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Collaborative case-based learning process in research ethics



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Abstract

The increasing concern about ethics and integrity in research communities has brought attention to how students and junior academics can be trained on this regard. Moreover, it is known that ethical behaviour and integrity not only involve individual but also group norms and considerations. Thus, through action research and participant observation, this research investigates the learning processes through which 64 students collaboratively develop research ethics and integrity competencies. The aim was to understand how bachelor, master and PhD students approach ethical dilemma cases through a collaborative process. The data consisted of recorded group work on ethics cases, student group reports, and post-training questionnaires. Later, the analyses considered groups as the unit of analysis. These data were analysed through content analysis utilizing the SOLO taxonomy to identify levels of understanding and assess evolvement of ethical sensitivity during a case-based training session. The results show that all groups reached the level of understanding where the groups demonstrated that concepts had been understood appropriately, but occasionally struggled to make connections between them. Students perceived working collaboratively as beneficial. The results help teachers of research ethics and integrity to make pedagogically justified choices in their teaching. Drawing on the results of this study, we propose a tool for the formative assessment of student learning of research ethics and integrity.

Keywords: Ethics, Integrity, Ethics competencies, Case-based learning, Collaboration, Learning process

Introduction

Academic ethics is part of the competences ('general abilities', as specified in Suciu and Măță 2010) that graduates of Higher Education should have. Ethical issues are central in the research process and it is in the interest of the entire research community to assure that its members adhere to high standards of ethics and integrity (e.g. Anderson et al. 2013). With the revision of the European Code of Conduct (ALLEA 2017) and simultaneous work to create or update national codes in many EU member states (e.g. *Estonian Code of Conduct for Research Integrity* was revised in 2017) research ethics and integrity have been high on the agenda of the European research community. There is both need and momentum for implementing the guidelines and developing research ethics and integrity competencies ('specific set of skills, knowledge, abilities' as specified in Suciu and Măță 2010) among students and academics, the current research focusing on students of various degree levels.



The term academic ethics includes being honest and achieving fidelity in teaching, learning and research in the research community (Turner and Beemsterboer 2003; Löffström *et al.* 2015). We include the terms of both research ethics and integrity in our article, and treat academic ethics as a general concept for moral and ethical considerations in an academic context.

Academics and administrators of higher education institutions generally agree that ethical research is an institutional priority, but their views diverge on how students obtain such knowledge, skills and values, whose task it is to teach students, and what can be taught in the first place (Löffström *et al.* 2015; Shephard *et al.* 2015). There is a variety of opinions on how ethics and integrity could be taught and who should do it; whether to implicitly model desired behaviours or to teach it explicitly, and whether or not it is academics role to teach ethics or not. There are also academics who think integrity cannot be taught as students either have a moral compass or they do not have it (Löffström *et al.* 2015; Hyytinen and Löffström 2017).

Many of the strategies used by academics may be intuitive in the sense that they are based on belief, opinion or experience, but rarely research. There are also various pedagogical strategies that have proven to be effective in teaching transversal skills, including ethics and integrity, for example, cases have been proven to be efficient in ethics education (Zuccherò 2008; Fisher and Kuther 1997; Rissanen and Löffström 2014). In addition, collaboration and teamwork enhance student learning and understanding especially in learning tasks that are complex and involve the need for multiple perspectives, such as in problem-based and inquiry learning (Johnson and Johnson 1986, 1999; Slavin 1980). In addition, taking into account that in real practice, ethical behaviour and integrity entail interacting with peers and other individuals, training these competencies through collaborative activities could be especially suitable.

While prior studies (e.g. Zuccherò 2008; Fisher and Kuther 1997) provide assurance that cases, on the one hand, and group work (e.g. Smith *et al.* 2005), on the other hand, are effective teaching and learning activities, there is not much knowledge about what takes place during the learning process in settings that combine both ethics cases and group collaborative work. Therefore, the aim of this study was to analyse the anatomy of the learning process when bringing these two commonly applied teaching methods together. The article reports the results of analysing the learning process of a total of 64 bachelor, master and PhD students in the context of 6 research ethics workshops at an Estonian university. As a practical application based on the research, we offer an assessment tool for teachers of ethics to evaluate students' progress in collaborative case-based ethics teaching.

Ethical sensitivity and pedagogy for developing ethical competence

The concept ethical sensitivity describes 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 consider various courses of action and their implications (Rest 1986; Myyry 2003; Morton *et al.* 2006). In this concept we include first tuning in to the possibility of ethical concerns in a given situation, and then gradually developing the sensitivity by considering different stakeholders and different courses of action and their implications. In addition, there is content-

related knowledge and knowledge pertaining to guidelines and procedures. However, without the prerequisite, i.e. ethical sensitivity, the application of the content and procedural knowledge is likely to fall short of expectations. In the case of ethical or moral sensitivity the person knows that the issue is present (or is asked explicitly to look at an issue).

Developing ethical sensitivity includes 1) learning about the codes, norms and rules that exist outside the person; 2) socialisation process (adhering to the values, norms and rules of the academic community); and 3) motivation and involvement in processing the information (seeing the issue in the context) (Löfström 2012; Rissanen & Löfström 2014; Sparks and Hunt 1998).

Research has shown that moral/ethical sensitivity/awareness can be developed (cf. Rest 1986; Bebeau et al. 1985; Jordan 2013). There are various pedagogical strategies that have proven to be effective in teaching ethics and developing ethical sensitivity. In particular, use of moral/ethical dilemma cases has been found to be efficient in ethics education (Zuccherro 2008; Fisher and Kuther 1997). Case-based learning can be used in most fields where students engage in real-life dilemmas (Biggs and Tang 2007). Effective ethics training is focused on facilitated ethical discussion in peer groups about potential or real ethical dilemma (Jordan et al. 2013). Dealing with cases enhances understanding of the topic, and helps putting theory into practice, facilitates understanding of the context, and enables collaboration. Even small-scale ethical interventions (like discussing cases) have been shown to be beneficial for learning (Clarkeburn 2002). Case-based learning is considered more efficient than traditional lectures and also more enjoyable from the learner's point of view (Kim et al. 2006). Kim et al. (2006) have synthesised the following criteria for good teaching cases: relevance (including taking into account the competence level of learner, goals and objectives, setting of case narrative); realistic setting (including authenticity, distractors, gradual disclosure of content); engagement (including rich content, multiple perspectives, branching of content); challenge (including difficulty, (un) familiarity of the case, case structure, quantity of cases), and an instructional aspect (does the case build upon prior knowledge, assessment method, feedback mechanism, and teaching aids).

Working in groups and cooperating/collaborating has been shown to improve critical thinking skills (Smith et al. 2005; Cavanagh 2011), develop understanding, and help learners relate new concepts to previous knowledge and experiences (Biggs 1999). This applies also to the teaching and learning of ethics and integrity. For instance, working in groups and collaboration increases students' awareness and concerns for academic misconduct and enhances personal integrity and mutual trust (Smith et al. 2005; Cavanagh 2011). However, group work and cooperation requires structuring, facilitation and support (Biggs and Tang 2007; Johnson and Johnson 1999) in which the facilitator initiates, organises and coordinates the collaboration, and is aware of how the activities enhance mutual learning. Scaffolding provides one perspective into supporting group learning processes (through structuring the tasks and providing face-to-face support).

Scaffolding is a teaching strategy providing assistance to students when needed and fading as the learner gains competence (Vygotsky 1978; Wood et al. 1976). The notion of scaffolding provides a suitable lens for understanding group learning processes on

the topic of research ethics and integrity in which ethical sensitivity is the prerequisite for the initiation of a solution-oriented learning process.

To sum, research shows that case-based learning as well as collaboration are efficient strategies for developing ethics competencies. However, we know less about what takes place in terms of the learning process and development of thinking during case-based learning session. To pinpoint how cases facilitate learning, and to better understand the processes that students engage in while working on ethics cases, we posed the following research questions:

- RQ 1. How is degree students' ethical sensitivity displayed during collaborative case-based learning?
- RQ 2. How does ethical reasoning evolve in terms of levels of understanding during collaborative case-based learning?
- RQ 3. What are the similarities and differences between students at different degree levels in displaying ethical sensitivity in a group learning context?

Pedagogical intervention

A research ethics workshop was designed integrating cases, collaboration and scaffolding. The focus of the workshop was to give basic knowledge of ethics and integrity to beginner researchers of four phases of research: planning, conduct, dissemination (publishing) and data management. The design of the workshop provided opportunities for development of ethical sensitivity. We use the term 'case' to denote situations with implicit or explicit, actual or potential ethical dilemmas. In some instances, the groups were asked to relate the case to their own context to make the case more applicable for their field.

The topics for the cases were based on the *European Code of Conduct for Research Integrity* (ALLEA 2017) and the design of training material followed the gradual development of ethical sensitivity, where the initial stage was to trigger ethical sensitivity, then the topics (in the form of questions) were presented to be solved with the support of the group and additional material. Group presentations gave a chance to develop ethical sensitivity even further with the support of one or two facilitators providing more scaffolding as needed by the groups. The design of the training material also supported all the participants to learn about all the cases presented during the training - e.g. if all 5 cases were presented during the training, the participants were encouraged to join in with questions and comments to develop their own understanding of other groups' cases. This way the students could cover the major topics present in the ALLEA code.

The workshops followed a predefined structure (to provide structural scaffolding) with a prior task, working on the case, presenting it and reflecting on learning:

- 1) Pre-practice questions were designed to attune the students for the topic and map their initial awareness.
- 2) Task 1 – groups received a case with relatively general and open-ended content (See [Appendix 2](#) for the topics). They were asked to come up with an example related to their field (the cases were applicable for different fields) and to

define a context to the ethical issues. The first step was to mark on the report sheet (underlying/circling/taking notes) which ethical issues they recognised (both explicit and implicit). The group had about 15 min for this. The following excerpt illustrates an implicit potential case:

The research institution turns to you to take over a part of a bigger survey as part of an European research project. The subjects of your research will be girls in their early teens (as an alternative - you are collecting data from a sensitive sample - rare artefacts/endangered plants), the results will be published in an international journal. You agree and start your planning. Which ethical issues might emerge?

- 3) Task 2 - the groups were given guiding questions about the case drawing attention to various issues (topics) characteristic of the research phase, i.e. planning, conducting or publishing. The topics students were expected to discuss were based on contents in the ALLEA Code of Conduct for Researchers. The groups were prompted to utilise the European and the national codes of conduct. The groups had about 20–30 min to discuss the questions. For example, for the case above, some of the questions were:

Which codes of conduct do you follow? Are you familiar with them? Where to find them? Are there special requirements and protocols for handling under-aged human research participants? Is an ethics review required? What determines this? Envision the impact of the research - What is the impact of your research on research participants and other parties?

- 4) Task 3 - the group was given support material - outlining the topics of the case accompanied by comments and references to rules and regulations pertaining to them, the groups elaborated the answers (in a different colour), the groups spent about 15–20 min on this.
- 5) Task 4 – the groups gave overviews of their cases to other groups (thus covering all the phases of research) - this task was scaffolded by one or two facilitators who tried to help the group develop the understanding further. All other students were encouraged to join in with questions and comments. Each group spent about 15 min on the overview.
- 6) All students who participated in the workshop were asked to fill in a feedback form (individually) in order to identify awareness development and students' perceptions of their learning.

Research method

In order to address our research questions, 6 workshops were organized with beginning researchers. These workshops followed an action research approach (Stringer 1999) doing a systematic, reflective study of the pedagogical intervention, and the learning process. During the workshops, the main facilitator followed a participant observation

technique (Kawulich 2005) enabling the researchers to learn about the activities of the people under study in an authentic learning setting. For the data analyses we adopted a mixed method approach, combining quantitative and qualitative techniques.

Context

In the Estonian higher education system, studies for a bachelor's degree take 3 years, with an additional 2 years necessary for a master's degree. A bachelor's degree equals 180 credits (1 credit in the European Credit Transfer System equals approximately 26 h of study), and a master's degree additional 120 credits. Doctoral programme lasts nominally for 4 years and equals 240 credits (out of which 180 credits are nominated for research work).

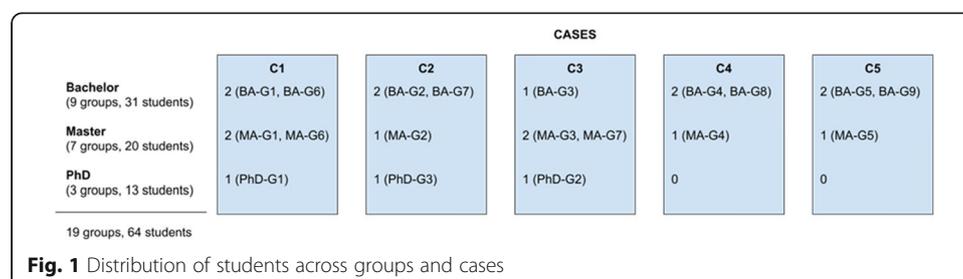
All BSc students lead an individual research project that forms the experimental part of their written final thesis. Bachelor curricula students' studies can culminate either with the defence of literature overview analysis or experimental thesis. In addition, bachelor students in Educational Sciences are expected to conduct small scale research which may include children. For graduation, the master's students in Natural Sciences curricula as well as Educational Sciences write a research thesis equivalent to one research paper and are encouraged to publish in scientific journals. Both the undergraduate and graduate theses work can require the acquisition of ethical permits.

Participants

Data were collected during 6 workshops taking place in 2018, where the different cases (C1 to C5) were tested (see Fig. 1). The participants were 64 students: 31 bachelor (BA/BSc), 20 master (MA/MSc), and 13 PhD students organised in 19 groups during the workshops. All participants were students at one Estonian university with social and behavioural sciences as well as natural science backgrounds. We have included both MA/MSc and PhD students in the study, as in the Estonian context also master students engage in research work and it is often at this level of studies that an interest for research and continued studies is sparked. While bachelor students do not engage in independent research, they are expected to understand central concepts including those related to research ethics, and to produce a bachelor thesis reflecting their understanding of processes of knowledge creation in their field.

Research ethics

The research followed the European Code of Conduct for Research Integrity (ALLEA 2017) and the Estonian National Code of Conduct (Hea Teadustava 2017). The



participants were asked for their informed consent prior to data collection. Participation was voluntary, and the decision not to participate in the research was not to influence the participants' status in the course or in their studies. Participants had the right to withdraw their consent at any time. The data were anonymized before analyses. The Estonian code of conduct does not provide guidance on ethics review, and there are no other guidelines in Estonia for non-medical research involving human participants. Therefore, as two of the authors are affiliated with a Finnish university, it appeared reasonable to apply the Finnish National Board on Research Integrity guidelines (2009) for research in the humanities and social and behavioural sciences. According to these guidelines, a study such as the one presented here does not require an ethics review. Ethics review is required when a study involves an intervention in the physical integrity of research participants; deviates from the principle of informed consent; involves participants under the age of 15 being studied without parental consent; exposes participants to exceptionally strong stimuli; causes long-term mental harm beyond the risks encountered in normal life; or signifies a security risk to subjects (Finnish Advisory Board on Research Integrity 2009). None of these conditions were met in this study.

Data collection

Data consisted of the following materials:

Collaborative group report

These were short (approx. one page) written reports produced by the groups. Each group produced one report making a total of 19 reports. The report paper had initially a case written on it, and the groups added an analysis of the case.

Video and audio recording of group presentations

Groups orally reported what they had written in the group report. The oral presentations were recorded either using video or audio recording. A total of 6 h and 26 min of recordings were transcribed verbatim. During the presentations two teachers supported the group (in case they had misunderstood or missed an important issue).

Individual feedback forms

After the workshop students filled in feedback forms in writing and individually. In total 51 feedback forms were returned. There were questions of various types – 3 multiple choice questions asking about the level of tasks, its clarity and the role of the group; there were 2 yes/no questions about the efficiency of the workshop and two open-ended questions asking for individual perceptions of the ethics workshop and recommendations for improvement.

Observation notes

During the workshop, the observer (who was one of the facilitators) took notes in the observation diary on student answers given during the warm-up task, how groups

appeared to be working collaboratively, as well as any problems or ideas of the facilitators. After each workshop general comments were added on the outcomes.

Group reports and presentations gave input to RQ 1, 2 and 3. Feedback forms and researcher's observation notes informed only RQ 3.

Analyses

Group reports and presentations were analysed qualitatively. Individual feedback forms were analysed quantitatively using descriptive statistics. Observation notes were not analysed per se, but they were used as supporting material for the other analyses.

We applied the *Structure of the Observed Learning Outcome*, the SOLO taxonomy, (Biggs 1999) for analysing the learning processes. The explanation and our interpretation of different SOLO levels are described in [Appendix 1](#). Shortly (Biggs 1999):

- At the pre-structural level, the learner has not yet approached the issue in a meaningful way, but is simply repeating the words in the question without understanding them.
- At the unistructural level, the learner has sufficient knowledge to identify, recognise, count, find, label, match, name, and perform simple procedures. The learner has mastered one relevant aspect - dealing with terminology, completing part of the task, defining concepts - but not others.
- At the multistructural level, the learner has understood several aspects but is unable to relate them to one another. The learner can enumerate, describe, illustrate, sequence, select, combine, and follow procedures, but struggles to make connections between them or draw conclusions based on interrelationships.
- At the relational level, relevant aspects are integrated into a coherent structure. The learner is able to address the point and provide explanations, give details, and connect to the whole, offering relevant examples.
- At the extended abstract level, the coherent whole is generalised or re-conceptualised at a higher level of abstraction. The learner grasps a more abstract version of the concept, and recognises other domains to which the concept might be applied.

As part of the analysis, an *Ethical Case Assessment Grid* (ECAG, see [Appendix 3](#) for the template) was developed based on the SOLO taxonomy. The facilitators used an ECAG sheet and topic legend for each case report - analysis of the reports took no more than 5 min a case and the final task was evaluated during oral presentations. Across the case and across the degree level analysis showed that the 'accelerated' method gave similar results to the detailed method (carried out based on written reports and transcriptions of presentations). Eventually, the group work results were evaluated during the training and at the end of the workshop participants were given instant feedback on their progression and topics they had identified as well as additional perspectives relevant in considerations of the case.

To display ethical sensitivity, group reports and presentation data were indicated in the ECAG grid. The content of the reports and presentations were divided into topics based on the ALLEA code of conduct (deductive analysis) and indicated in the grid.

To identify the different stages of their work, the groups were asked to use different colours during different tasks of the workshop. Since the learning activities and the reports were carried out collaboratively, the analysis focused on the group rather than on individual level.

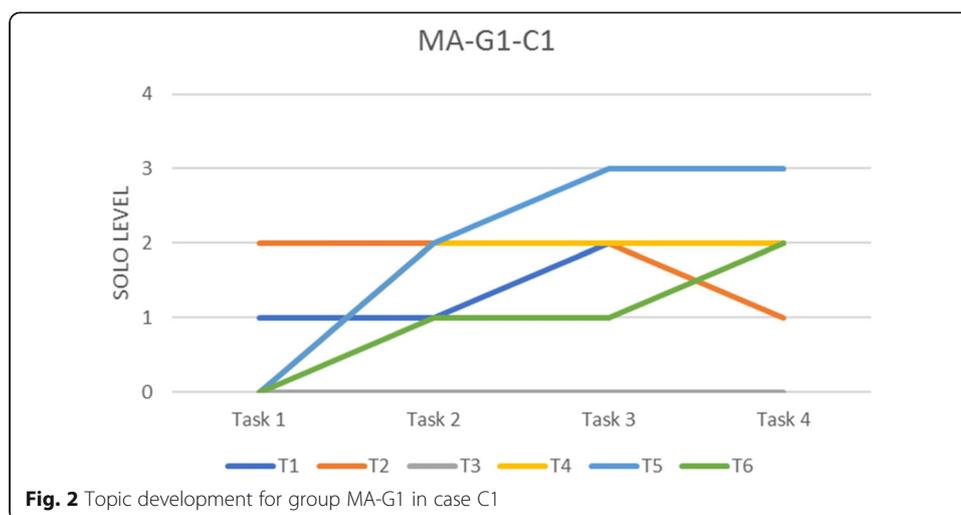
The analysis was conducted on three levels: topics, group performance and case overviews. To illustrate how the *topic analysis* was carried out, we take as an example one of the MA groups (MA-G1) which worked on a case dealing, among other ethics topics, with “Topic 1 - Knowledge of the codes of conduct (which ones to use and where to find them)” and “Topic 2 - Requirements/necessity of ethics review”. Table 1 illustrates how, based on the group (MA-G1) responses to the different tasks, we inferred the SOLO level of the group understanding in each task. While during the group work (tasks 1 to 3) the evidence came from the comments and notes written by the students in their reports, for Task 4 (oral presentations) the topics were identified in the presentation transcripts. In those cases when the students did not spot the ethics topics, the facilitators prompted the discussion during Task 4, and the group answers were taken into consideration.

Figure 2 visualizes the *group performance*, showing how this one particular group (MA-G1 dealing with case C1) progressed during the workshop in the different topics covered by the case they had been assigned. As can be seen not all topics were recognised during Task 1 (topics 3–6). Task 2, asking the questions and drawing attention to the ethical aspects, helped the group notice most of the topics and most of them even on the multistructural level. In task 3 the group was provided with support material to learn more about the topics, and some topics reappeared in the group’s answer. In Task 4, oral presentation and simultaneous scaffolding, the group showed gain in one topic, but it was also discovered, that they had misunderstood one topic, which displays as a drop on the graph.

Once all the groups were analysed, we aggregated the data per case, obtaining *case overviews*. This analysis helped us to identify commonalities and discrepancies among groups working with the same cases. It is not possible to directly compare

Table 1 Example of topic analysis

Topic	Task	Student response	SOLO level
Topic 1	1	Highlighted text: [...] Project [...] European project [...]. Comment: “What exactly is the aim of the project?”	Unistructural
Topic 2	1	Highlighted text: [...] Girls in their early teens [...]. Comment: “Vulnerable group of minors; research permits; consent from the girls/parents; ensuring confidentiality”	Multistructural
Topic 1	2	Comment: “All the aspects of the code of conduct (e.g. Hea Teadustava; code of conduct, etc). Yes; from the internet.”	Unistructural
Topic 2	2	Comment: “Yes, as they are minors thus a vulnerable group”	Multistructural
Topic 1	3	Comment: “European Code of Conduct of Research Integrity”	Multistructural
Topic 2	3	Comment: “Can this research be published in the chosen journal? [requirements to be checked]”	Multistructural
Topic 1	4	The students mentioned various codes of conduct, and the need to use the international codes as the project was EU guided	Multistructural
Topic 2	4	The group showed some discrepancies regarding the need of informed parental consent	Unistructural



the five cases based on the groups' learning processes, because the cases were different. For example, case C5 involved more factual questions while the other cases offered opportunities for more explorations of different solutions. In addition, we did not evaluate whether the groups reached the 'roof' of their understanding. It might be possible with different kinds of tasks to achieve even higher levels of understanding.

Results

It was possible to identify display of ethical sensitivity of student groups on all levels of the SOLO taxonomy among all BA/BSc, MA/MSc and PhD groups. The groups exhibited learning on different SOLO levels during different phases of their group work (see [Appendix 1](#)).

Display and evolvment of ethical sensitivity

During collaborative case-based learning all groups displayed some ethical sensitivity, and the understanding of ethical issues increased in terms of levels of understanding. The display and evolvment of understanding is presented based on tasks (1–4).

As students received their case, in some instances they first had to specify the context for it (cases C1 and C2), and then were presented with the first task, where they were prompted to identify ethical issues. The groups displayed their understanding by underlining the words in the cases, sometimes highlighting or circling. Some groups even added explanations and examples exhibiting their knowledge, e.g. "*girls in their early teens: vulnerable group of minors*".

Results of Task 1 indicated that only a few topics were more apparent to some groups than others, e.g. the most commonly displayed topic was the conflict of interest (in the case of knowing the reviewer). This was closely followed by recognising the necessity of the ethics review (in case of vulnerable population), the relevance of not neglecting negative results, who can claim authorship of a publication, how the chosen method may influence the sample, and the procedure for the informed consent. Out of 35 ethics sub-topics introduced in the cases (see

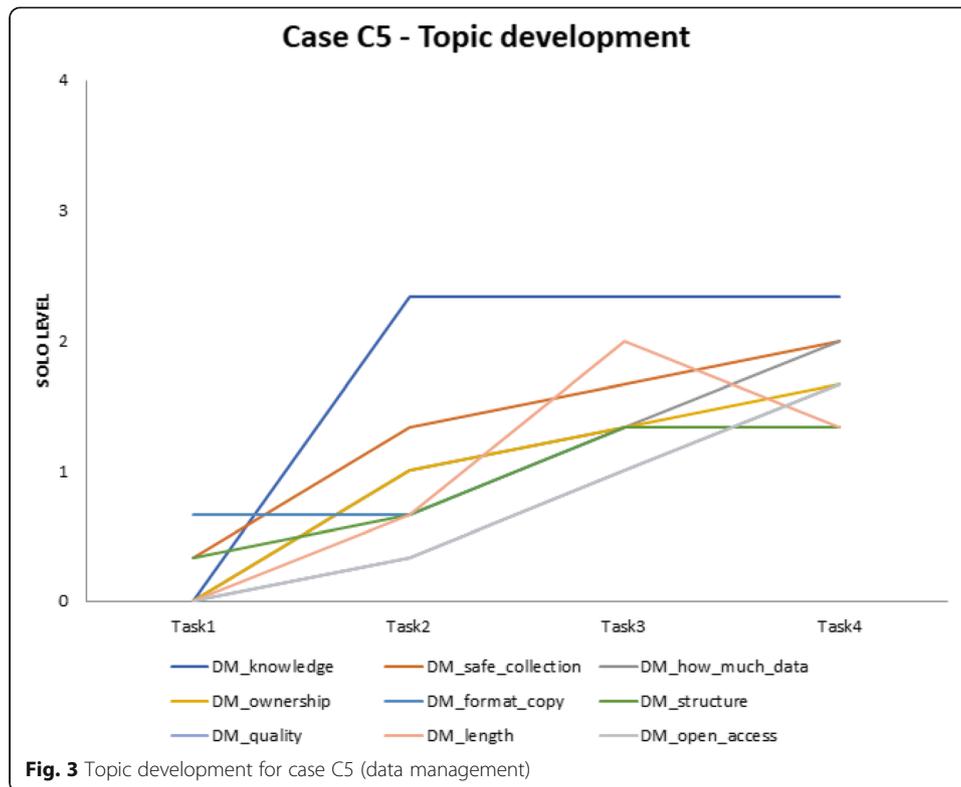
Appendix 2) there were 22 topics that were not recognised at all by groups during the first task. The reason might be that many ethical issues are implicit and not so clear after first examination of the case.

It was difficult for students to recognise more subtle (and even some very basic) topics, which made Task 2 crucial. By wording the topic in the form of a question all topics were recognised by groups. Indeed, about a third of groups could not answer all the questions presented during Task 2 immediately, but they kept the issues in mind and were able to utilise the support material to find the answer in the next task. For factual questions, the groups often reached unistructural level, e.g. for the question about which codes of conduct should be used, the groups often said, for instance: *national code of conduct, ALLEA, can be found for example online*. Even if the topic was recognised in the first task, most groups who did, were able to add an explanation and progress to a higher level of understanding. For instance, on a question about how to treat your research participants and colleagues, one group had recognised the topic already during Task 1 and reached unistructural level. When they got the questions they elaborated: *[treating everyone] according to the codes of conduct, respect, keep confidentiality, be honest, find a trusted contact*.

Indeed, there were some instances where there was fluctuation between SOLO levels from Task 1 to Task 2. For instance, one group in Task 1 showed awareness of importance of data management in case of delicate information, but in Task 2 when prompted about the necessity of a data management plan, they responded “*It is necessary to have specially trained staff. Data management system needed*”, failing to address the issue asked for. On occasions groups seemed to display understanding but with further prompting it became apparent that they had misunderstood the topic or were advancing in a non-relevant direction.

Progressing to Task 3 groups were provided with support material, which explicitly described the topics in the ALLEA Code of Conduct, explanations to topics and links for further reading. Results indicated that the greatest gain from support material came to the topics related to data management (there were 11 sub-topics related to data management with nine showing gain), as this case contained mostly factual questions and answers could easily be found. The topic development of case C5 (data management) is illustrated in the Fig. 3 below. Almost all the groups showed gain between Tasks 2 and 3:

The finding of fluctuation of display of understanding of research ethics and integrity may be the result of various factors. Many factual questions were provided with answers in the support material, e.g. information about the codes of conduct, necessity, procedure in case of conflict of interest, publishing criteria, and so on. On the other hand, the gain was smaller or non-existent with questions that required more contemplation by the groups (analytical questions). This was also anticipated as students often expected ready-made answers to questions they struggled with and that might require analysis of information. For instance, one group wrote about a topic –‘which steps should you take in case of misconduct’:
 “*Explain the research to the participants *Get a written consent *Explain data protection (who can see) *Confidentiality and anonymity - how is ensured? *Eliminate risks *Ensure voluntary participation and the right to withdraw *Explain again



what is about to happen". The group just listed the steps for getting an informed consent, not the steps to be taken in the case of misconduct (they were expected to come up with their original answer). It can be assumed that they expected ready-made answers to the questions from the support material and did not work on drawing conclusions.

In the display of topics in Task 4 (oral presentation of the group work) the analysis showed the gain for topics that required more contemplation. At this point, oral scaffolding was provided by one or two facilitators. Factual questions generally remained at the level of the previous task. The biggest gains were identified for topics concerning misconduct, publishing issues, negative results, evaluation of the impact of the research, and minimising risks and harms. Many of these topics may have several answers, and require ethical deliberation. In Task 4 the scaffolding helped students recognise ethical aspects they had not thought about before and develop their understanding even further. For instance, one group (BA-G3) dealing with a case of misconduct (senior researcher claiming authorship in an article he/she has not contributed to) showed quite rapid development of understanding of Topics 2, 3, 5 and 6 during presentations. The following dialogue provides an example of the scaffolding provided by the facilitator and the group responses (translation from Estonian):

A group member speaks on behalf of the entire group (BA-G3-P1): *"We discussed it in the group and First we could ask the senior researcher what the problem was and then explain how this is not ethical. Then turn to the council or board of the*

institution that would help us solve the problem by discussing the issue, And the next question is – who could we turn to to get help? Ummmm ... yes, then to the research institution and then the lawyer” [end of the sentence not clear].

Facilitator: *“I would ask you - if this article you are discussing is part of your MA thesis and the senior researcher in question is a member of the defence board - would it be easy for you to have this conversation?”*

Student (BA-G3-P1): *“It might not be easy, but at the same time, if there is the national code of conduct for researchers where the ethical aspects have been written down ... the ones he/she is violating, then probably our research is more important ... our findings are more important We have conducted that research and if he is just a member in that board or a reviewer then he/she has no right to use his position to have his/her name on our work.”*

Facilitator: *“OK, but let’s assume that you are the MA student who has had a conversation with that senior researcher that after your graduation there will be a vacancy of a junior researcher for you.”*

Student (BA-G3-P1): *“So that he/she would be convincing me ... that he/she would be returning the favour? That is the ethical conflict!”*

Facilitator: *“How would you solve the problem? Would you feel on the safe ground?”*

Student (BA-G3-P1): *“Well, I think there is no choice for either side, as, first of all, his/her offer for taking the research and me getting the position – this is by no means ethical. And then me accepting the position – this lacks any kind of Justice, so to say.”*

The previous example illustrates how ethical sensitivity is clearly present, the students just needed a bit ‘nudging’ to expand the case. To illustrate, initially the presenter just listed possible instances to turn to, but not really seeing the relation between them (multi-structural level). Following that, a facilitator extended the case by introducing another aspect to consider which led the presenter to analyse the situation again and find support for the argument. Another extension introduced the next topic, and as the sensitivity was already triggered, the topic of the conflict of interest was noticed immediately. The direct questions by a facilitator resulted in a balanced argument by the presenter.

Similarities and differences between degree levels

Different degree levels advance non-linearly in ethical understanding and require different forms of support. The data were drawn from task-based results (see the previous section), observation notes and the feedback forms, where participants reflected on the group work and learning.

Bachelor students started on a pre-structural level for almost all topics, which was expected considering their very limited exposure to research ethics. Wording the ethical issues in Task 2 helped beginners reach unistructural level. Support material

further helped about a half of groups to reach a multistructural level. For bachelor students, oral scaffolding (Task 4) was the most beneficial as they exhibited the most gain during this task. Observation notes also revealed that BA/BSc students were open to new ideas, did not get stuck with details, and were creative to invent a context. Feedback forms showed that while more than 90% of bachelor students found the level of difficulty of the tasks average, about a third of the students thought certain parts of the material were unclear. Their challenges were mostly related to terminology, lack of knowledge of where to access information and lack of research experience. Almost all the students claimed that working collaboratively was a big help and case-based collaborative learning had improved their ability to identify ethical issues better in the future (i.e. ethical sensitivity).

Master students started at almost the same level in the SOLO taxonomy as bachelor students, but possibly due to more knowledge and experience in research, Task 2 helped most groups reach unistructural or multistructural levels. Support material and oral scaffolding contributed only slightly to their understanding. Observation notes and feedback forms also indicated that master students found it more difficult to identify the context. They would have preferred to have more details provided in the task itself. Also, the relatively minor gain during Task 4 was unexpected as master students received more than twice as much oral scaffolding compared to bachelor students (times of prompting were counted in the transcripts). Oral scaffolding was provided by facilitators based on the need of students. In case there was no progression in the group, more scaffolding was provided. Overall, bachelor and master students reached almost the same level of understanding, i.e. nearly the multistructural level, which is also considered a threshold. Based on the feedback forms master students considered the level of difficulty average or easy, they also considered the tasks clear. All master students claimed that group-work was very efficient and helped them see different points of views.

PhD students progressed the most. PhD groups started on different levels, mostly between pre-structural and unistructural levels. They gained the most from Task 2 on wording the ethical issue, which helped the groups reach the multistructural level. Support material in Task 3 only helped a little and oral scaffolding was practically not needed. Groups showed increased understanding of only in a few topics during the presentation task. Observation notes and feedback forms indicated that while PhD students considered the level of tasks average, they reported being confused by the case. They got stuck on uncertainties, and speculated on things that were not relevant for the case. Nevertheless, they also thought that group-work was an asset and working in groups was more efficient than listening to a lecture.

Generally, bachelor students lacked the knowledge and experience, at the same time exhibiting high sensitivity for ethical issues and potential for development when provided with appropriate support. MA/MSc groups had difficulties seeing the 'bigger picture' of the case and getting stuck on detailed aspects of the case. PhD groups differed from the master level groups in that after the first reading of the case they requested more information instead of inventing the context themselves (which was part of the task). The difficulty for the PhD students was the fairly open nature of the cases. Due to the limited information in the cases the

discussions became speculative and side-tracked. This can be seen as an effort to extrapolate hints in the cases and to draw some more general conclusions. The role of the group proved to be efficient for all groups. The participants highlighted in their feedback forms that discussions, peer explanations, help with translating, answering questions together, and expressing different points of views as aspects distinguishing group work as beneficial.

Discussion and conclusions

The current research supports findings that case-based and collaborative learning is efficient in developing ethics competencies, as also indicated by Rissanene & Löfström (2014), Clarkeburn (2002) and others. Our aim was to scrutinise the anatomy of learning processes during collaborative case-based workshops of such pedagogical intervention by utilising the SOLO taxonomy. The posed research questions were: how is ethical sensitivity displayed and how does it evolve among degree students; and what are the similarities and differences of degree students' involvement.

The analysis of the groups' ethical reasoning in relation to SOLO levels shows that groups gradually developed their reasoning towards higher levels of reasoning, but not all groups reached levels beyond the multi-structural level. Similarly, Löfström (2012) found that both master and doctoral students may fail to recognize ethical issues beyond the multi-structural level. Bachelor students seemed to lack knowledge and research experience, at the same time exhibiting high sensitivity and potential for development when provided with appropriate support. Observation notes also indicated that groups that seemed to work more actively together achieved higher levels of understanding, but group dynamics was not in the focus of the present research.

Generally, cases of the workshop are somewhat individual instances - case descriptions were quite general and groups were asked to invent their own context for their case (to make it relevant for their field). Nevertheless, the cases are comparable as the training design follows the same pattern - there are cases relevant for various phase of research, there is a number of topics (between 6 and 9), their display and progress can be evaluated. Indeed, the topics of the cases have different value (e.g. some topics just require factual knowledge while others demand more thorough contemplation, we called them 'factual' and 'analytical' questions), so it would not be appropriate to expect higher level of understanding of all the topics - the main aim was to evaluate how the progress of topics within the case happened.

Wording the ethical issue was a crucial step in triggering ethical sensitivity. Prior research has also demonstrated that by wording the ethical issue the person becomes aware of it and is thus able to proceed to recognising different stakeholders and possible courses of action (Rest 1986; Myyry 2003; Morton et al. 2006).

In addition, results indicated that development of understanding of topics that were factual in nature was more efficient with the help of additional reading material, while more analytical topics benefited more from group discussions and, in case of BA students, oral scaffolding.

There were instances where there was fluctuation between SOLO levels appearing as a "backward" step. Prior research (Löfström 2012; Butterfield et al. 2000) distinguishing between ethical awareness and ethical sensitivity suggests that

ethical awareness, although a prerequisite for ethical problem-solving, does not necessarily translate into a deeper understanding of the ethical issue itself. Such backward fluctuation has been explained by Rissanen and Löfström (2014), Sparks and Hunt (1998) and Niemi (2016) as a possibility of routinisation: when people get used to certain tasks they do not check them as thoroughly any more, fall into routine. We are assuming that sensitivity towards ethical issues might be higher during BA level, as they are not 'routinised' yet, which is also outlined in the literature (Rissanen and Löfström 2014; Sparks and Hunt 1998; Niemi 2016). Another possible explanation offered by Niemi (2016) and Kvalnes (2014, 2019) is the situational variation and subsequent moral neutralisation. Both authors (Niemi 2016; Kvalnes 2014, 2019) point out that situational and environmental variation are often underestimated but have a great influence on ethical conduct of people, possibly also ethical sensitivity. For instance, if the environment does not support integrity or encourages unethical behaviour then the students in that environment will learn to do the same and see it as 'normal' conduct (or fail to see certain ethical aspects). In addition, in certain situations students may use various moral neutralisation techniques (Kvalnes 2014, 2019) to justify misconduct (e.g. denial of responsibility or appeal to higher loyalties). Both authors (Niemi 2016; Kvalnes 2014) point out that being aware of such challenges in the research community may alleviate the threat of misconduct – this would include systematic ethics training, open discussions and creating the working environment that would support academic integrity.

While the research allowed us to identify group learning processes during the solving of ethics cases, future research should analyse the nature of scaffolds that groups may need in order to advance in their task.

Educational implications

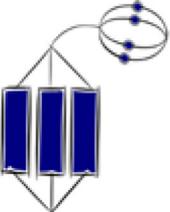
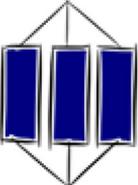
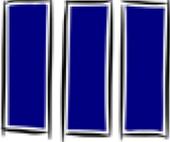
Using Action Research as a methodological approach in this study has contributed to deeply understand the learning process taking place in the groups of students. However, it should be noticed that given that this research methodology is "context-bound", the research questions (and our answers) may not be very generalizable.

In terms of analyses, the SOLO taxonomy has helped us to evaluate how the student understanding of ethics topics evolved during various tasks of cases. According to our experience, this instrument could be useful for other facilitators to assess the involvement of topics present in ethical cases. Even more, to make the assessment of progression smoother, learners could use pre-prepared template slides that have different sections for different tasks. This will help facilitators pinpoint the level of understanding more easily and give feedback to the group.

Drawing on these results, to help facilitators and learners of research ethics courses, we have created an *Ethical Cases Assessment Grid* (ECAG) – a tool to evaluate students' understanding and its progress of ethics cases during collaborative group-work (see Appendix 3; for a filled ECAG see Appendix 4). In the future, we will explore how to enrich the grid with a visualization that shows topics and their progress. The tool will help facilitators evaluate the progress of understanding, give instantaneous feedback to groups, and make recommendations on which topics to cover again or more thoroughly.

Appendix 1

Table 2 SOLO taxonomy explanation

SOLO taxonomy level, image (Hook 2011)	General explanation (Biggs and Tang 2007)	Our explanation
 <p>Extended abstract level</p>	<p>On the extended abstract level the coherent whole is generalised or re-conceptualised to a higher level of abstraction - the response goes beyond conceptualising, higher level of abstraction with application to new and broader domains.</p>	<p>On the extended abstract level, groups went beyond conceptualizing the present issue making steps towards relating the ethical issues to applications beyond the present case.</p>
 <p>Relational level</p>	<p>On the relational level relevant aspects are integrated into an overall coherent structure - ability to address the point and provide explanations, give details and connect to the whole, giving relevant examples.</p>	<p>On the relational level, groups displayed an ability to address the most relevant ethics issues and provide explanations pointing out interrelations and providing examples demonstrating own reasoning.</p>
 <p>Multistructural level</p>	<p>On the multistructural level several aspects have been understood, but not relating them to one another - ability to enumerate, describe, illustrate, sequence, select, combine, follow procedures, but struggle to make the connections between them or draw conclusions based on interrelations.</p>	<p>On the multistructural level, the groups demonstrated that concepts had been understood appropriately, but struggled to make connections between them and to draw conclusions based on any interrelations.</p>
 <p>Unistructural level</p>	<p>On the unistructural level knowledge enables learner to identify, recognise, count, find, label, match, name, perform simple procedures. One relevant aspect is understood - dealing with terminology, meeting part of the task, defining concepts while some aspects still missing.</p>	<p>On the unistructural level, the groups identified one relevant aspect displaying some familiarity with relevant concepts, but failing to address some more pertinent dimensions of the case.</p>
 <p>Pre-structural level</p>	<p>On the pre-structural level the issue is not approached in a meaningful way - repeating the words in the question/ simulation/ code; no understanding.</p>	<p>On the pre-structural level, the groups failed to identify a relevant ethical perspective or they identified an issue, but did not approach it in a meaningful way, repeating the words in the case without displaying evidence of own processing.</p>

Appendix 2

Table 3 Table with topics

Topic	Sub-topics (code)	Sub-topics explained	Cases with the topic
BEN - Benefit	BEN_who	Who will/should benefit	C2
CC - Codes of conduct	CC_knowledge	Knowledge of the codes of conduct	C1
CI - Conflict of interest	CI_knowing_reviewer	Conflict of interests - knowing the reviewer	C4
	CI_steps	How to notify of the conflict of interest	
DA - Data analysis	DA_transparency	Data analysis transparency	C2
DM - Data management	DM_format_copy	Data format and copy	C1, C2, C5
	DM_how_much_data	How much data is needed	
	DM_knowledge	Knowledge of DMP	
	DM_length	Data storage length	
	DM_open_access	Is data openly accessible	
	DM_ownership	Data ownership	
	DM_plan	Data management plan	
	DM_quality	How to ensure data quality	
	DM_safe_collection	Data safe collection	
	DM_storage	Data storage	
ER - Ethics review and special requirements	ER_application	Ethics review application procedure	C1, C2
	ER_need	Need for ethics review	
IC - Informed consent	IC_procedure	Procedure for the informed consent	C2
IM - Impact of research	IM_evaluate_impact	Evaluating the impact	C1
MIS - Misconduct	MIS_alone_help	Deal with misconduct alone or seek help	C3, C4
	MIS_confrontation	Confront the violator	
	MIS_procedure	Procedure of action in case of misconduct	
	MIS_republishing	Would you republish the same article	
	MIS_resubmitting_minor_changes	Would you resubmit the manuscript with minor changes	
NR - Negative results	MIS_steps	What steps would you take in case of misconduct	C4
	NR_procedure	What is the procedure to notify of negative results	
NR - Negative results	NR_relevance	What s the relevance of publishing negative results	C4
	NR_procedure	What is the procedure to notify of negative results	
OB - Observation/method	OB_issues	Observation issues	C2
PUB - Publishing	PUB_author	Who can be the author	C3, C4
	PUB_authorship_claim	Who can claim authorship	
	PUB_requirements	What are publishers' requirements	
	PUB_reviewing	Reviewing manuscripts	
RH - Risks and harm	RH_minimise	How to minimise risks and harm	C1
TR - Treating collaborators	TR_others	Treating others - partners and participants	C1

Appendix 3

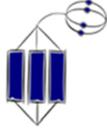
SOLO taxonomy level	Report - task 1	Report - questions independent	Report - questions with support material	Oral presentation of results
				
				
				
				
				

Fig. 4 ECAG template for facilitators. (image: Hook 2011)

Appendix 4

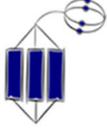
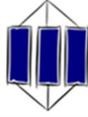
SOLO taxonomy level	Report - task 1	Report - questions independent	Report - questions with support material	Video - oral presentation of results
				
			Potential risks/harm, how to minimise	Potential risks/harm, how to minimise
	EU Project; Girls in their early teens	Requirements/ necessity of ethics review; Treating participants and colleagues; Potential risks/harm, how to minimise;	Knowledge of the codes of conduct; Requirements/ necessity of ethics review; Treating participants and colleagues;	Knowledge of the codes of conduct; Treating participants and colleagues; Data management planning
		Knowledge of the codes of conduct; Data management planning	Data management planning	Requirements/ necessity of ethics review???
		Evaluating the impact of the research;	Evaluating the impact of the research	Evaluating the impact of the research

Fig. 5 ECAG for group MA-G1-C1. (image: Hook 2011)

Abbreviations

ECAG: Ethical Case Assessment Grid; SOLO: Structure of the Observed Learning Outcome

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Authors' contributions

AT created the research concept and designed the training and assessment materials for the research purposes, acquired, analysed and interpreted the collected data, wrote and revised the manuscript. MJR-T analysed and interpreted the data, created the aggregated dataset, visualised the research process and results, substantially revised the manuscript. KK conducted trainings and acquired data, supported research design, drafted and revised the manuscript. EL created the research concept and helped design the training materials, interpreted results, substantially revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

As the current research is based on data collected on a small scale, in one institution and analysed qualitatively, we cannot make the data openly available, as without knowing the context it will be dubious what interpretations can be made based on the data. We cannot dispose institutional context in order to protect the anonymity of the participants. In addition, as some of the data were collected before and some after the new GDPR regulations, the informed consent did not specifically ask for the participants' consent to make their data openly available. Nevertheless, we can provide data to other researchers for verification purposes, and we are sharing our aggregated data which shows the overview of each one of the groups in the additional supporting files. The dataset supporting the conclusions of this article is included within the article.

Competing interests

The authors declare that they have no competing interests.

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