as mediators during the workshops- would elaborate a brief report summarizing such the rules for participation.

Step 2: Interventions 2 and 3 based on creating a multilateral dialogue space by the use of dialogue modes about specific and tangibles objectives.

Interventions 2 and 3 will be simultaneously implemented during this step. Mediators will promote the use of EIA to lead a learning process by *creating a multilateral dialogue space* (see intervention 2 in table 1). In this way, EIA developers and stakeholders will meet face-to-face and share their views about the extent and the scope of the EIA. Stakeholders will have the opportunity to get know each other and build relationships, which will enable them to better assess how others may react in future interactions. In addition, this permits to modulate their views and interpretations by learning from other participants during the process. The mediator will have a central position in ensuring that no participant/group takes a dominant role in the discussion. To do that, mediators should use the participation rules established in the step 1.

To make operative the creation of a multilateral dialogue space, mediators will use *dialogue modes about specific and tangibles objectives, such as impacts and the treatment of transport project alternatives* (intervention 3). Specifically, mediators will structure the session in two phases (even on separated days if necessary to prepare material):

- *Phase 1 (1h 30 min)*: participants will determine what environmental impacts (e.g. air; water; noise; green space; biodiversity; landscape; etc.) will be discussed, and why. To do that:
 - o First, mediators will firstly introduce the problematic for 15 minutes using photographs; videos; figures; etc.
 - o Second, participants will be encouraged to discuss freely for the next 60 minutes about what environmental impacts should be assessed, and why.
 - o Third, during the last 15 minutes the mediators will summarize the main conclusions and agreement achieved between participants.
- *Phase 2 (1h 30 min)*: participants will discuss on how project-alternatives are *generating* environmental impacts, and why (cause-effect logic), as well as they will discuss about the adoption of specific thresholds. To do that:
 - o First, mediators will firstly introduce the problematic for 15 minutes using photographs; videos; 3D animations; etc.
 - o Second, participants will be encouraged to discuss freely for the next 60 minutes about how project alternatives are generating impacts and why, as well as the adoption of possible thresholds. Mediator will stimulate the discussion using examples from other transport projects; legal frameworks, etc.
 - o Third, during the last 15 minutes the mediators will summarize the main conclusions and agreement achieved between participants.

Step 4: Post-workshop evaluation

During the Step 4, a final evaluation will be conducted by researchers about how the effective were the three proposed interventions to improve the knowledge integration during the Scoping phase according to the perception of participants. This step will be completed in two phases:

- Phase 1: in 15 minutes, participants will be encouraged to fill in an “ex- post” survey (see appendix 4). The “ex-post” survey has been designed on the same statement that the “before-survey”. This will provide researcher specific quantifiers about the effectiveness of the three interventions. Furthermore, filling in the survey participants can reflect on the process and their mind will start to be prepare for a later discussion.
- Phase 2: during 40 minutes, participants will freely discuss on what interventions worked or did not work and why. They will encourage to propose new improvements for the interventions, etc.

APPENDIX B: THE “EX-ANTE” AND “EX-POST” SURVEY

EX-ANTE EVALUATION	EX-POST EVALUATION
Desired general outcome: improving knowledge integration from multiple perspectives and stakeholders during the scoping phase of EIA in transport planning	
-How is the integration of different types of knowledge (e.g. stakeholders, expert) during the scoping phase of EIA in transport planning? Very poor: 1 2 3 4 5: Very good	-How was the integration of different types of knowledge (e.g. stakeholders, expert) in the workshop? Very poor: 1 2 3 4 5: Very good
Desired specific outcome 1: finding a balance between too much and too little information and complexity	
-How well does the information obtained during the scoping phase of EIA in transport planning balance between the extremes of being too much and too complex and too little and too simplistic)? Unbalanced: 1 2 3 4 5: Balanced	-How well did the information obtained during the workshop balance between the extremes of being too much and too complex and too little and too simplistic)? Unbalanced: 1 2 3 4 5: Balanced -Can you rank the following factors according to their contribution to this outcome? <input type="checkbox"/> A predetermined length of the discussion <input type="checkbox"/> Agreement on how to conduct the discussion of environmental impacts <input type="checkbox"/> Agreement on how information gaps should be covered <input type="checkbox"/> Agreement on how to prioritize what types of conflict should be covered -In your opinion, please indicate what other factors were influent in this outcome, and why:
Desired specific outcome 2: using the EIA to lead a learning process	
-Is the EIA in transport planning a tool used to facilitate a learning process between involved actors (e.g. experts learning form stakeholders, and stakeholders learning from experts)? Not at all: 1 2 3 4 5: Completely	-Was the EIA a tool used to facilitate a learning process between the involved actors in the workshop? Not at all: 1 2 3 4 5: Completely -Can you rank the following factors according to their contribution to this outcome? <input type="checkbox"/> Participants were free to express themselves <input type="checkbox"/> All information was openly shared among participants <input type="checkbox"/> Participants were listening to each other <input type="checkbox"/> Participants were engaging with each other views <input type="checkbox"/> The mediator supported the process of mutual learning between participants -In your opinion, please indicate what other factors were influent in this outcome, and why:
Desired specific outcome 3: adapting participatory processes to the specific EIA characteristics in transport planning	

<p>-Is the EIA sufficiently adapted to the specific characteristics of transport planning?</p> <p>Not at all: 1 2 3 4 5: Completely</p>	<p>-Was the EIA sufficiently adapted to the specific characteristics of transport planning in the workshop?</p> <p>Not at all: 1 2 3 4 5: Completely</p> <p>-Can you rank the following factors according to their contribution to this outcome?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Illustrated arguments and 3D animations used by the mediator helped to adapt the EIA to the transport planning context <input type="checkbox"/> The used dialogue modes based on thresholds and cause-effect logic helped to adapt the EIA to the transport planning context <input type="checkbox"/> The discussion was focused on the strengths/weakness of transport planning alternatives <p>-In your opinion, please indicate what other factors were influent in this outcome, and why:</p>
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Table 1. Interventions and mechanisms for improving knowledge integration

INTERVENTIONS AND MECHANISMS				
Context	INTERVENTIONS	MECHANISMS	Outcomes	
			Specific	General
In the context of the scoping phase of EIA in transport planning...	[1] ...creating rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers...	<p>...to invoke the mechanisms by which:</p> <ul style="list-style-type: none"> • Mediators, EIA developers and decision-makers have the opportunity to get to know each other; • Then, they can better define rules for participation and processing of information; • Such rules will facilitate a process where different views and dimensions are recognized but complexity does not become unmanageable by covering issues such as: which topics will be addressed; which information gaps should be covered; what types of conflicts should be prioritized to be discussed and how; how long should the participatory process take; what is the optimal number of participants? 	...to find a balance between too much and too little information and complexity	...to improve knowledge integration from multiple perspectives and stakeholders
	[2] ...creating a multilateral dialogue space facilitated by a mediator...	<p>...to invoke the mechanisms by which:</p> <ul style="list-style-type: none"> • Stakeholders and the public feel encouraged to participate; • They feel safer under free speech conditions; • They could build relationships, which can be useful to share detailed information about projects in a process of mutual learning; • Stakeholders can better understand each other's standpoints, increasing opportunities for reaching agreements; • They can change their own views by learning from other participants. 	...to use the EIA to lead a learning process	
	[3] ...using dialogue modes about specific and tangible objectives, such as impacts and the treatment of transport project alternatives...	<p>...to invoke the mechanisms by which:</p> <ul style="list-style-type: none"> • Stakeholders and the public can focus their participation on the strengths/weakness of project alternatives; • They can provide solutions for the considered alternatives; • They can build their knowledge about project alternatives by illustrating arguments; 3D animations, etc. • They can focus on environmental tangible objectives, such as thresholds, cause-effect logic, etc. 	...to adapt participatory processes to the specific EIA characteristics in transport planning	

(Source: Soria-Lara et al., 2015b)

Table 2. Selection of workshops participants according to Andalusia's legal framework

Andalusia legal framework		Participants Case Study 1	Participants Case Study 2
Types of stakeholders	Description		
Environmental authorities	Regional and local authorities, authorities responsible for air quality, nature and landscape preservation, spatial planning, etc	-1 member from local authority -1 member from transport authority	-1 member from local authority -1 member from Andalusia environmental Ministry
Other interested parties	Sectorial governments, associations that represent users of the environment like hikers and tourist	-2 member of a local association for the protection of the environment	-1 member of a local association for the protection of the environment -1 member of a entrepreneurship association
The public	Landowners and residents, elected representatives and community figures, etc.	-2 Landowners -2 Residents	-2 Landowners -2 Residents
Others	Other people with interest in the project such as consultancy firms, etc.	-1 EIA developer (from a consultancy firm) -1 Decision-maker (from Andalusia government)	-1 EIA developer (from a consultancy firm) -1 Decision-maker (from Andalusia government)

Table 3. Operationalization of interventions for case 1

INTERVENTIONS	OPERATIONALIZATION CASE 1	LIMITATIONS CASE 1	REVISED OPERATIONALIZATION CASE 2
Creating rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers	<p>Face-to-face meeting for approximately 1h 20m;</p> <p>Achieving consensus mainly on how to participate and how to process the obtained information;</p> <p>Elaboration of rules for participation by the mediator and dissemination between participants.</p>	Participants sometimes did not focus the discussion on the main concern of the meeting, but they tended to discuss other secondary problems.	<p>Reinforcing the boundaries of the dialogue space in the participation rule dossier;</p> <p>Encouraging the mediator to clarify the boundaries of the discussion at the beginning of the session as well as making permanent reminders during the dialogue process.</p>
Creating a multilateral dialogue space facilitated by a mediator	<p>Face-to-face meeting conducted by a mediator;</p> <p>Two parts in the same day (1h 30m each):</p> <ul style="list-style-type: none"> - During the first part, participants share and discuss their point on potential impacts, their causes and effects of each project-alternative. - During the second part, participants share and discuss potential solutions for each project alternative. 	Limited time for the dialogue and discussion. Participants exposed their views on impacts and solutions; however, a more in-depth discussion was lacking. This limited the use of EIA as a learning process.	<p>Double the time available for dialogue and discussion;</p> <p>Extending this step of the workshop in two separated days:</p> <ul style="list-style-type: none"> - First day, two parts of 1h 30m each. In the first part, participants would share their views on impacts, causes and effects. In the second part, they would discuss in-depth the previously identified impacts - Second day, two parts of 1h 30m each. In the first part, participants would share their views on solutions for each project alternative. In the second part, they would discuss in-depth the previously identified solutions.
Using dialogue modes about specific and tangible objectives, such as impacts and the treatment of transport project alternatives	<p>The mediator used photographs, 3D representations, simulation effects to introduce the potential problems of each project alternative.</p> <p>The mediator illustrated the discussion of potential solutions of each project alternative by showing participants best practices from other cities and countries.</p>	No limitations were highlighted during the workshop of the experiential case 1	No modifications were proposed.

Table 4. Operationalization of interventions, limitations and improvements for case 2

INTERVENTIONS	IMPROVEMENTS FROM CASE 1	OPERATIONALIZATION CASE 2	LIMITATIONS CASE 2	REVISED OPERATIONALIZATION
Creating rules for participation and processing of information through face-to-face meetings between mediators, EIA developers and decision-makers	<p>Reinforcing the boundaries of the dialogue space in the participation-rule-dossier;</p> <p>Encouraging the mediator to clarify the boundaries of the discussion at the beginning of the session as well as making permanent reminders during the dialogue process.</p>	<p>Face-to-face meeting for approximately 2h;</p> <p>Achieving consensus mainly on how to participate and how to process the obtained information;</p> <p>Elaboration of rules for participation by the mediator and their dissemination among the participants.</p>	No limitations were highlighted during the workshop of the experiential case 1	No modifications were proposed.
Creating a multilateral dialogue space facilitated by a mediator	<p>Double the time available for dialogue and discussion</p> <p>Extending this step of the workshop to two separate days:</p> <ul style="list-style-type: none"> - First day: two parts of 1h 30m each. In the first part, participants would share their views on impacts, causes and effects. In the second part, they would discuss in-depth the previously identified impacts; - Second day: two parts of 1h 30m each. In the first part, participants would share their views on solutions for each project alternative. In the second part, they would discuss in-depth the proposed solutions. 	<p>Face-to-face meeting conducted by a mediator;</p> <p>Two parts in two different days (3h each day):</p> <ul style="list-style-type: none"> - During the first day, participants share and discuss their views on potential impacts and their potential to be mitigated. - During the second day, participants share and discuss potential solutions of each project alternative 	It was difficult to achieve agreement during the dialogue space.	<p>Incorporating techniques to achieve agreement among participants (i.e. clustering ideas in a panel, etc.);</p> <p>The mediator should be strongly encouraged to foster agreement processes among participants.</p>
Using dialogue modes about specific and tangible objectives, such as impacts and the treatment of transport project alternatives	No modifications were proposed.	<p>The mediator used photographs, 3D representations, simulation effects to introduce the potential problems of each project alternative;</p> <p>The mediator illustrated the discussion of potential solutions of each project alternative by showing participants best practices from other cities and countries.</p>	Illustrations were sometimes too obvious and did not always provide useful insights on impacts.	Using non-conventional illustrations and examples on impacts and solutions.

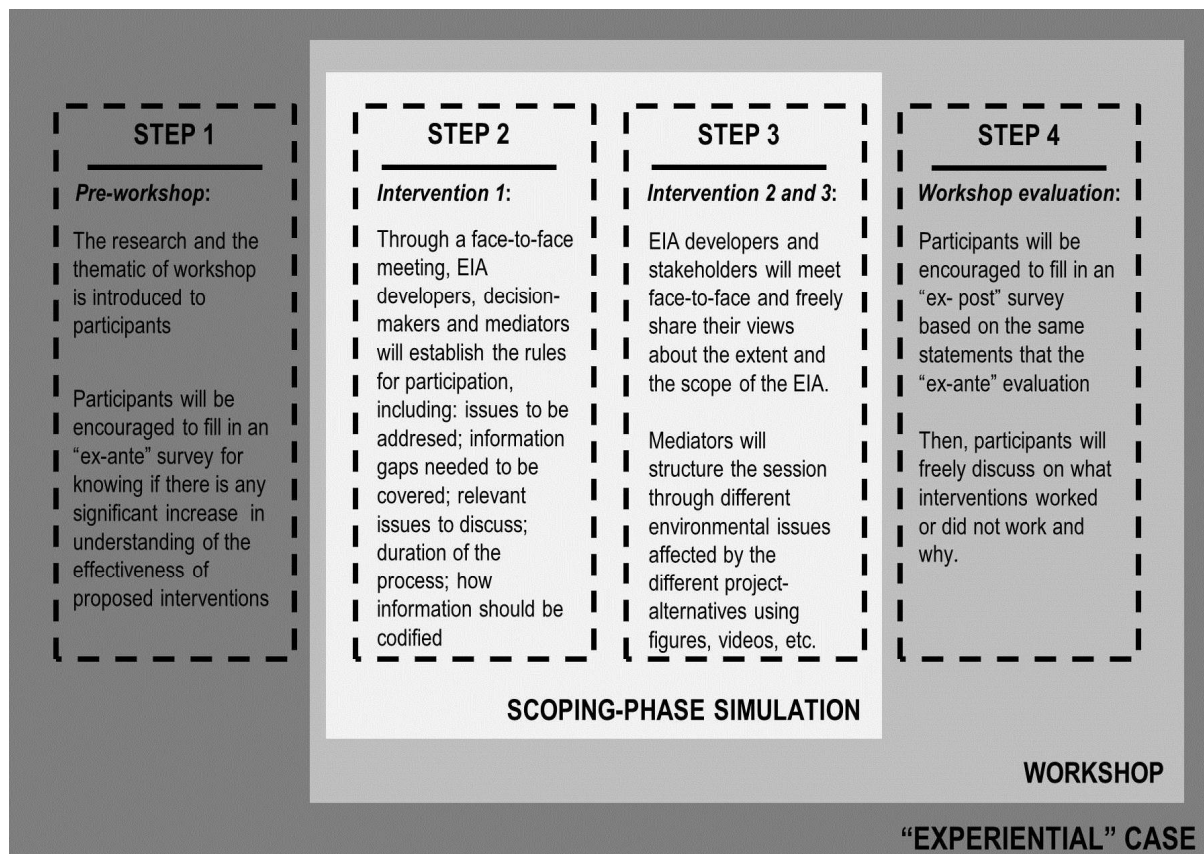


Figure 1. Setup of experiential case studies

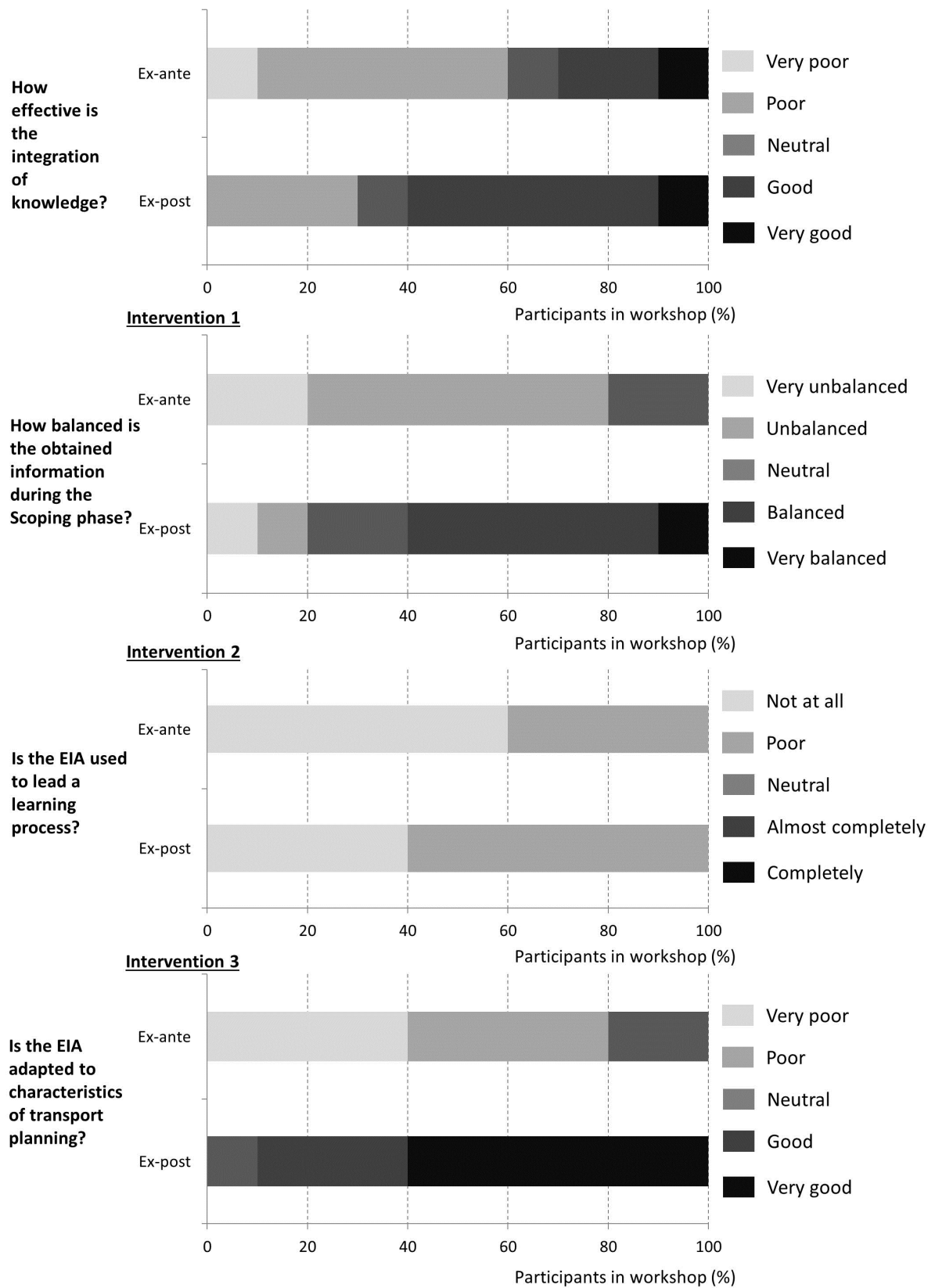


Figure 2. Participant perception of the interventions' effectiveness during experiential case 1

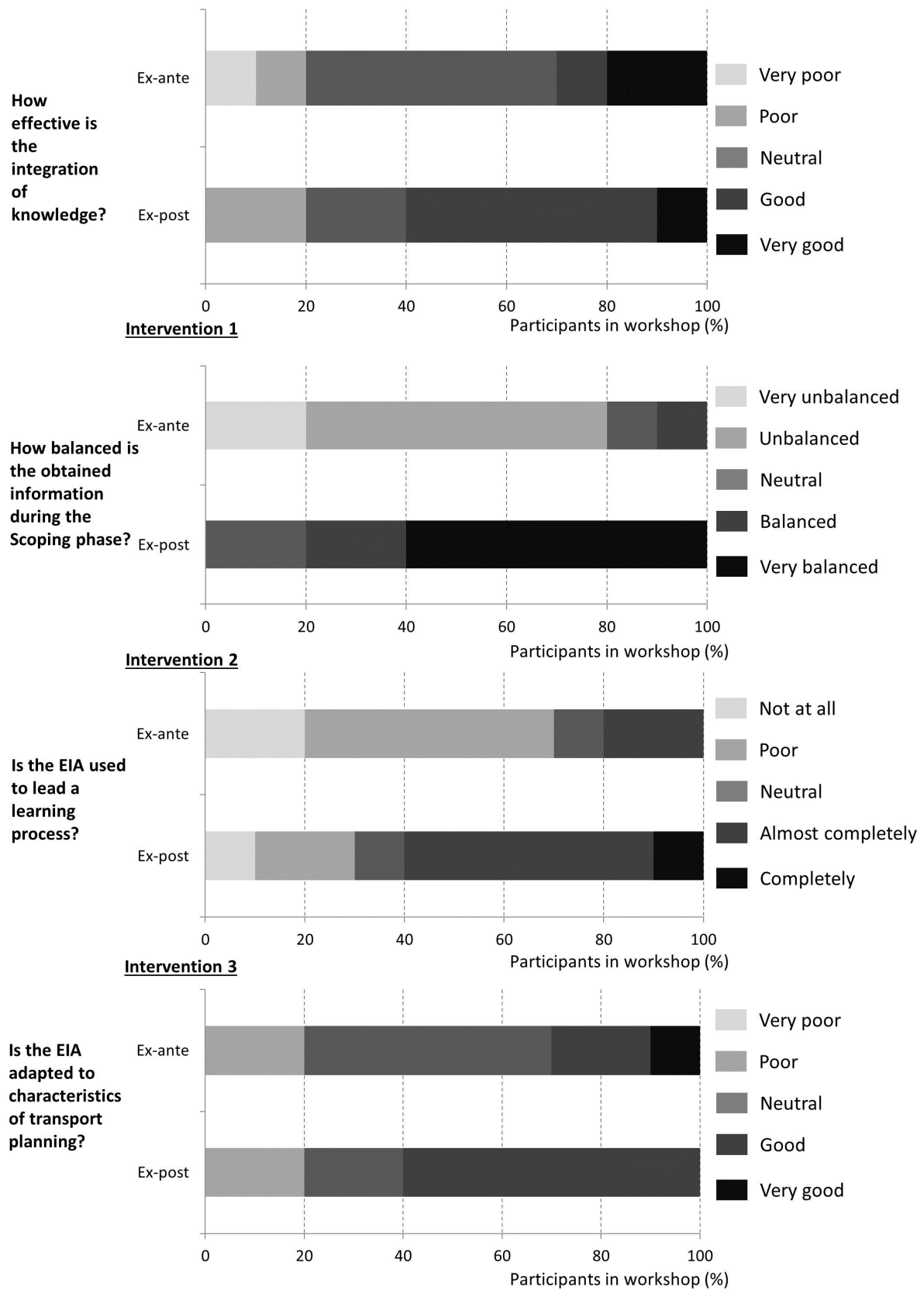


Figure 3. Participant perception of the interventions' effectiveness during experiential case 2

