

Redesigning Tools for Knowledge Exchange: An Improvement Framework

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Abstract: This research explores a new collaborative improvement framework called improvement matrix, where the instructions, functions and flexibility of tools are improved within three layers of engagement. This paper describes how the framework was tested in practice through a series of workshops, where engagement practitioners redesigned tools to improve their engagement practices as a part of a larger action research project. This research provided a dual outcome that enabled participants to gain a tangible benefit from improved versions of tools that came out from the process as well as enabled us to develop a deep understanding about the improvement process as the research output. The findings from three case studies suggest how the framework plays out in practice, providing guidelines on how to improve tools using the improvement matrix. We found that the matrix can be used for different purposes, such as improving flexibility of tools or designing facilitation approaches.

Keywords: Knowledge exchange, creative engagement, improvement, redesign, tools

1. Introduction

Knowledge Exchange (KE) involves sharing ideas, results, expertise and approaches among individuals to learn together about a situation. This approach enables people to collaborate in the decision-making of projects, programmes or policies that affect their lives. In these processes, tools are often used to facilitate a creative exchange among participants to achieve a desired outcome. A good KE design gets the most out of the knowledge, experience and creativity of the participants. However, generic or prescribed KE tools alone do not ensure a good design. This involves specialised tools for particular contexts, such as specific tools for engaging with young people (YP) or young adults. One approach to achieve more effective KE design is to improve existing tools. Traditional improvement processes involve transferring improved outcomes to organisations and communities to spread better practices. In contrast to this top-down approach, we put forward a bottom-up approach, where engagement practitioners, who understand their context best, improve tools to develop their practice.

In this paper, we propose a redesign approach, where participants experiment, improve tools and reflect on their processes. We explore how tools can be improved by testing a framework called Improvement Matrix. This matrix helps people to improve dimensions of tools within layers of engagement to meet their contextual needs. In this paper, we will explore how this was tested in practice through a series of workshops, where participants reviewed and improved tools. Research outcomes include which aspects to look at when improving tools through the redesign process. As a practical outcome, we developed improved versions of tools and made them freely available to download.

2. Improvement Concepts

The action of improvement involves changing any aspect of our life or work, or how an activity or product works, making it better than the current state by showing positive difference in results. In other words, an improvement can only be perceived if criteria are determined in the process of change, and not all changes result in improvement. Historically, improvements have been achieved through trial-and-error approaches, where people propose a change to a situation and see if it improves by tracking records of the change.

Current improvement approaches (e.g. Lean improvement, Six Sigma) communicate improvement through the traditional knowledge transfer, where improvements developed by experts are spread and adopted by individuals within organisations or communities. In KE research, everyone with an interest has something productive and creative to contribute to any process. In this paper, we propose an approach that places improvement in a closer relationship to KE research, which has a strong relationship to more participatory, open and co-design approaches. It moves away from researchers telling individuals best practices, and from consultation based design, where information extracted from individuals is used to develop improvements.

3. KE Design and Tools

In broad terms, KE design produces tools, mechanisms and activities to facilitate a creative exchange between people and organisations in order to achieve a desired outcome (Author, 2012). Tools are often designed to operate under a concept of a human activity, structuring the way people engage with tasks (Leont'ev, 1978; Suchman, 2007). A KE tool supports engagement practices, promoting the sharing of ideas, and helping practitioners to meet an objective. It could be about increasing awareness, building a network, understanding social situations and individuals within them, etc.

Designing a KE activity to engage with experts with different backgrounds involves considering the aims and objectives, audience, and facilitation approach. Experts are the stakeholders, the most influential people in the project (e.g. managers, policymakers), or public sector practitioners (e.g. health and social care professionals), or people affected by the project (e.g. YP, local communities). Understanding the background of those involved helps to design a structure, which enables engagement between participants, to meet KE objectives. Enabling participants to achieve these objectives is also part of KE design. A facilitator acts as an enabler to make sure everyone can contribute to an activity. This role requires using mechanisms, actions and techniques that have specific functions, such as energising participants and generating ideas (Tassoul, 2009). To support these KE designs, tools are often adopted to assist engagement practices.

There are a wide range of tools and toolkits for multiple applications freely and commercially available in the literature (e.g. Ketso toolkit, Oblique Strategies, and IDEO method cards). However,

prescribed or generic tools alone do not ensure a good KE design. Our previous studies have shown the need for engagement approaches tailored to particular contexts (Author 2012; 2017). Given that, this research will look at how practitioners can improve tools to develop their practices. It addresses the emergent question: How can KE tools be improved? We are seeking to explore how to improve existing tools to enable people to run better KE activities.

4. Methodology

In the 3-year AHRC-funded project entitled Leapfrog (www.leapfrog.tools), we have co-designed tools to support engagement practices in different aspects of the public sector (e.g. healthcare and library services). It aimed to transform public consultation through the development of new design approaches for the engagement of communities in public service decision-making. These emerging approaches employed KE tools that were co-designed in collaboration with public sector and community partners to support creativity and problem-solving abilities in non-designers without using designerly processes. These tools present suggestive and motivational instructions, and editable elements to support people in creating their own application of tools. As part of this larger action research, we looked at potential strategies for re-co-designing tools to improve KE designs.

This paper describes an action research project where engagement practitioners — as active agents of change interested in getting the benefits of improved tools — experimented, learnt and reflected on the process of improving Leapfrog tools and their practices, providing research data to test a new improvement framework. This study was approved by FASS-LUMS Research Ethics Committee (FASS-LUMS REC), and written informed consent was obtained from all participants.

4.1 The improvement matrix

In this paper, we propose and test an improvement framework in order to make KE tools more appropriate in engagement activities. Our experience in designing flexible tools, toolboxes and taxonomies to support people in creating their own application has shown that the function, instruction and flexibility of tools play out a role in enabling better KE design (Author, 2012; 2017). These three dimensions of tools were specified a priori as the constructs that helped to shape the initial design of this research.

Looking at the role of tools in KE design practices discussed in previous section, we propose three engagement layers where tools can be improved:

1. **Design** looks into the concept of a tool, and how the idea that underpins the tool and addresses challenges.
2. **Facilitation** looks at the actions and techniques a tool requires to enable the engagement of participants in KE activities.
3. **Application** looks at the practical use of tool by participants and how the tool operates when they are engaged in KE activities.

In this research, we selected cases that could extend the emergent theory, which is produced from the relationship between engagement layers and dimensions of tools called Improvement Matrix. The matrix is described as follows:

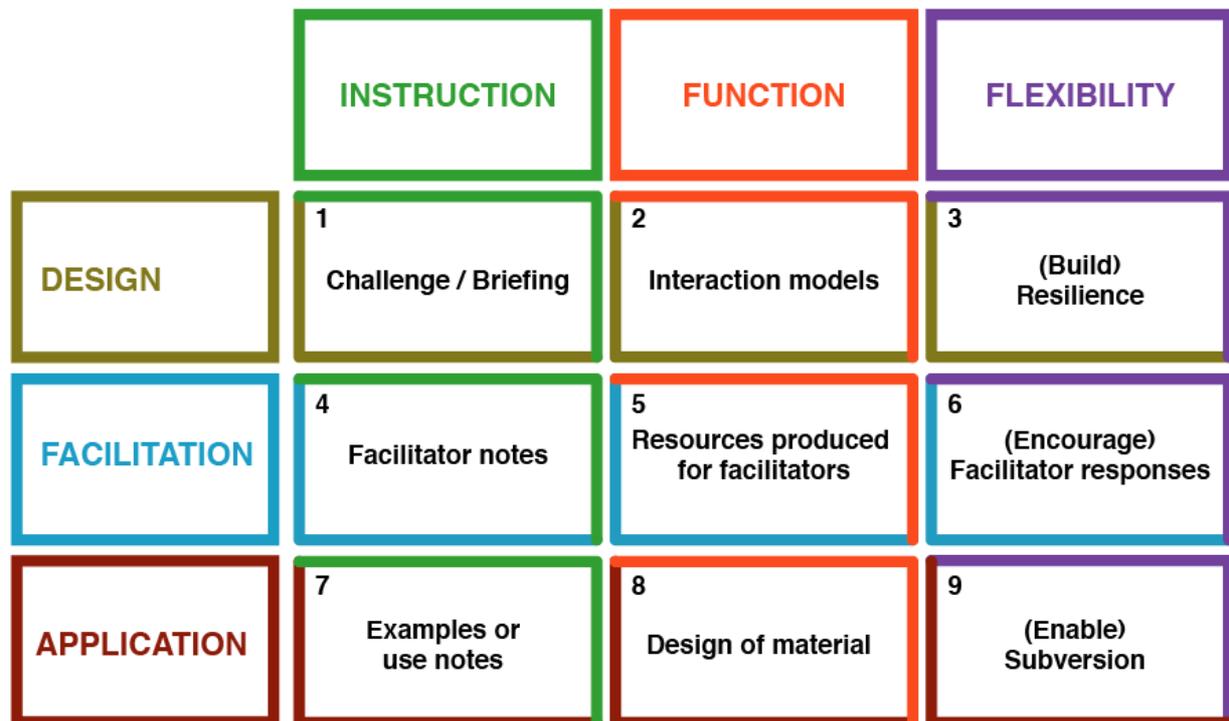


Figure 1. The improvement matrix: 9 components explored in a series of improvement workshops

1. **Challenge / Briefing** (Design + Instruction) guides the concept of a tool. A briefing documents a mutual and coherent understanding of objectives, challenges and issues among project stakeholders (Murphy & Hands, 2012). In tool design, the briefing describe the frame, in which a tool can address engagement challenges, providing essential information about its design. Improving the briefing involves changing the manner a tool is described to solve a challenge, making the problem solving more effective. For example, tool guidelines can be improved with different stories of use to change the way practitioners apply a tool in KE activities.
2. **Interaction models** (Design + Function) in interaction design describe how an interface should work and is organised to enhance the product use (Preece et al. 2002; Johnson and Henderson, 2002). In KE design, the concept of a tool binds the intentions and engagement context for which it was designed. In this context, individuals are involved in conversations through a KE tool, in which its concept enables creative engagement. For instance, the building success tool, a tool co-designed by Leapfrog, reflects the concept of library practitioners designing the space and resources in a building they work together, using bricks as a metaphor for the decisions they have to take about the space.
3. **Resilience** (Design + Flexibility) is the tool concept that accommodates unforeseen applications. In a project called Make It Stick (Author, 2017), a tool developed to enable creative engagement without the need for participants to write was designed to be customised, downloaded and printed out. However, the tool was not meeting the practitioners' needs due to the limited customisation. As a result, we redesigned the tool to allow people to apply it in unexpected ways.
4. **Facilitator notes** (Facilitation + Instructions) guide facilitators to use tools to enable creative engagement among individuals. These notes instruct practitioners how to facilitate activities to participants, describing actions required, tasks, wording, etc. For example, a YP's tool guidelines could instruct a facilitator to encourage

participants to draw ideas in a group, or ask them to individually write their ideas and share to the group according to their age range.

5. **Resources produced for facilitators** (Facilitation + Function) give support to practitioners to design their own facilitation approaches. These resources can include techniques, maps, and inspirational activities to help facilitators to guide their participants' actions in KE activities (e.g. prompt cards or stickers for engaging participants to exchange knowledge).
6. **Facilitator responses** (Facilitation + Flexibility) provide ways for practitioners to change their facilitation approach instead of sticking to a prescriptive plan. Creative facilitation responses to a challenge can be encouraged by providing different strategies and tips to engage with participants on different situations. For example, suggesting participants to use the blank spaces for an impromptu activity can be a way to improve the tool to support improvisation.
7. **Example or use notes** (Application + Instruction) instruct participants on how to fill in the blank spaces. For example, headings, captions, illustrated examples are elements that guide participants to complete an activity. Improving these elements involves making the wording appropriate to the audience.
8. **Design of material** (Application + Function) presents the appearance, and the features of a tool, i.e., the affordances (Norman, 1988) and visual design (e.g. diagrams, text boxes, etc).
9. **Subversion** (Application + Flexibility): Participants can use tools in unexpected ways, adopting a different attitude than what the tool or facilitator ask them to do in order to work towards a more creative dialogue and desired outcome. Alan Dix (2007) discusses about designing for appropriation, where a system allows unexpected uses through flexible attributes. For example, The Small Things, a tool co-designed by Leapfrog, has three coloured notes that allow different interpretations.

Given these definitions, we designed and delivered three workshops to test the improvement matrix in order to develop a 'thick' description of the framework. These improvement workshops were designed to collect data from multiple sources of data, with data converging in a triangulating approach in order to provide stronger substantiation of the emergent theory. We tested the theory through case study research, having grounded theory as a general strategy for conducting qualitative research. These workshops and case studies are described in the following sections.

4.2 Improvement workshops

We validated the improvement matrix in practice through a series of redesign workshops composed of three case studies. In these workshops, participants reviewed tools, documented their observations, improved, and evaluated whether the ideas were perceived as improvements or not. The Langley's 5 principles of improvement (2009) were used as a reference to develop the workshops, where each principle of the intervention is described as follows:

1. It is the aim of the improvement effort. That is, the improvement of the dimension of tools.
2. It is the criteria used to understand whether improvement is happening. Participants highlighted what needed to be changed in each dimension, allowing them to 'see' the resulting differences in outcomes.
3. It is the action of improving tools. Participants suggested proposals that may result in improvement.

4. It involves testing and learning whether the improvement suggestions produce positive impact in their own practice. Through discussing about the aspects of change, participants assessed whether their suggestions were considered improvements or not.
5. It involves the implementation, which is about how to make the improvement permanent. This stage is not described in this paper as it focuses on the execution after testing has shown the proposals lead to improvement, although we redesigned tools and made them available to participants.

We designed and further refined the following workshop structure – pilot tested in practice with Lancashire County Council engagement practitioners on the 27/11/2017 – used in our case studies:

Table 1. Workshop structure

Step	Activity / Actions
Arrival	Read PIS and complete consent form
Introduction	Warm up exercise, introduction, objectives, and definitions of tools
Round 1	Review instructions and suggest improvements
Round 2	Inspect functions and suggest improvements
Round 3	Explore flexibility aspects and suggest improvements
Testing and learning together about the impact of the changes	Firstly, groups look across the set of proposals, discuss and rate each suggestion. Secondly, groups present a summary of what they learnt from their assessment. Thirdly, all participants discuss about what actions are warranted.
Wrap up	Conclusion

Participants were divided into 3-5 groups of 2-3 members each, providing a strong substantiation of the improvement matrix and multiple perspectives on the process (Figure 2). Then, we asked participants to highlight aspects that needed to be changed and provide improvement suggestions in each round. They responded to each task by documenting their observations and generating ideas on a pro forma (Figure 3) we provided in each round. At the end of the round, each group moved to the next table and improved another tool, looking at a different dimension. After the round 3, participants returned to their initial tool to assess the set of proposals in an evaluation sheet (Figure 3), and discussed what actions were warranted. These multiple data collection methods and types of data provided us with considerable saturation and triangulation of data that are summarised below:

Table 2. Framework of analysis

IMPROVEMENT STAGE	CATEGORIES (How to improve the instructions/functions/flexibility of tools)
Documented observations	Criteria for judgement (written responses in the pro forma)
Improvement suggestions	Ideas to improve the tool (written responses in the pro forma)
Testing (evaluate ideas) and learning (what action is warranted?)	Evaluate what ideas will result in improvement (written responses from the evaluation sheet) Group discussion to summarise learning from the evaluation and decide which actions are warranted (Audio recording of the discussions)



Figure 2. Workshop layout and group dynamics at the University of Limerick

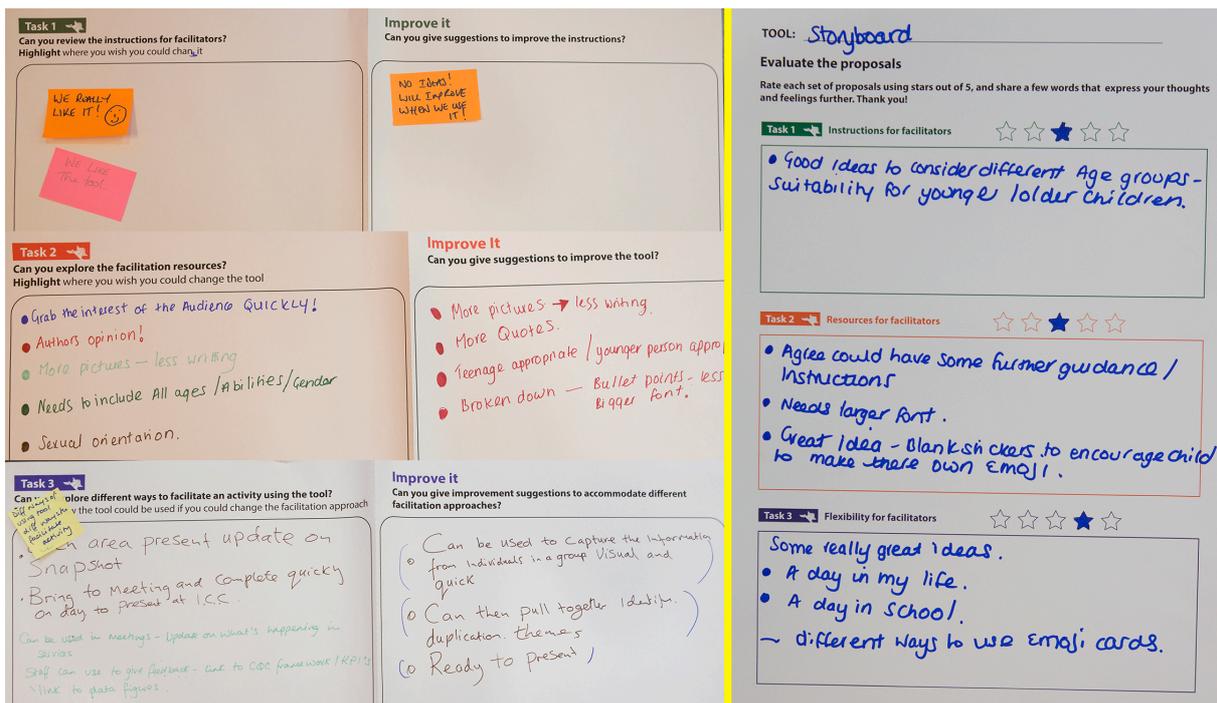


Figure 3. Pro formas (left), and evaluation sheet (right)

We invited engagement practitioners to help with the research and, as a benefit of taking part of it, they have received the improved tools that came out from the improvement workshop. This research relies on theoretical sampling, where cases were chosen to fill theoretical categories, i.e., the engagement layers of the improvement matrix. We chose cases that could extend the emergent theory, where participants provided descriptions, drawings, and notes about their observations on the dimensions of tools as well as improvement suggestions. We captured audio via Dictaphone from

participants' presentations and discussions as well as their written responses from the pro formas. The case studies are described in more detail in the following section.

The data analysis followed an analytic strategy of examining, categorising, tabulating, testing and recombining evidence in order to draw conclusions. A coding technique was performed to examine and tabulate data, identify and categorise ideas. Then, a process of discovering meanings and patterns through data interpretations were performed through a cross-case analysis. A table with each stage of the process within the improvement matrix table was used to cross-compare data and draw insights in order to establish constructs and theory validity as illustrated in the Figure 4.

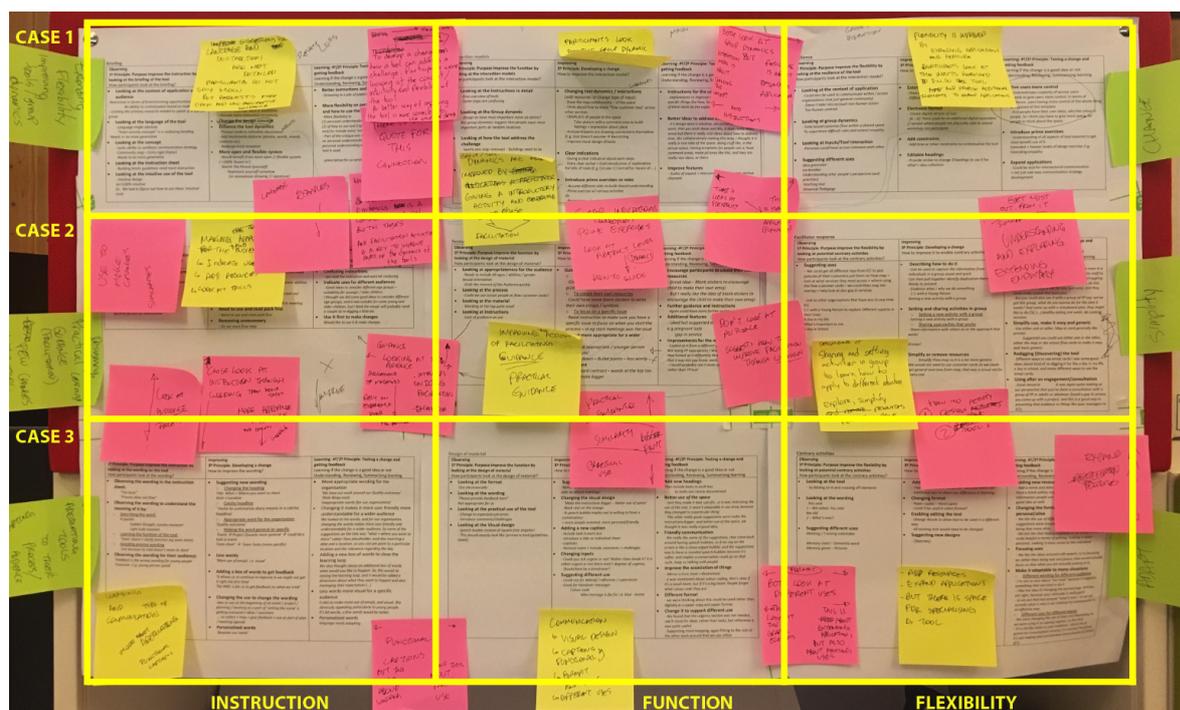


Figure 4. The sensemaking process and cross-case analysis

4. Case studies

The action research design builds on current KE design practices (Swan, 2002), adding the improvement matrix to redesign KE tools. It comprises of three cycles, where we delivered workshops to practitioners from different organisations and backgrounds to test each layer of the framework:

1. **Design:** 8 DRS2018 delegates attended to a workshop delivered on 25/05/2018
2. **Facilitation:** 7 YP's practitioners attended to a workshop delivered on 26/07/2018.
3. **Application:** 15 healthcare improvement officers attended to a workshop delivered on 05/04/2018.

Research outcomes of each action cycle informed us how the improvement of tools within each layer of engagement worked in real-world situations. We reported our outcomes on the Leapfrog website, and created diagrams in order to help with the data analysis of this research. Each case study as well as the analysis of the data provided by participants, and the research findings are described in a top-down order in the following sections.

4.1 Improving the design with DRS2018 delegates

The workshop ‘Improving Creative Engagement Tools’ was held during a one-day event (PhD by Design) prior to the Design Research Society 2018 at the University of Limerick. We invited delegates who work with groups of non-designers, and design researchers specialised in participatory approaches and tools. The delegates attended to a 1.5-hour workshop, where we presented a toolbox co-designed by library practitioners that addresses the challenge of bringing multiple services together in one place. Participants looked at the design layer, and improved the three dimensions of tools: Briefing / Challenge, Interaction model, and Resilience.

Briefing / Challenge

When participants were improving how a tool addresses specific challenges, they provided generic suggestions to improve instructions (e.g. ‘Provide inspiring examples’, and ‘Review language used in guidelines’), but more specific solutions to improve the concept and the flexibility in understanding the tool (e.g. ‘Represent yourself somehow or anonymous drawing // signature’, and ‘Would benefit from a more open // flexible system (less boxed in)’). These findings are described as follows:

Table 3. Improving the Briefing / Challenge

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Intuitive use (usability)
	Language and instructions
Improvement suggestions	Generic improvement instructions
	Specific improvements to the function and flexibility
Summarising learning	Changing the concept to improve personal understanding
	Providing more flexibility on understanding and how to use tools

Interaction models

When participants were improving the design concept, they suggested improvements to the group dynamics and the tool interactions to address a challenge as well as other suggestions on how to improve the facilitation of activities. These findings are described as follows:

Table 4. Improving the interaction model

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Group dynamics
	Concept (Addressing the challenge with the tool)
	Restrictive elements
Improvement suggestions	Changing group dynamics / interactions
	Providing ideas to facilitate initial activities
Summarising learning	Providing specific instructions (How, how long, who, etc) to improve the usability of tools
	New ideas to address the challenge

Resilience

When participants were improving flexibility, they explored different applications of tools in engagement activities, and suggested improvements to extend features, format or editable elements in order to give users more control and extend understandings of tools. These findings are described as follows:

Table 5. Improving the resilience

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Context of application
	Group dynamics
	Types of inputs and interactions
	Different uses
Improvement suggestions	Extending features
	Suggesting electronic formats
	Enabling editable headings
Summarising learning	Giving users more control
	Extending understanding of the tool

4.2 Improving the tool facilitation with the children's champions team

The children's champions team is responsible for looking after children and their needs in the local communities of South Cumbria and North Lancashire (UK), as part of a joint health and care system called Integrated Care Communities (ICC). The team is a group of health and care practitioners (nurses, therapists, general medical practitioners, etc.) who wanted better assets and engagement, to get their point across ICCs, and to demonstrate through tools the work they have been doing in different projects. We invited the team to improve 3 tools from a short list of tools in a 3-hours workshop at the ImaginationLab, where they looked at the facilitation layer, and improved three dimensions of tools: Facilitator notes, Resources for facilitators, and Facilitator response.

Facilitator notes

When participants were improving the facilitator instructions, they suggested a need to use it first before proposing improvements, although one group suggested indications on how to use the resources of tools to engage with different audiences. These findings are described as follows:

Table 6. Improving the facilitator notes

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Background of the audience (age, experience)
	Need to use first
Improvement suggestions	Indications of use according to the audience
	Need to use first
Summarising learning	Indicate uses for different audiences
	Use it first to suggest improvements

Resources for facilitators

When participants were improving the facilitation resources, they looked at how to facilitate activities using tools. They noticed that tools were lacking guidance on how to use it, and were not including all ages, abilities, gender and sexual orientation. They proposed suggestions on how to guide participants to complete tools throughout a KE activity. These findings are described as follows:

Table 7. Improving the resources for facilitators

IMPROVEMENT STAGE	CATEGORIES (How to improve the resources for facilitators?)	
Documented observations	Appropriateness for the audience	
	Different concept (design)	
	Guidance on use	
Improvement suggestions	Guiding participants	<ul style="list-style-type: none"> - to fill in the template - to create their own resources - to focus on a specific issue - through the visual design of the tool
	Making it more appropriate for a specific audience	
Summarising learning	Additional resources	
	Further guidance and instructions	

Facilitator response

When participants were looking at flexibility through exploring different facilitation approaches, they proposed descriptions on how to facilitate an activity, suggested setting activities and sharing approaches that work as a group, and simplifying resources to enable creative facilitation. Exploring, designing and sharing approaches that work as a group are the ways to improve the facilitator response. These findings are described as follows:

Table 8. Improving the facilitator response

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Suggestions of use
Improvement suggestions	Describing how to facilitate an activity
	Setting and sharing activities in group
	Simplifying or removing resources
Summarising learning	Designing different activities as a group
	Exploring tools and improving the facilitation by looking at the organization's perspective
	Simplify use, make it easy and generic

4.3 Improving the application of tools with Lancashire Care Quality Improvement team

The team is composed of different health service specialists who liaise with the public and deal with complaints of various levels. They were interested in creating their own tools for their own organisation. Considering this opportunity, we invited the team to improve 5 tools from a short list of tools in a 3-hours workshop at the ImaginationLab, where they looked at the application layer, and improved three dimensions of tools: Example or use notes, Design of material, and Subversion.

Example and use notes

When participants were improving these notes, they suggested different wording to make tools more relevant to their organization, more catchy, or more general/specific to audiences. Participants concluded that changing the words makes tools more user-friendly and more appropriate for a particular/wider audience. They also suggested the inclusion of words to improve the use of tools (function). These findings are described as follows:

Table 9. Improving example and use notes

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Visual design (Concept)
	Inappropriate wording
Improvement suggestions	Different wording <ul style="list-style-type: none"> - Catchy headline - Appropriate words for the organisation - More generic - More specific
	Changing the use to change the wording
Summarising learning	Choose more appropriate words to the audience <ul style="list-style-type: none"> - wider audience - specific audience
	Changing and adding words to improve the process

Design of material

When participants were improving the design of material, they suggested different tool uses, and changes on the visual design, the captions, the format, the types of inputs. They also proposed suggestions to improve the visual design, providing a more friendly communication to their audience. These findings are described as follows:

Table 10. Improving the design of material

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Format
	Caption
	Visual design
Improvement suggestions	Different format

	Changing the visual design
	New captions
	Changing inputs
	Different uses
Summarising learning (what action is warranted?)	Better use of the space
	Friendly communication
	Improve the association of things
	Different format
	Add new captions
	Simplify tools to support different uses

Subversion

When participants were looking at flexibility through exploring unexpected ways to use the tool, they looked at the wording, features and tool applications, and proposed improvements to accommodate distinct approaches, such as different formats, new designs, resources and features. Enabling participants to perform subversion is about making a tool more versatile, embracing a variety of functions, but also making it more focused on a situation. These findings are described as follows:

Table 11. Improving subversion

IMPROVEMENT STAGE	CATEGORIES
Documented observations	Removing features
	Suggesting different wording
	Suggesting different uses
Improvement suggestions	Adding new resources/features
	Changing format
	Enabling editable captions
	Suggesting new designs
	Suggesting different use
Summarising learning	Adding new blank spaces
	Changing the format to make it personal/alive
	Focusing uses
	Make it adaptable to many situations

5. Insights

The case studies demonstrate how the improvement matrix works in practice and supports the improvement of tools to enable better KE design. The findings from this study provide important insights on how to apply the framework, and how it plays out in practice. These findings extend the emergent theory, providing detailed information about the dimensions and components of the framework, described in the following subsections.

5.1 Layers of engagement

Improving tools through layers of engagement provided indications on the aim or purposes of the improvement effort in each layer.

Design - Participants focused on improving the flexibility in understanding and using. They suggested less prescriptive designs and instructions, expanding the applications and allowing interpretation of tools.

Facilitation – Participants focused on improving facilitation approaches by providing indications for tool resources, and expanding applications through additional resources and further guidance to the audience.

Application - Participants focused on tailoring tools to specific audiences and their organisations. Their suggestions focused on improving visual and written communication through changing the words and visual design of tools in order to make them more appropriate to their contexts.

5.2 Dimensions of tools

We cross-compared the data and drawn insights from the three main constructs/dimensions of tools within case studies, providing different types of tool improvements.

Instructions provide improvements to three main aspects that interrelate with each other: audience, interpretation, and language. When participants looked at the Briefing/Challenge and the Facilitator notes, they documented a need or attempt to intuitively understand or use first before suggesting improvements. Changing the order the instructions are improved may provide different results. Additionally, language improvements were a consensus in both cases, although the first case provided generic tool improvements, whereas the second case provided more specific improvements to the wording. When looking at the facilitator and use notes, improvements were focused on indicating resources or tailoring the instructions to the audience.

Function provides improvements to the group dynamics, the facilitation and the tool use by participants. It implements two different improvements that interrelate with each other: practical guidance and new visual design concepts. We found similarities between the Mark Tassoul's (2009) creative facilitation and the types of facilitation improvements. He highlights a session should have introductions and guidance during the process, and these were covered in different cases: interaction models and resources for facilitators.

Flexibility provides improvements to the application of tools through designing new or flexible resources, and on how to develop facilitation approaches as a group. We found a similarity between the flexibility components: resilience and subversion. Although the improvement focus on each case study was different, participants suggested similar improvement and rationales for tools. While in one case (design) was more focused on providing less prescriptive solutions, in the other case (application), participants contrasted between focusing the use of a tool and making it adaptable to many situations.

5.3 Components and general insights

Based on the above findings, we suggest some changes in the names of the components to make them more appropriate to the descriptions developed in this research as follows:

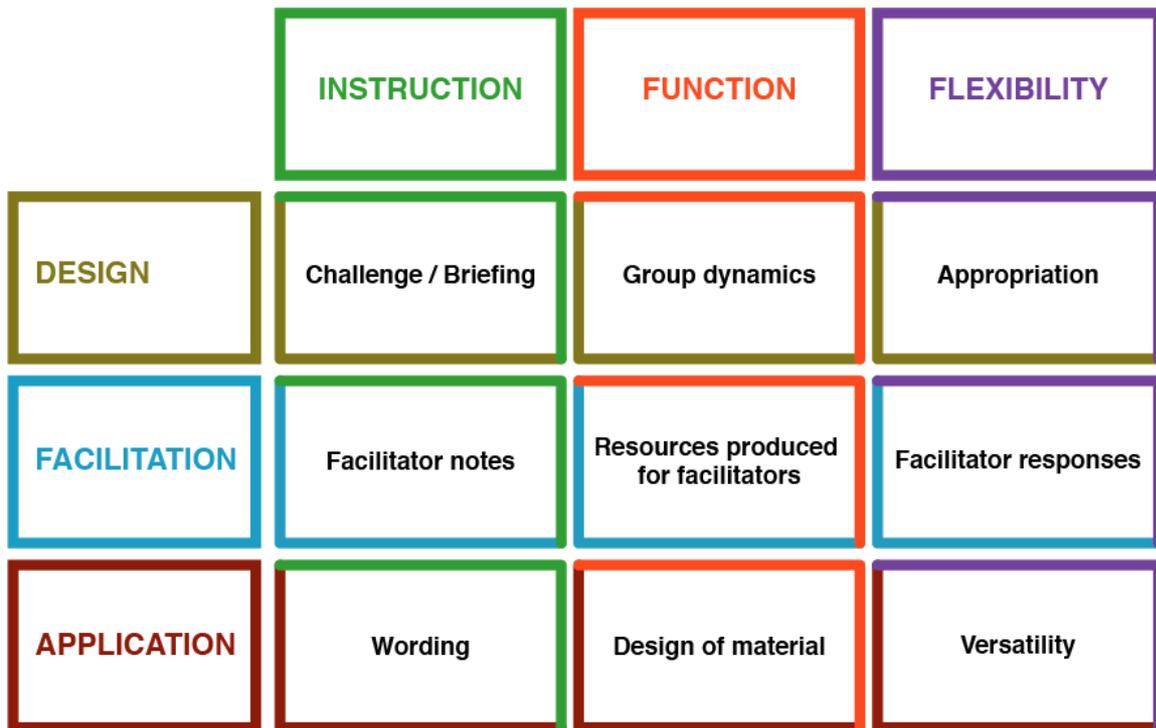


Figure 5. Refined Improvement matrix

Considering the insights when improving tools, the Figure 6 highlights how the components, aspects and dimensions relate to each other. The tinted shapes can be used as the aim or purpose of an improvement effort (e.g. Improving flexibility or designing facilitation approaches) as follows:

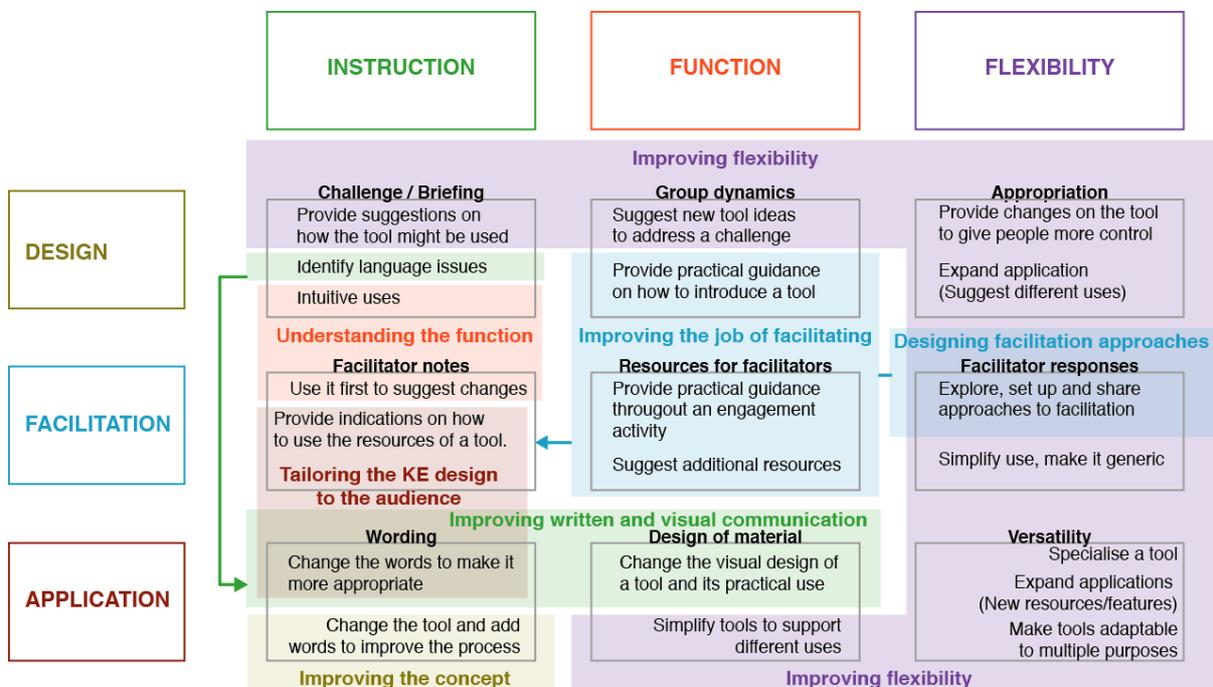


Figure 6. Relationship between layers, dimensions and components of the improvement matrix

8. Conclusion

This research aimed to test and explore a new improvement framework, where engagement practitioners redesigned existing tools to improve their engagement practices. It set out to gain a better understanding of the Improvement Matrix, learning together how to improve KE tools in order to develop a thick description through case study research.

The research findings have shown insights on how the framework plays out in practice, such as the aspects to look at when improving tools in different layers of engagement within the context of KE practices. Looking at the facilitation layer provides enhanced instructions as practitioners focus on how to enable effective engagement with participants. Improving the design layer provides more flexibility as it looks at changing the group dynamics to address different challenges. Although improving the application layer suggests less flexibility, it provides more appropriate wording and visual designs for specific audiences.

The similarities in the findings in the flexibility components may have occurred due to the misunderstanding of the words 'use' and 'apply' on the case study 3, or may have caused by similar definitions between the two components. Another limitation of this study was a shorter period of time in the case study 1 compared to the others. One participant mentioned they could have improved tools even further if there was more accessibility in the workshop. A future research on the flexibility components as well as on the design layer could revise and extend the findings of this research.

References

- Author (2017). *Journal article*. [GENERIC REFERENCE TO THE AUTHORS' OWN WORKS UNTIL FINAL ACCEPTANCE, FULL REFERENCE SHOULD BE INSERTED AFTER THE BLIND REVIEW]
- Author (2012). *Conference paper*. [REFERENCE TO THE AUTHORS' OWN WORKS UNTIL FINAL ACCEPTANCE, FULL REFERENCE SHOULD BE INSERTED AFTER THE BLIND REVIEW]
- Dix, A. (2007). Designing for appropriation. In Ramduny-Ellis, D. & Rachovides, D. (Ed.), *Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI... but not as we know it-Volume 2* (pp. 27-30). Swindon: BCS Learning & Development Ltd.
- Langley, G. J., Moen, R. D., Nolan, K. M., Nolan, T. W., Norman, C. L., & Provost, L. P. (2009). *The improvement guide: a practical approach to enhancing organizational performance*. San Francisco: Jossey-Bass.
- Leont'ev, A. N., & Hall, M. J. (1978). *Activity, consciousness, and personality*. Englewood Cliffs: Prentice-Hall.
- Johnson, J., & Henderson, A. (2002). Conceptual models: begin by designing what to design. *interactions*, 9(1), 25-32.
- Manzini, E. (2015). *Design, when everybody designs: An introduction to design for social innovation*. Cambridge: The MIT Press.
- Murphy, E., & Hands, D. (2012). Wisdom of the Crowd: How participatory design has evolved design briefing. *Swedish Design Research Journal*, 2(12), 28-27.
- Norman, D. A. (1988). *The psychology of everyday things*. New York: Basic Books.
- Preece, J., Rogers, Y., & Sharp, H. (2002). *Interaction design: Beyond human-computer interaction*. New York, NY: J. Wiley & Sons.
- Sarkissian, W., Hurford, D., & Wenman, C. (2010). *Creative community planning: Transformative engagement methods for working at the edge*. London: Earthscan.

- Suchman, L. (2007). *Human-machine reconfigurations: Plans and situated actions* (2nd ed.). Cambridge: University Press.
- Swann, C. (2002). Action research and the practice of design. *Design issues*, 18(1), 49-61.
- Tassoul, M. (2009). *Creative facilitation*. Delft: VSSD.
- von Hippel, E., & Katz, R. (2002). Shifting innovation to users via toolkits. *Management science*, 48(7), 821-833.

About the Authors:

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