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Title **Design principles for developing online ethics resources – the outcome of holistic DBR process**

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Abstract In various fields people need to make morally good decisions. At the same time, it is not very common in education to help people develop their ethics competencies of various fields. The current article gives an overview and outlines the outcomes of a holistic DBR process focusing on facilitation of the learning process to develop ethics competencies. Over the past 4 years an online research ethics resource has been under development by utilising DBR. The ultimate goal of DBR is to provide research-based design principles that would also be transferable into other contexts. While there is knowledge about effective strategies in ethics education and a variety of online resources have been developed, there are no design principles available that would enable

creating ethics resources for different fields. The outcome of the current research is a set of design principles to help design ethics resources for various fields. Their transferability was tested and recommendations are provided for implementation.

Keywords holistic DBR, design principles, applied ethics, transferability

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Design principles for developing online ethics resources – the outcome of holistic DBR process

Anu Tammeleht

1.0 Introduction

In every discipline the researchers and practitioners encounter situations where they need to make decisions – good, just and morally right decisions. This is the realm of applied ethics (Dittmer, n.d.). Applied ethics deals with practical challenges of a discipline focusing on moral problems, practices and policies (Petersen & Ryberg, 2019). The key issue for the current article is how such competencies can be developed.

Previous studies have researched pedagogical strategies to teach ethics and moral reasoning. For example, research shows that ethical dilemmas and cases have provided good results in ethics education (Fisher & Kuther, 1997; Zucchero, 2008). In addition, Jordan (2013) states that ethics training which includes facilitated ethical discussion in groups about lifelike ethical dilemmas has proven effective. Moreover, collaboration is a beneficial means to develop a variety of competencies as it fosters critical thinking skills (Smith et al., 2005; Cavanagh, 2011), development of understanding, and relating new concepts to previous knowledge and experiences (Biggs, 1999) – all of which are relevant in developing ethics competencies.

Nevertheless, while there is research about strategies that have proven their effectiveness in teaching ethics and integrity, there is a lack of design principles for creating online training resources reaching beyond individual responsibility and that would focus on gradually developing ethics competencies. There are examples of online learning materials of ethics (e.g. Goldin, Ashley & Pinkus, 2001; Lu, Lajoie & Wiseman, 2010), but it may be difficult to replicate their design. Previous research (Lu & Lajoie, 2008; Lu, Lajoie & Wiseman, 2010; Furberg, 2016) shows that computer-supported training of transversal competencies may provide good results. In addition, the global health crisis made it clear that there is a need to create opportunities for learners to engage with material online with perhaps limited support from facilitators.

The current article outlines the results of DBR (design-based research) about designing an online research ethics resource that gradually develops research ethics and integrity competencies. The focus of the research was the understanding of *how to facilitate a learning process so that it would support development of ethics competencies*. As a

result of the holistic DBR, design principles were extracted that would help create online ethics resources in different disciplines.

The article is divided into three sections. The first section reflects on the theoretical background of ethics education and the designed resource. The second section outlines the methodological framework used for research and design. The third section introduces the design principles, their transferability, and provides recommendations for their implementation.

2.0 Theoretical background

Ethics education

Ethics and research ethics education have received attention in recent decades (Löfström et al., 2015; Mustajoki & Mustajoki, 2017) and there are various challenges that have been pointed out. First, there is a variety of opinions among academics on how ethics and integrity could be taught and who should do it: whether to implicitly model desired behaviours or to teach it explicitly (Löfström et al., 2015; Shephard et al., 2015). There are also split opinions on whether or not it is academics' role to teach ethics or not (Löfström et al., 2015 Shephard et al., 2015). Second, it has also been pointed out (Löfström et al., 2015 Shephard et al., 2015) that many of the strategies used in ethics education are based on opinions, experience or belief, but not on research. In addition, there has been contradictory evidence on the success of formal research ethics training; e.g. M. S. Anderson et al. (2013) show how having passed a compulsory course in research ethics does not necessarily result in ethical behaviour. This means, ethics training needs to be reconceptualised to be effective in a certain context.

Prior research sheds light on what has been considered effective in ethics education. Case-based learning has been used in various disciplines where students engage in discussing lifelike situations (Biggs & Tang, 2007). In particular, the use of moral dilemmas has been found to provide good results in ethics education (Fisher & Kuther, 1997; Zucchero, 2008; Jordan et al., 2011; Rissanen & Löfström, 2014). Dealing with cases improves understanding of the concepts, shows how theory is connected with practice, facilitates understanding of the context by enhancing mental representations (Ericsson & Pool, 2016), and enables collaboration. Previous research shows that only even occasional discussions of cases can be beneficial for learning research ethics (Clarkeburn, 2002). Case-based learning is also perceived as more enjoyable by learners and provides better results than traditional lectures (Kim et al., 2006).

Moreover, Johnson et al. (2012) have studied case-based ethics education and point out that dealing with cases has an impact on ethical sense-making (ethical sensitivity) and ethical decision-making. *Ethical sensitivity* is a cognitive competence where the person first becomes aware of the presence of an ethical issue, is then able to recognise the involved parties of the case, and finally considers various courses of

action and their implications (Rest, 1986; Myyry, 2003; Morton et al., 2006; Caughron et al., 2011). Ethical sensitivity is a prerequisite of the *ethical decision-making* process (Rissanen & Löfström, 2014). Alternative terms are: *cognitive moral development* (Kohlberg & Hersh, 1977), *moral reasoning* (Rest, 1986), and *ethical reasoning* (as used by Jordan et al., 2011). The present study uses *ethical decision-making* to designate identifying possible outcomes and solving the ethical dilemma (as outlined in Johnson et al., 2012; Rissanen & Löfström, 2014). There are various ethical decision-making measures and strategies combined in the current study by various authors (Kitchener, 1985; Mumford et al., 2006; Caughron et al., 2011; Mustajoki & Mustajoki, 2017), like role-taking, dealing with various scenarios, identifying virtues or ethical principles, and utilising ethical analysis.

In addition, the quality of the case has an impact on the training outcomes. Namely, the reasonably complex cases with negative outcomes enable learners to more easily identify the key ethical issues and produce higher quality forecasts (Johnson et al., 2012). Bagdasarov et al. (2012) additionally point out that elaborating (i.e. answering questions about) a well-structured case provides better results with knowledge acquisition than working on one's own case or having no need to elaborate (not answering questions).

Also, some authors suggest that ethics training should facilitate discussion in groups about possible or lifelike ethical dilemmas (Jordan et al., 2011). Collaboration improves thinking critically and making decisions (Smith et al., 2005; Cavanagh, 2011; Larraz, Vazquez & Liesa, 2017). Working in groups improves understanding, and helps relate new ideas to prior knowledge and experiences (Biggs 1999; Biggs & Tang, 2007). This is closely related to teaching and learning of transversal skills (Larraz, Vazquez & Liesa, 2017) including ethics and integrity. For instance, collaboration increases awareness of misconduct and improves integrity and mutual trust (Smith et al., 2005; Cavanagh, 2011). Nevertheless, it is important to scaffold group work (Johnson & Johnson, 1999; Biggs & Tang, 2007) by initiating, organising and coordinating activities. Scaffolding may take the form of structuring the tasks and providing face-to-face support by peers or a facilitator.

Theoretical grounding of the training resource

The research and the design of the online ethics resource was heavily influenced by Vygotsky's (1980) ideas about learning and development. For instance, double stimulation (Vygotsky, 1980) in the online resource involves first stimulating the learners through task design, and then engaging them in the process of co-creating artefacts to alter the problem solving and mediating the learning process. The design of the online ethics resource follows the knowledge building theory (KBT) pedagogy offered by Scardamalia (2002) where group learning takes place with the support of a digital device. The collaborative learning is not linear, the questions are often open-ended and so can the answers be; knowledge is co-created as groups work on expanding epistemic objects and do so iteratively to refine the knowledge – such a learning

process cannot be scripted, but it can be scaffolded (Scardamalia & Bereiter, 1996; 2006; Scardamalia, 2002).

Table 1: Overview of the content design principles of the online ethics resource

LEVEL	*Pedagogical strategies*		*Scaffolding*			*Focus of the learning material*				
	Case-based learning	Group collaboration	Sense Making	Process Management	Articulation & Reflection	Ethical awareness	Ethical principles	Ethical analysis	Ethical approach	Leader principles
Foundation level - individual	✓	✓	✓	✓	✓	✓ (6-9 topics per case)				
Advanced level - group	✓	✓	(✓)	✓	✓		✓	✓		
Leadership level - institution	✓	✓	(✓)	✓	✓		✓	✓	✓	✓

(Ticks in parenthesis indicate that support material is available for Advanced and Leadership levels as well, referring back to the Foundation level to help with sense-making.)

As displayed in Table 1, the ethics resource follows the systems approach (Bertram Gallant, 2011) according to which building the ethical institution is to see the integration of all the levels present – individual, research group, department, organisation. The resource gradually follows the widening of the community (*individual, group, institution*). The resource relies on *pedagogical approaches* that have proven to be efficient in developing ethics competencies – namely, cases (Zucchero, 2008; Fisher & Kuther, 1997; Rissanen & Löfström, 2014; Jordan et al., 2011) and collaborative group work (Smith et al., 2005; Cavanagh, 2011; Biggs, 1999). In addition, the *scaffolding* framework gives a possibility to include suitable forms of support to learners of different expertise levels (Wood et al., 1976; Van de Pol et al., 2010; Azevedo & Hadwin, 2005; Reiser, 2004; Chi et al., 2001) – in sense-making, process management, and articulation and reflection. To develop research ethics competencies gradually, the *focus* shifts throughout the resource. The focus of the Foundation Level is becoming aware of the ethical aspects present in various phases of research, making sense in the guidelines and understanding the content of the codes of conduct. At the Advanced Level the focus is on guiding the team or group through understanding the ethical principles (Kitchener, 1985) and practicing ethical analysis (Mustajoki & Mustajoki, 2017) to help solve various ethical dilemmas/conflicts. As the gradual development of

ethical competencies includes developing ethics leadership skills, the principles of transcendental leadership (Cardona, 2000; Sanders et al., 2003) were included in the training material on the Leadership Level. In addition, on this level the ethical approaches (consequentialism, rule-based and virtue ethics) were added to help learners see various aspects of possible courses of action.

3.0 Methodological framework

The research and resource design was embedded into the pragmatic paradigm and adopted a design-oriented and interventive approach. In the pragmatic paradigm, DBR is often used (Juuti & Lavonen, 2006; Alghamdi & Li, 2013). DBR is a systematic research approach focused on improving educational practices in real-life context through design, development, iterations and implementation, and leading to context-sensitive design principles and new theories (T. Anderson & Shattuck, 2012; Barab, 2014; Bakker, 2018). DBR utilises mixed methods during multiple iterations, requires collaboration between researchers and practitioners, as well as formative evaluation by experts to enhance solution implementation (Van den Akker et al., 2006; Edelson, 2002; T. Anderson & Shattuck, 2012). In addition, DBR was chosen because it has proven its efficiency in creating technology-enhanced learning environments (Wang & Hannafin, 2005).

The research dealt with the development of a complex design object, which made the existing models (e.g. Reeves, 2006; Bakker & Van Eerde, 2015; Euler, 2014) a bit restrictive as they focused on the iterative cycles around development, design and analysis of a simple design object. In the current case, the focus of iterations shifted and it was difficult to see one iteration and outcome of the iteration as an improvement of the same aspect of the design object. The holistic DBR model by Reinmann (2020) was utilised instead.

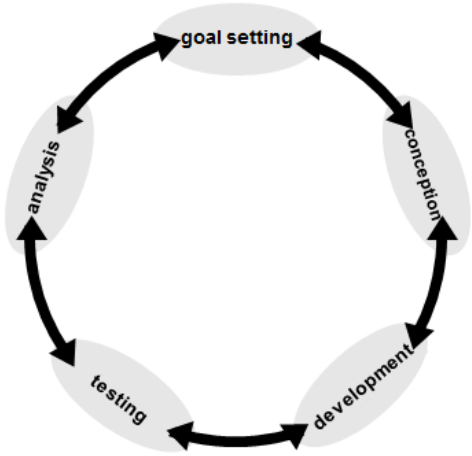

Figure 1: Iteration type I of the holistic DBR (Reinmann, 2020)

The holistic DBR treats all the elements as part of the whole and distinguishes between three levels of iterations. Iteration I is the cycle of the overall process with one focus – the design object with all its elements. It is divided in 5 *semantic fields* of goal setting (GS), conception (CO), development (DE), testing (TE) and analysis (AN) and the circle turns back to goal setting. Within each semantic field various research activities take place, but the fields have to coincide.

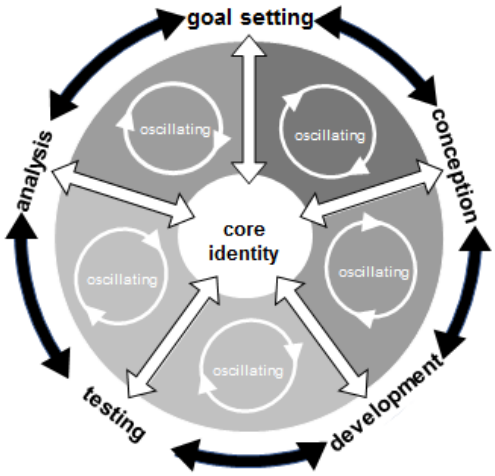

Figure 2: Iteration type II (Reinmann, 2020)

Iteration II denotes each segment between semantic fields as a *field of action*. This means there are smaller cycles between each semantic field where there is back and forth movement between the foci of the semantic fields while constantly referring to the core identity (or the main research question) of the research.

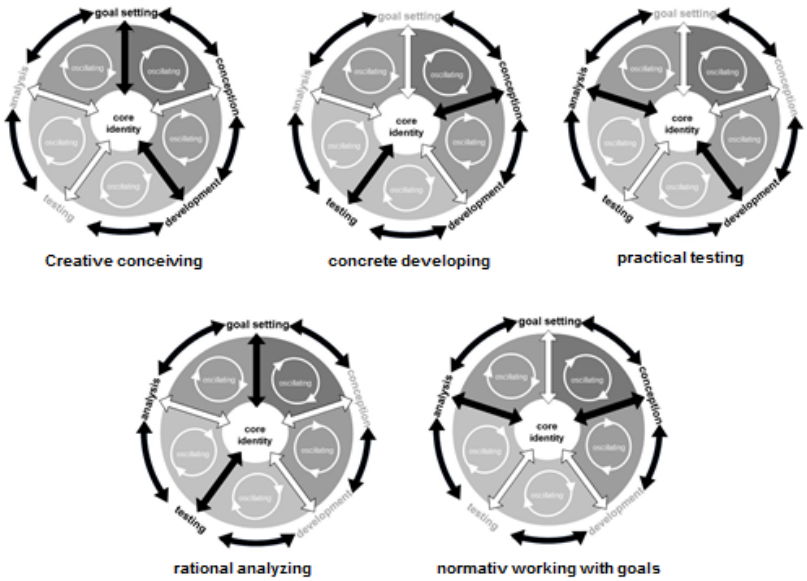

Figure 3: Iteration type III (Reinmann, 2020)

Iteration III (called *playing fields*) involves interplay between three semantic fields forming larger units within the overall DBR process. As the iterations within the DBR may focus on different aspects, it can be difficult to indicate whether one cycle was conducted or several. This is where the holistic DBR comes to aid – the iterations can be of different types, either having the full cycle or focusing on playing fields or fields of action (Reinmann, 2020).

As the current research dealt with a complex design object, it had separate design objects – namely, the content of the resource and the digital form, which require quite different approaches for development. In addition, data collection and analysis instruments had to be designed when the need became apparent. With the traditional DBR phases it became difficult to distinguish various iterations within this research. At the first glance it looked logical and straightforward (see Figure 4): starting off with an orientation phase to set the goals and build the theoretical framework. Then three iterations followed where different aspects of the resource were developed and researched. Eventually, the whole research process was summarised, reflecting back on the lessons learned, evaluating the potential implementation success and providing design principles.

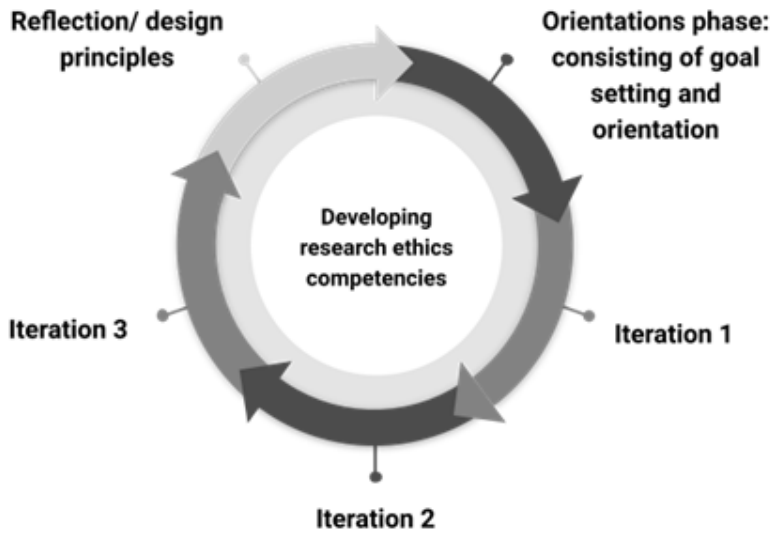

Figure 4: General outline of the DBR process

The actual DBR process looked more complex. Figure 5 visualises the entire process while Table 2 provides detailed information about each cycle represented in the figure. Cycle numbers (1-10) indicate the order in which various aspects of the design work were executed; the lines indicate the connection between various cycles.

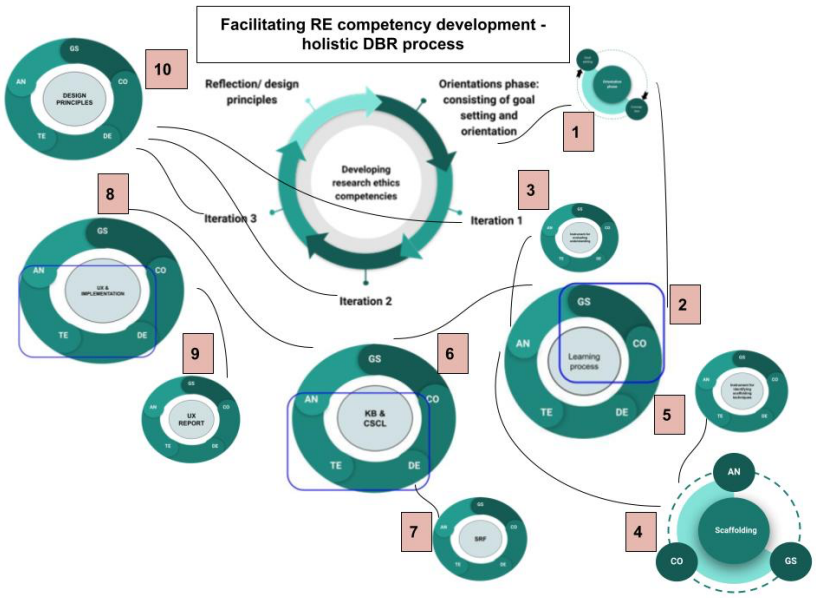

Figure 5: Visual of the entire holistic DBR process

The current article displays the results – namely, design principles – of the entire DBR process. To illustrate the content of all iterations, Table 2 was compiled: the first column displays the cycle number, the central topic (in italics) and research question(s) of the cycle. The second column identifies the iteration type (based on Reinmann, 2020) and indicates the more dominant semantic fields of the cycle. The third column outlines the sample and data collection source. The fourth column shows the data analysis methods and instruments. The fifth column indicates into which cycles the results feed, and the final column indicates the outcomes and the design principles that derived for the cycle (please refer to Figure 6 for design principles).

Table 2: The content of all iterations in the research process

Cycle no. ***Topic* + RQs**	**Iteration type (+ main semantic field)**	**Sample/source (Event/ Date/ Participants/ Data sources)**	**Analysis (methods /instruments)**	**Feeds into**	**Outcomes and design principles (DP)**
1 *Orientation* How to teach ethics competencies? What kinds of competencies are necessary?	II (GS,CO)	Event: Development of the framework for the resource Date: Jan 2018 - Mar 2018 Participants: Research team, practitioners Data sources: previous studies; researcher development framework	Literature review, consultations, framework development	GS and CO of cycle 2	Framework developed DP 1, 2, 3, 5
2 *Learning process* How is degree students' ethical sensitivity displayed during collaborative case-based learning? How does ethical reasoning evolve in terms of levels of understanding during collaborative case-based learning? What are the similarities and differences between students at different degree levels in displaying ethical sensitivity in a group learning context?	I (GS, CO)	Event: Research ethics training sessions Date: Mar 2018 - Dec 2018 Participants: 64 students of social and behavioural sciences and natural sciences: 31 bachelor (BA/BSc), 20 master (MA/MSc), and 13 PhD students organised in 19 groups. Data sources: written group reports, session recordings and feedback forms.	Deductive content analysis; *Ethical Case Assessment Grid* (ECAG) based on the SOLO taxonomy	Cycle 3 and 4 - instrument development (ECAG) and scaffolding, cycle 10	ECAG; Knowledge of the learning process during research ethics training; feedback collected from participants on the content. See Tammeleht et al. (2019) DP 4, 6, 7, 9, 10
3 *Instrument: Ethical Case Assessment Grid (ECAG)* How to evaluate and display levels of understanding during research ethics training?	I (all)	Event: Developing an instrument to evaluate learners' understanding. Date: Mar - Apr 2018 Participants: 5 bachelor and 5 master level groups Data sources: group work reports	Evaluation of various taxonomies for interpreting understanding; SOLO taxonomy was adopted to create the instrument suitable for evaluating understanding during training	Cycles 2, 4, 6, 7	ECAG developed and tested
4 *Scaffolding*	III (AN, GS, CO)	Event: Scaffolding during research ethics training.	Deductive content analysis based on the scaffolding	Cycle 2, 6, 10	Understanding of which scaffolding

Which scaffolding techniques are used during research ethics training? Are the used scaffolding techniques effective? What are the similarities and differences of scaffolding techniques between various expertise levels?		Date: Mar - Aug 2018 Participants: 46 participants (15 bachelor students, 12 master students, 11 doctoral students, 8 supervisors working in 15 groups) Data sources: oral group presentations/ discussions which were video- or audio- recorded.	framework: recordings were transcribed verbatim, a total of 3 hrs and 18 min; ECAG was used to evaluate the learning process.		techniques can be used during research ethics training, which ones are effective and what the differences are between expertise levels (Tammeleht et al., 2020). DP 4, 7
5 *Scaffolding framework* How to identify and evaluate different scaffolding techniques?	I (all)	Same as cycle 4	Literature review, selection of possible frameworks, combining them for the current analysis needs.	Cycle 4, 6	Scaffolding framework compiled, see Tammeleht et al. (2020)
6 *Knowledge building and CSCL* How is the learning process in the context of research ethics displayed in the CSCL? What are the externally observed and self-perceived learning outcomes resulting from the interaction with the CSCL ethics resource? How does scaffolding in CSCL support the learning process and achieving learning outcomes in the context of research ethics?	I (DE, TE, AN)	Event: Learning process/knowledge building during CSCL. Date: Oct 2019 - Oct 2020 Participants: 43 participants from 7 different countries and 5 disciplinary backgrounds (24 beginner researchers working in 6 groups; 10 more experienced researchers working in 3 groups; 9 expert researchers working in 3 groups. Data sources: group reports, group discussions, self-reflections	Deductive content analysis based on ECAG to evaluate the learning process. Achieved and self-perceived level of understanding based on the SOLO taxonomy; Scaffolding analysed based on the scaffolding framework.	Cycle 7, 8, 10	Comparison of face-to-face training with the CSCL approach, similarities and differences. Collecting user experience; improvement ideas. Poster and EARLI 2021 presentation by Tammeleht et al. (2021) DP 4, 6, 8, 9, 11
7 *Self-reflection form* How do learners perceive their learning process and levels of understanding during research ethics training?	I (DE, TE, AN)	Event: Developing an instrument to evaluate learners' understanding. Date: Oct 2019 - Dec 2020 Participants: I version - 21 respondents working in 6 groups; II version - 20 respondents working in 5 groups. Data sources: Filled self-reflection forms.	SOLO taxonomy, descriptive statistics, thematic analysis of responses.	Cycle 6, 8	A self-reflection form compiled DP 11
8 *User experience & implementation*	I (DE, TE, AN)	Event: Utilising the user experience to improve the resource. Implementation plan.	The reports were analysed based on ECAG (deductive	Cycle 9, 10	A new improved online ethics resource

How to utilise user experience to improve the online research ethics resource? How to implement the resource?		Date: Sep 2020 - Mar 2021 Participants: User experience team compiled (17 participants, master level students). With the improved resource 2 sessions were organised, 5 groups of BA students (20 in total) and 5 groups of PhD students (18 in total). Data sources: group reports and self-reflections were collected. Oral feedback was asked from the groups.	content analysis) and achieved and perceived levels of understanding were compared. Also, results were compared to the results of the previous version. An instrument was needed to collect user experience.		(Research Ethics Compass) was compiled DP 6, 8, 9
9 *User experience report* How to collect data on and evaluate the user experience?	I (all)	Event: Developing the user experience report. Date: Sep - Oct 2020 Participants: I version - 17 master level students working in 3 groups. II version - 19 users working in 3 groups. Data sources: Groups used the online resource and filled in user experience reports.	Content analysis of user experience reports. Recommendations for improvement.	Cycle 8	UX report__template compiled
10 *Design principles* Do the design principles support the creation of ethics resources in various domains?	I (all)	Event: Outlining the design principles. Testing them. Date: 2019 - 2021 Participants: 1 practicing teacher; 24 bachelor/master level students working in 4 teams. Data sources: Documents from groups' Google Drive folder (group-based); teams' final ethics resource; short questionnaire (filled individually)	Creation of design principles; testing the design principles; document analysis; questionnaire for developers.	Overall	Design principles outlined. Creating new ethics materials based on the design principles - Cyber ethics resource in 2019, 4 resources created in spring 2021. DP 3, 4, 5, 6, 7, 8
Overall How to facilitate a learning process so that it would support development of ethics competencies?	DBR	All cycles	Empirical and design methods	Future studies	(forthcoming)

The research followed the European Code of Conduct for Research Integrity (ALLEA, 2017), the Estonian National Code of Conduct (Hea Teadustava, 2017), as well as the Finnish National Board on Research Integrity guidelines (2019). No ethics review was required since the study did not involve an intervention in the physical integrity of research participants; deviate from the principle of informed consent; involve participants under the age of 15 being studied without parental consent; expose participants to exceptionally strong stimuli; cause long-term mental harm beyond the risks encountered in normal life; or signify a security risk to subjects (National Board on Research Integrity, 2019). Participation was voluntary, and the participants were asked for their informed consent. The data were anonymized before analyses.

4.0 Design principles

Based on the lessons learned throughout the DBR process design principles (see Figure 6 below) were devised for designing a training resource to develop ethics competencies. The training can be related to any field where ethics competencies are relevant (e.g. cyber ethics, political ethics, leadership ethics, data ethics, school ethics, etc.).

Conceptualisation of the resource. First of all, it is necessary to identify the need, context and scope of the resource. Principle 1 (*need, context and scope*) grew out from the orientation phase (cycle 1) of DBR and is necessary to pinpoint the content and the target group of the users (their needs and expertise level). Principle 2 (*collaboration with experts*) stems directly from the content (which stems from cycle 1) – the creator of the resource does not need to be an expert in the field, it is advisable to find practitioners and experts to collect information on the ethical issues present in the field. Principle 3 (*building a framework*) summarises the orientation phase (cycle 1) by building a framework for the resource, including central topics and possible support material or advice from the expert/practitioner. Cycle 10 also revealed that building the framework and collection of cases may be conducted hand in hand. Occasionally, collecting various cases in one place may reveal the common topics and contribute to finalising the framework.

Authoring the training resource. Principle 4 (*epistemic object*) emerged from cycles 2, 4 and 6 of the research. As during cycle 4 the Advanced level groups did not create a written epistemic object and during cycle 6 another pilot group provided a very limited epistemic object, it became clear that the group discussion becomes side-tracked and not all group members contribute equally. The epistemic object is a necessary element for knowledge building, so even a very simple epistemic object is needed (poster, handwritten report, portfolio, slides, etc.) to keep the focus of the group and support mutual understanding. Nevertheless, as cycle 10 revealed, this concept is difficult to understand by creators/developers and there may be shifting from one epistemic object to the next. It is important to remember not to make the

selection of epistemic object(s) too complex for the users. Principle 5 (*writing cases*) refers to the framework and focuses on the topics and target group of the ethics resource (cycle 1). Again, cycle 10 showed that the cases may actually give the grounding to the framework, so they are intertwined. The cases can be collected from the target groups (by interviewing them), from literature, experts, or invented based on the topics in the framework. The main goal is to draw users' attention to the most prevailing topics, and cases provide an excellent starting point. Care must be taken to anonymise and adopt the cases if they are real-life cases (to protect the people who shared them). Principle 6 (*tasks/questions*) points out how to help users enhance their ethical sensitivity by asking them to elaborate on the case (pointing out important ethical aspects that may not have been too obvious in the case). The first question could be a more general one just asking if the group sees anything off in the case. The following questions could either ask about specific topics or take the format of ethical analysis (Mustajoki & Mustajoki, 2017). This principle was elaborated throughout the cycles 2, 6 and 8 and questions were added and adopted. Cycle 10 also showed that there should be consistency in the questions and the ethical analysis steps make it more consistent for the users. Principle 7 (*support material*) is about creating support material (from cycle 2) – again, consulting with practitioners and experts to get valuable information or asking an expert to be present in the training session to provide oral scaffolding (from cycle 4). Cycle 10 showed that the support material – perhaps in the format of 'expert opinion' or 'possible solutions' – should follow the case discussion and ethical analysis, as the users see the need for 'advice' only after getting a possibility to provide solutions of their own. Comparing the learners' answers and the expert's opinion is an important learning opportunity.

Facilitation of training sessions. Principle 8 (*website design*) was devised based on the results of cycles 6 and 8 – during these cycles it was discovered that the results of learners using online material were better than the results with paper-and-pencil material. Even if the online format includes the same material and takes a very simple format, the online environment provides structural scaffolding for the group work. Still, cycle 10 showed that well-considered layout and collecting user experience feedback provides better results. Principle 9 (*learners' groups*) stemmed from cycle 2, but became more pronounced during cycles 6 and 8. Even though learners can use the resource individually, the results are better when working as a team – as user feedback was collected throughout cycles 2 and 6, it was very consistent and more than 90% of learners pointed out the benefit of peer support. Of course, as due to the global health crisis it became obvious that the group or the facilitator cannot always be present, the online resource should provide sufficient scaffolding to facilitate the development of ethics competencies. The training format described in principle 10 (*facilitation*) was already taken into use during cycle 2. In this way the ethical sensitivity can be gradually developed and scaffolded. Oral presentations should be considered as part of the learning process as it provides a chance for the human facilitator to pinpoint misconceptions and provide oral scaffolding – especially important for people

with limited expertise in the field. Principle 11 (*reflection*) was created as a result of cycles 6 and 7. Before that, it was only the facilitator who determined what the level of understanding of the learner (based on the ECAG) was. While transferring the material online, a SOLO-based self-reflection form was added to encourage the learner to evaluate the level of understanding they had achieved. This provides an opportunity to compare the perceived and achieved levels of understanding and with the epistemic object this provides an opportunity to triangulate learning outcomes.

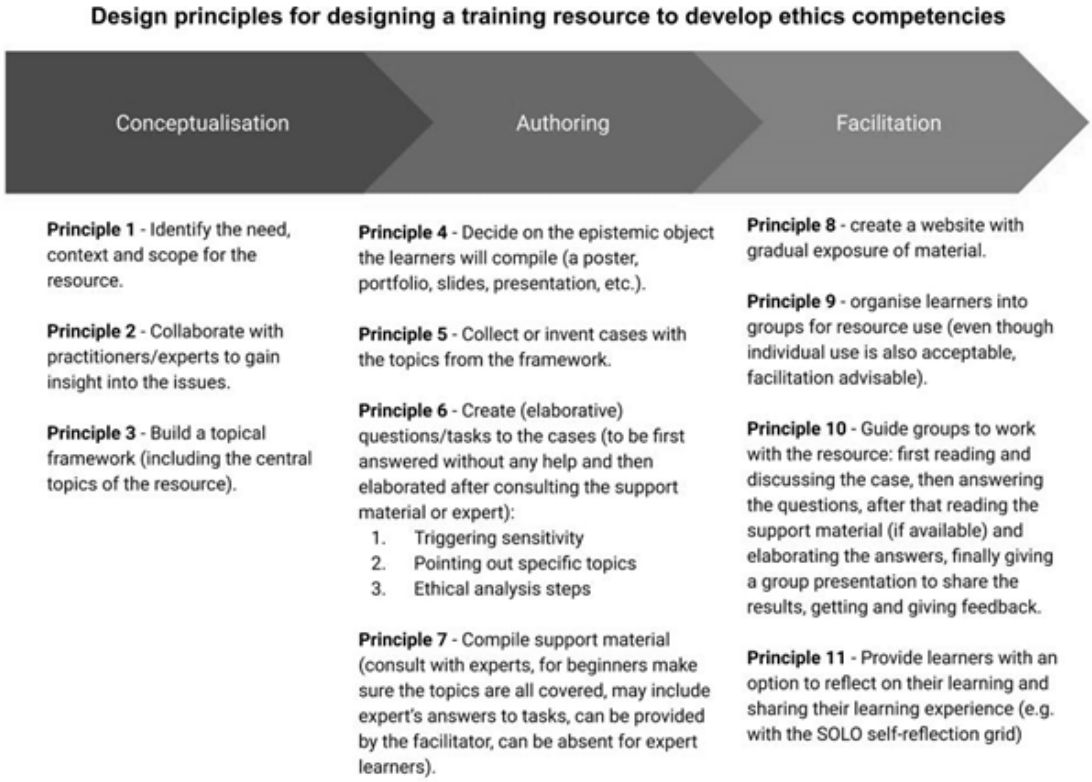

Figure 6: Design principles for creating ethics training material

5.0 Transferability

As part of the current study and based on the lessons learned, already in late 2019 an attempt was made to replicate the resource development in another field. With the help of a practitioner, a Cyber Ethics resource was developed for upper secondary students. The resource was tested and feedback was collected. Participants (N=25 working in 5 groups) provided very positive feedback: 95% considered working in a group an asset, 80% considered the resource logical and clear. 70% believe that it would be easier to notice ethical issues pertaining to cyber security in the future.

At the beginning of 2021 a team of university students (bachelor and master students) was invited to try out the design principles and develop various online training resources for various fields and target groups. 24 students volunteered and they enrolled in an interdisciplinary course called LIFE. The volunteers divided themselves into 4

teams based on their mutual interests and 4 different resources were developed: a cyber ethics resource for adults, a school ethics resource for teachers, a local political ethics resource for young electors and an ethics workshop to prevent bullying for elementary and middle school students. The design principles supported the development of high-quality training resources. Please see a Practical Illustration paper *Iteration type I of holistic DBR – transferability of design principles* (Tammeleht, 2022) with an overview of cycle 10. Results of cycle 10 indicated that design principles support the creation of ethics resources in various fields.

6.0 Conclusion

The data collected and analysed throughout the DBR process support the notion that with utilising the CSCL approach and case-based learning it is possible to effectively support the development of ethics competencies. Moreover, holistic DBR has provided an opportunity to implement the development of a complex design object. In addition to design principles that were compiled as an outcome of the research there are additional recommendations for scaffolding ethics training:

- Learners with limited prior knowledge need scaffolding when they cannot proceed on their own. The facilitator should understand which topics are difficult for learners, and evaluate how to support them and when to offer help. Structural scaffolding can be provided by an epistemic object. (Indicated by results of cycles 2 and 4.)
- Structural scaffolding through task design and process management helps learners of different levels. It may be necessary to decompose a bigger task into smaller steps, handing out tasks one after another, providing guiding questions and support material. (Indicated by results of cycle 4.)
- Sufficient time should be allotted to groups for thorough discussion of the cases and questions provided. It is also advisable to organise several training sessions to get a better impact. (Indicated by results of cycles 2 and 6.)

As critical evaluation is part of the DBR, Klein and Sorra's (1996) model for innovation implementation can be used to evaluate the potential success of the created material. It is not enough to create the training resource. Whether the resource is taken into use depends on the organisational climate and whether the potential users see it as an effective tool for their development. It can be predicted that if the management of the institution sees the value in the resource, creates a climate for its implementation and displays how it would improve the users' daily work, the implementation could be quite successful.

Recommendations for implementation:

- For innovation implementation opportunities should be provided for skills' development – making training and resources

available, providing assistance and guidance, time and space for discussions and networking.

- Incentives should be positive – monitoring the implementation process, guiding where necessary, praising implementation trials.
- Obstacles should be eliminated – time and space for development, organising meetings and training sessions, alleviating concerns by encouraging open discussions, providing access to support.
- Asking the users whether the innovation should be implemented, making their needs visible to them.
- Developing organisational values for innovation implementation – making the need for it visible, using artefacts to display one's own values and beliefs.
- Display positive examples – from outside the organisation or from piloting groups within the organisation in the form of testimonials, peer support, etc.
- Improve policies and practices – make sure ethics infrastructure is available (guidelines, templates); there are advisors and support groups to turn to.

7.0 Limitations and future studies

Even though the research team and participants were from various countries and disciplines, the testing and data collection was carried out in one university. In addition, qualitative research methods were more dominant while quantitative data only included descriptive statistics. Moreover, the effectiveness of new resources designed based on the design principles has not been studied yet.

Future studies could include other universities and research institutions. In addition, data could be gathered using multimodal learning analytics and include quantitative data and analysis methods. Further analysis is also needed to evaluate the effectiveness of new resources designed based on the design principles.

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