

How to Support Co-creation in Higher Education: The Validation of a Questionnaire

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Abstract

In this study, we regard co-creation as a collaborative process where students, lecturers and working field professionals from outside the university jointly develop innovative products, processes or knowledge. In co-creation all stakeholders equally contribute to the collaborative process and aim to create beneficial outcomes for each participant. Co-creation can be used as a valuable pedagogical method to support continuous interaction between learning and working in higher education to foster innovation. However, this process is not necessarily mastered by co-creation groups. In order to identify which components of this collaboration process can be further improved, we developed a questionnaire to assess co-creation processes in higher education. Students, lecturers and working field professionals participating in co-creation projects completed the questionnaire. We validated the questionnaire using a principal component analysis. The seven extracted scales proved to be sufficiently reliable. The final questionnaire consists of seven components: positive interdependence, individual accountability, collaboration, shared mental models, safe and supporting conditions, creative community, and group evaluation. We described how the tool can be used in practice.

Keywords: co-creation, higher education, professionalization, innovation, educational methods, collaborative learning

1. Introduction

A diversity of studies show important outcomes of co-creation as a pedagogical method in higher education (Goi et al., 2022; Ribes-Giner et al., 2016). A major part of this research is performed on co-creation in which students and teachers collaborate to innovate curricula (Dollinger et al., 2018). Bovill and Felten (2014) explored how faculty members and students can engage as partners in teaching and learning in higher education (HE). They define co-creation as ‘a collaborative, reciprocal process through which all participants have the opportunity to contribute equally, although not necessarily in the same ways, to curricular or pedagogical conceptualization, decision-making, implementation, investigation, or analysis’. We feel an urge to take a next step and also involve external partners in co-creation projects in HE. When students participate in working environments collaborating with professionals or other external partners, this may lead to reciprocal learning processes. Apart from students learning individually, co-creation also leads to collective learning processes and outcomes for all stakeholders (Bakker & Akkerman, 2014).

In our study, we use an adapted version of the definition of Ind and Coates (2013): co-creation in HE is a collaborative process in which all stakeholders (students, teachers and working field professionals) equally contribute to generating innovative products, processes or knowledge. Co-creation re-addresses hierarchies between participants (Kasnakoglu & Mercan, 2022; Ehlen, 2015; Lubicz-Nawrocka & Bovill, 2021). In co-creation the different participants are regarded as equally valuable for the process of creation. Lecturers and external partners are active participants in their co-creation with students, instead of being supervisors observing the students’ performance.

The use of co-creation in HE can serve different purposes and lead to several outcomes. Co-creation can positively affect student engagement (Bovill & Felten, 2016), it supports the development of positive relationships and community, it stimulates student engagement and enjoyment, it promotes students taking risks and overcoming challenges, and it leads to academic achievement and student retention (Lubicz-Nawrocka & Bovill, 2021). It is also a useful pedagogical method to bridge the gap between studying at a university and working as a professional (Bakker & Akkerman, 2014; Bouw et al., 2021a). Further, it contributes to a continuous professionalization of teachers and working field professionals and to innovations in both practice and educational programs, by addressing wicked problems in both contexts (Dollinger et al., 2018).

First, we will explain several advantages of using co-creation in HE at length. Second, we will discuss some pitfalls of implementing co-creation in HE, and third we will describe essential elements for successful co-creation projects in HE. Finally, we will argue why a tool assessing co-creation processes is useful.

1.1 Advantages and Outcomes of Using Co-creation in Higher Education

1.1.1 Co-creation as Effective Learning Environment for Students

Co-creation leads to higher student engagement (Wang et al., 2022; Bovill & Felten, 2016). Engagement is seen as a deep involvement in learning (Axelson & Flick, 2010). Temple and Clothier (2019) for example, studied a collaborative project of educational experts, lecturers and students. They found that ‘co-created outputs exceeded initial expectations, and a collation of student reflections evidenced in a deeper engagement with the issues associated with teaching and learning’ (p. 18 -19). Student engagement contributes to student success in HE (Kuh et al., 2010), because it involves self-regulated learning, metacognition, application of learning strategies and strategic thinking and studying (Lester, 2013). This all leads to increased shared responsibility, ownership and motivation (Lubicz-Nawrocka & Bovill, 2021).

Principles such as respect for students and the establishment of study environments where students are offered the role of becoming leaders of their own learning processes contribute to higher learning outcomes (Iversen et al., 2015). Learning environments where students act responsibly and have influence on the curriculum while collaborating with teachers create good conditions for developing the knowledge and skills that are not only expected and described in the formal study regulations, but also required for the 21st century (Iversen et al., 2015). Co-creation stimulates creativity and innovation skills necessary to deal with the issues of the current society (Bovill, 2011; Rill & Härmä, 2018).

Furthermore, HE alumni experience the transition from being a student to being a professional as difficult (Reddy & Shaw, 2019). Young professionals struggle with different responsibilities and expectations, such as ‘being pro-active’, and using their expertise in professional contexts (Monteiro et al., 2020). Students and employees in organizations still consider education and working as (partially) separate worlds. There is a gap that is not easily bridged (Chreech et al., 2008; Trevelyan, 2019). Co-creation could contribute to bridging this gap by bringing both worlds together.

1.1.2 Co-creation as Professionalization of Working Field Professionals and Lecturers

To be fit for a changing world, the teacher has to take part in the learning process and to change role. Disciplinary knowledge transmitting needs to be transformed to a form where teachers, students and stakeholders work together as co-creators in trans-disciplinary knowledge development for a fast-changing world. This asks for new forms of experimental education, such as co-creation where it is allowed to make errors (McWilliam, 2007). Lecturers could professionalize themselves by participating in co-creation processes and by learning side by side with students and professionals. Solutions for wicked problems in the professional field can be sought in co-creation, so all stakeholders learn in collaboration and innovate practice at the same time. This also works the other way around: by allowing professionals to contribute to curriculum innovations, educational programs can adapt to continuous changes in the professional field. In their educational environment, students and teachers can use what is learned in collaboration with external partners, such as working field professionals (Bouw et al., 2021b).

1.1.3 Co-creation as Catalyst for HE Agility

Curricula in HE need to include space for innovation and creativity (Bovill, 2017; Bron et al., 2016; Bovill & Woolmer, 2019; Knight, 2001). HE institutions are regarded to be resistant to change. They find it difficult to move smoothly along with changes in society and it takes too much time to adapt to the ever-changing world (Kumari et al., 2020). Involving working field professionals in HE co-creation projects could generate new opportunities. In the co-creation process each stakeholder equally contributes to the process, resulting in a continuous interaction between working and learning. By regarding education and work as two dimensions of a

continuum, the alignment of HE with the professional field is inevitable and self-evident. Consequently, the agility of HE institutions would increase. Agility is the ability to create and respond to change. It is a way of dealing with, and ultimately succeeding in, an uncertain and turbulent environment (Agile Alliance, n.d.). A more agile HE institution will therefore be more apt to changes in society, will be more innovation minded and will enhance creativity in its students and teachers.

We described the advantages of implementing all stakeholder co-creation in HE; yet there are also pitfalls to mention for the implementation of co-creation.

1.2 Pitfalls when Implementing Co-creation

It is not self-evident that in co-creation groups, participants will equally contribute to the collaborative process; however, it is key for co-production and for the value of the co-creation process and outcomes (Dollinger et al., 2018). In co-creation there is a need for balanced roles, because this helps to facilitate transparency, dialogue and trust, which leads to shared responsibility throughout the co-creation process (Ramaswamy & Ozcan, 2014). In order to be able to co-create, teachers will have to take on a different role in their interaction with students and have to adopt a learning and collaborative attitude (Santana-Martel, et al., 2022; Brauer & De Hei, 2020; Hämäläinen & Vähäsantanen, 2011). Teachers in general prefer to be in control of teaching. Letting go the role of expert and leader in the process may lead to feelings of insecurity, because the outcomes of the process are uncertain (Cook-Sather & Luz, 2015; Könings et al., 2021). Some teachers think it is difficult to recognize the value of the quality of the contribution of students (Bovill, 2013). Teachers have to be open to learning and reflecting together with students on their skills (Könings et al., 2021).

Also, students need to get used to teachers as participants in a collaborative project instead of the teacher being the knowledgeable expert. Students can be insecure about their knowledge and skills, especially when co-creation asks them to think ‘out of the box’ (Boville et al. 2016, Könings et al. 2021). Teachers have to be able to participate in the process in a positively engaging way, so they give feedback to students as they do amongst colleagues; thus, they refrain from giving personal feedback as a supervisor. (Cook-Sather & Luz, 2014; Könings et al., 2021).

Consequently, a problem that will arise is the assessment of students. In co-creation, equal contribution of each of the participants is conditional in order to achieve a shared mental model on the problem and to develop creative ideas. Adaptations in the assessment are necessary, because in equal contribution to the process, the issues of power and identity of the participants in the co-creation will reflect on the assessment. Therefore, stakeholders involved in co-creation projects need to consider democratic forms of feedback and assessment (Matthews et al., 2021).

The necessary participation of professionals from the working field can also be a hindrance

for co-creation projects. In the full schedules of the professionals, focused on productivity and the completion of tasks, time will have to be retained to participate in co-creation projects without prior knowledge of the benefits for their organization. HE institutions will have to adapt their organization when they strive to implement co-creation in their curricula to enable participation of the professional field and to convince the professional field of benefits of participating in co-creation projects (Temple-Clothier & Matheson, 2019).

Finally, we would like to stress that co-creation requires a lot of effort: *‘It is important to note that (curriculum) co-creation – in being inherently disruptive of previous ways of relating, teaching, and learning – was considered by our participants to be challenging’* (Lubicz-Nawrocka & Bovill, 2021, p. 12).

1.3 Essential Elements of Co-creation

From empirical literature and existing validated surveys concerning collaborative learning, team learning, learning communities and co-creation in higher education contexts, we deduced the following eight essential elements of effective co-creation processes: positive interdependence, individual accountability, interaction, group evaluation, shared mental models, safe and supporting conditions, community identity, and creativity. These all influence the equal contribution of all of the participants.

1.3.1 Positive Interdependence

Positive interdependence means that group members realize that they are dependent on the effort of all group members, including their own effort, to attain the common goal (Gheorghe et al., 2022; Janssen, 2014). Positive interdependence leads to the development of new insights and discoveries (Johnson, & Johnson, 2009). In co-creation processes this is nurtured by participants with different backgrounds, ages and levels of expertise that contribute by sharing ideas, knowledge and experiences (Wilson et al., 2004). This sharing leads to the building

of shared mental models and an improvement of interaction resulting in adequate team effectiveness (Fransen et al., 2011).

1.3.2 Individual Accountability

In order to support positive interdependence, group members should all not only feel individually responsible for completing their share of the work, but also to facilitate the other group members to be able to perform their part and to consider the welfare of the other group members (Johnson & Johnson, 2009). Close relationships involved in co-creation stimulate the sense of community, shared responsibility and accountability (Lubicz-Nawrocka & Bovill, 2021). Individual accountability of students is needed to create more engaging and transforming learning environments (Cook-Sadler, 2010).

1.3.3 Interaction

Interaction in co-creation refers to the process of collaboration needed to attain shared goals (Janssen, 2014; Strijbos et al., 2004). Promotive interaction occurs when group members encourage and help each other to work on the group's goals (Johnson & Johnson, 2009). Interaction can be about meta-cognitive activities (such as planning, monitoring and evaluating the collaboration) and involve social activities to get to know and understand one another, but of course it can also be about the problem participants are working on collaboratively, talking about declarative or procedural knowledge and about the participants' experiences and expertise (Dennen & Hoadley, 2013; Härmäläinen & Vähäsantanen, 2011). Interaction is a key factor influencing the transformational outcomes of co-creation in HE (Lubicz-Nawrocka & Bovill, 2021).

1.3.4 Group Evaluation

Group evaluation supports the active participation of group members in collaborative work and prevents social loafing (Tosuntas, 2020). When groups evaluate their collaboration, they reflect on helpful and unhelpful behavior of group members and decide on what should be done to improve the collaborative process (Jansen, 2014; Johnson & Johnson, 2009). Group evaluation supports the building of interpersonal relations by awareness of how team and task aspects carry on in the process, which helps the group update the team's shared mental models (Fransen et al., 2011).

1.3.5 Shared Mental Models

For good collaboration, participants need to agree on how they need to work (Wilson et al., 2004). It is essential to develop shared mental models with the group members (Lines et al., 2022). Shared mental models enhance the quality of interaction and help group members identify their shared values (Zamani & Pouloudi, 2022). Teams first need to develop shared mental models before they are able to effectively set team goals, decide on team strategies, divide tasks and monitor the group processes and communication. (Fransen et al., 2011).

1.3.6 Safe and Supporting Conditions

Emotional safety (feelings of mutual trust and security) is very important in co-creation. It contributes to a sense of community and improves the interaction (Admiraal & Lockhorst, 2021). Safe and supporting conditions help group members to develop mutual trust and prevent them from putting effort in protecting, checking and inspecting the actions of other group members (Fransen et al., 2011; Wilson et al., 2004). In groups with sufficient mutual trust, group members will be attentive to the rights and interests of the other members and will be eager to share information (Fransen et al., 2011). A caring and nurturing environment encourages risk taking (Wilson, et al., 2004) which is needed to stimulate creativity and innovation (Lubicz-Nawrocka & Bovill, 2021).

1.3.7 Community Identity

A community identity beholds the agreement on shared goals, a shared belief system, and rules and norms accepted and lived up to by the community members. The establishment of a community identity assures that the community continues to function, because the participants feel a sense of belonging (Brauer & De Hei, 2020). A sense of community and an environment where participants are engaged and enjoy learning will promote participants to spend more time and effort in their learning and to take risks. (Lubicz-Nawrocka & Bovill (2021). The encouragement of risk taking, making mistakes as a part of the process and thinking about how to manage the process, fosters creativity (Starko, 1995; Gibson, 2010).

1.3.8 Creativity

Creativity is the ability to design ideas or concepts (Ehlen, 2015). Creativity selects, combines and reshuffles existing facts and ideas (Gibson, 2010). The word 'co-creation' is derived from two words: 'collaboration' and 'creativity' (Ehlen, 2015). Innovation is a social process in a context to implement a solution (Ehlen, 2015, p115.) Creativity requires an openness to experience, a willingness to take risks and an amount of flexibility and open

mindedness (Ewing and Gibson, 2015). Also, Bovill (2017a) states that focus on the process of co-creation will lead to more space for innovation and creativity. Creativity is often the result of a collaborative effort that arises from engagement and group knowledge (Craft et al., 2014; Ehlen, 2015). ‘Everyone has the potential to contribute to creative processes, if they are motivated to do so and if stimulating conditions and processes exist’ (Ehlen, 2015, p 116).

1.4 Why a Co-creation Questionnaire

Effective co-creation processes that lead to the development of innovative products, processes or knowledge do not arise naturally (Lubicz-Nawrocka & Bovill, 2021). The elements essential for good co-creation processes may not all be fulfilled in projects. In order to adjust and improve an ongoing co-creation process, it would be beneficial to be able to monitor the extent to which each essential element is met. With this knowledge, a co-creation group can enhance the process of exchanging feedback. This feedback is a means for the group members to make sense of performance-relevant information and use this information to enhance the process (Henderson et al., 2019).

1.5 Research Question

The purpose of this research is to validate a questionnaire that is based on a narrative literature study and can be used as a tool in higher education to assess the quality of co-creation processes by assessing each of the essential elements. Therefore, our research question is: “To what extent are the components of the co-creation questionnaire that we developed reliable and valid to map the process of co-creation in higher education?”

1.6 Research Goal

A major body of studies is published on co-creation in which students and teachers collaborate to innovate the curriculum (Dollinger et al., 2018). There is also research on related topics, for example about boundary crossing in HE to address wicked problems (Veltman et al., 2019). However, co-creation involving the working field as a stakeholder in addition to teachers and students is not yet thoroughly studied. With this study, we aim to explore aspects of co-creation that contribute to its described advantages and outcomes and to give guidance in how to improve co-creation processes in which working field professionals, teachers and students contribute equally.

After the description of the process of validating the questionnaire, we will describe how to use the questionnaire in HE contexts.

2. Method

2.1 Design of the Questionnaire

The constructs and the items of the questionnaire are based on empirical studies regarding collaborative learning (e.g. Admiraal & Lockhorst, 2012; De Hei et al., 2018; Johnson & Johnson, 2009), team learning (e.g. Fransen et al., 2010), learning communities (e.g. Bielaczyc & Collins, 1999; Wilson et al., 2004) and co-creation (e.g. Lubicz-Nawrocka & Bovill, 2021; Ehlen, 2015). We developed this questionnaire in four steps. In step 1, we explored the different aspects that various studies mentioned as indispensable aspects of good co-creation processes to get an indication of scales for our questionnaire. In step 2, we searched for items or formulated items that could represent these scales. We also deduced and (re)formulated relevant items regarding the essential elements of co-creation of step 1. In step 3, we tested the items of the questionnaire with five students using a thinking aloud procedure to test whether the items were as comprehensible and understood as meant. In step 4, when necessary, we adjusted items after the thinking aloud procedure and the feedback of the participating students.

The questionnaire provided a set of items that were scored on a 4-point Likert-scale (1= totally disagree, 2=disagree, 3=agree, 4=totally agree).

2.2 Participants

Co-creation groups, in which students, teachers and working field professionals collaborated, within a Dutch university of applied sciences were asked to cooperate in this research. We collected 103 questionnaires from participating teachers, students and external parties. The descriptives of the respondents can be found in table 1.

Table 1. Descriptives of the respondents

Role	Number of respondents	Mean age (N*)	SD	Range
Teacher	11	45.7 (11)	10.1	21 – 61 years
Student	86	22.9 (52)	3.5	18 – 40 years
Working field professional	6	39.0 (4)	8.2	30 – 50 years

*Only 69 out of 103 respondents filled in their age.

Some teachers and working field professionals participated in more than one project. In those cases, they only completed the questionnaire once. Not every individual participant of each co-creation group filled in the questionnaire. As our aim was to test the items, to explore the possible components and to validate the questionnaire and not to research the process of co-creation of each specific group itself, it was not necessary that every participant of each group completed the questionnaire.

2.3 Procedure

The participants received a hyperlink to the online questionnaire. Informed consent was given by the participants prior to answering the questions. They completed the questionnaire during or within two weeks after their co-creation projects.

2.4 Analyses

After data inspection and a missing data analysis, we performed a Principle Component Analysis (PCA) using Oblimin Rotation (21 rotations needed for the final analysis) to explore underlying components. The KMO = .84, Bartlett's test of sphericity, using as inclusion criterion a factor loading of $\geq .46$ loading on one component only, was significant ($p < .001$), showing sufficient correlation between the components. The Eigen Values of the seven components we found were higher than 1.0 and explained 65,3% of the variance. The resulting components were used to perform a reliability analysis.

3. Findings

First, we will give an overview of the reliability of the components in table 2 and the correlation between the components in table 3. After that, in table 4 we will justify what literature or questionnaire was used for each item of the respective components.

Table 2. Descriptives of the components of the questionnaire

	Number of items	M	SD	N	Reliability (Cronbachs alpha)
Positive interdependence	4/5*	3.3	.48	102	.634/.684**
Individual accountability	3/5*	2.9	.70	103	.660/.764**
Interaction	3/5*	3.4	.49	102	.633/.742**
Shared mental models	5	3.0	.62	99	.802
Safe and supporting conditions	9	3.4	.52	102	.914
Creative community	6	3.2	.64	102	.907
Group evaluation	3*	2.8	.66	102	.737/.824**

* number of items/number used for the Spearman Brown correction.

** Cronbachs Alpha using the Spearman Brown correction.

Table 3. Correlations of the components of the questionnaire

	PI	IA	IN	SM	SC	CC	GE
PI Positive interdependence	1	.209*	.316**	.304**	.328**	.399**	.202*
IA Individual accountability	.209*	1	.286**	.415**	.304**	.421**	.232*
IN Interaction	.316**	.286**	1	.418**	.574**	.520**	.274**
SM Shared mental models	.304**	.415**	.418**	1	.505**	.456**	.430**
SC Safe and supporting conditions	.328**	.304**	.574**	.505**	1	.628**	.253*
CC Creative community	.399**	.421**	.520**	.456**	.628**	1	.255*
GE Group evaluation	.202*	.232*	.274**	.430**	.253*	.255*	1

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4. Origin of the items per component

Positive interdependence	
1. We depend on each other for information and advice.	<i>Fransen, et al. (2011), p 1111</i> <i>Janssen(2014) p 30,38</i>
2. When my group members succeed in their tasks, it works out positively for the group work	<i>Fransen, et al. (2011), p 1111</i> <i>Wilson (2004) p 8,9</i>
3. In our group we need each other to work towards our goals	<i>Johnson & Johnson (2009) p 368</i> <i>Wilson (2004), p 5</i>
4. In our group we depend upon each other to be successful.	<i>Fransen, et al. (2011), p 1111</i> <i>Johnson & Johnson (2009)</i>
Individual accountability	
1. In our group, all members equally contribute to the project.	<i>De Hei, et al (2018), p 2360</i> <i>Cook- Sadler (2010)</i>
2. In our group, there is at least one group member who mostly let other groupmates do his/her work.	<i>De Hei, et al. (2018), p 2360</i> <i>Slavin (2014) p 2</i>
3. In our group, all members are eager to contribute to the project.	<i>Johnson & Johnson(2009), p 368</i> <i>Lubicz-Nawrocka &Bovill (2021) p 7</i>
Interaction	
1. There's room for the opinion of every group member.	<i>Fransen, et al. (2011) p 1111</i> <i>Wilson et al. (2004), p17</i>
2. Problems and issues are brought up and addressed in our conversations.	<i>Fransen, et al. (2011) p 1111</i> <i>Hama ĩa ĩen (2011) p 175</i>
3. Working with members of this group, my unique knowledge, skills and talents are valued and utilized	<i>Fransen, et al. (2011), p 1111</i> <i>Johnson, & Johnson(2009, p 368-369</i> <i>Lubicz-Nawrocka &Bovill (2021), p 7al</i>
Group evaluation	
1. We frequently take time to figure out ways to improve our group work processes.	<i>Fransen, et al. (2011), p 1111</i> <i>K ĩnings et al (2021) p.925</i>
2. In this group, someone makes sure that we stop to reflect upon the group's work process.	<i>Fransen et al. (2011) p 1111</i> <i>K ĩnings et al (2021) p.925</i>
3. In our group we agree that it is important to evaluate the group process.	<i>Janssen (2014), p16</i> <i>Johnson & Johnson(2009),p 369</i> <i>K ĩnings et al (2021) p.925</i>
Shared mental models	
1. It was clear from the beginning what this group had to accomplish.	<i>Fransen et al. (2011) , p 1111</i> <i>Wilson (2004), p 5</i>
2. Group members understand what is expected of them in their respective roles.	<i>Fransen et al. (2011), p1111</i> <i>Zamani, & Pouloudi (2022) p 737</i>
3. Shortly after the start, this group had a common understanding of the task we had to handle.	<i>Fransen et al. (2011) p 1111</i> <i>Zamani, & Pouloudi (2022) p726</i>
4. Shortly after the start, this group had a common understanding of how to manage the task	<i>Fransen et al. (2011), p 1111</i> <i>Lines (2022), p 27</i>
5. Group members are focused on certain goals we have in common.	<i>Wilson, et al.(2004), p 17</i> <i>Decuyper et al. (2010) p121/122</i>
Safe and supporting conditions	
1. It is safe to share success in this group.	<i>Admiraal &Lokhorst(2012) p 250</i> <i>Decuyper et al. (2010) p123</i> <i>Lubicz-Nawrocka (2018) p54</i>
2. It is safe to share needs in this group.	<i>Admiraal &Lokhorst(2012) p 250</i> <i>Wilson, 2004, p17</i>
3. We feel safe to ask for help from others in this group.	<i>Admiraal &Lokhorst(2012, p250</i> <i>Fransen et al. (2011), p 1111</i>
4. We are able to freely share our passion about our work to others in the group.	<i>Admiraal &Lokhorst(2012), p 250</i> <i>Lubicz-Nawrocka (2019) p 205</i>
5. It is safe to share personal insecurities with others in this group.	<i>Fransen, et al. (2011) p 1111</i>

6. Differences between people are respected.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Wilson et al., (2004), p 17</i> <i>Fransen, et al. (2011) p 1111</i>
7. There is a high level of respect for others in the group.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Wilson (2004), p 17</i>
8. People's feelings in the group are just as accepted as their thoughts and ideas.	<i>Fransen, et al. (2011) p 1111</i> <i>Admiraal & Lokhorst(2012), p 250</i> <i>Wilson, 2004, p 5</i>
9. If there are differences and conflicts, they will be dealt with respectfully in this group.	<i>Admiraal & Lokhorst (2012), p 250</i>
Creative Community	
1. There is a good vibe in this group.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Lubicz-Nawrocka, (2018) p56</i>
2. The group acts like a community.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Wilson, et al. (2004) , p 17</i>
3. We are proud to be a part of the group.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Lubicz-Nawrocka (2018) p54</i>
4. People feel loyal to the other group members.	<i>Admiraal & Lokhorst(2012), p 250</i> <i>Lubicz-Nawrocka, T. (2019) p 205</i>
5. Most people of the group like to try new things even if it sometimes leads nowhere.	<i>Johnson & Johnson (2011), p 46</i> <i>Könings, et al. (2017) (p. 311)</i> <i>Wilson, et al. (2004) , p17</i>
6. Members of the group like to experiment with other working methods.	<i>Könings et al (2017) (p. 311)</i>
7. Together as a group, we come up with whole new ideas	<i>Hämäläinen & Vähäsantanen (2011) (p. 174)</i> <i>Wilson, et al. (2004) , p7</i>

In the construction of the questionnaire, we specified two separate constructs: 'community identity' and 'creativity'. However, the PCA showed that the items of these two constructs proved to belong to only one component. Therefore, we combined these items into one component that we named 'creative community'.

4. Discussion and Implications of the Findings

Our research question was: 'To what extent are the components of the co-creation questionnaire that we developed reliable and valid to map the process of co-creation in higher education?'. The components of the questionnaire proved to be sufficiently reliable. All components are significantly correlated. This correlation indicates that there is overlap and alignment between the different components. This is congruent with the literature we described in the introduction. We mentioned several relations: a relation between positive interdependence and the building of shared mental models and the quality of interaction, a relation between the sense of community (creative community) and individual accountability, a relation between group evaluation and shared mental models, and a relation between safe and supporting conditions and creativity and innovation (creative community).

The strongest correlation we found in our analyses was between safe and supporting conditions on the one hand and between three other constructs on the other hand: creative community ($\alpha = .628$), interaction ($\alpha = .574$) and shared mental models ($\alpha = .505$). The latter three also correlate rather strongly: creative community and interaction ($\alpha = .520$), creative community and shared mental models ($\alpha = .456$) and shared mental models and interaction ($\alpha = .418$). We hypothesize that safe and supporting conditions are moderators in effective co-creation processes. When safe and supporting conditions are optimal, this results in trust and respect; it encourages risk-taking, the exchange of ideas and feedback; and it contributes to shared responsibility (Fransen et al., 2011; Wilson et al., 2004).

Creative community correlates the strongest with safe and supporting conditions in our study. This is in line with the findings of Beghetto and Kaufman (2014), who found that teachers should support and encourage creativity, and model this behavior. They also state that teachers just as students need support themselves, 'by collaborating with other teachers and by establishing partnerships with community organizations and experts who can help establish creative learning environments in and outside of the classroom'.

Furthermore, considering the relation between interaction and *shared* mental models, Chater et al. (2022) conclude that social interaction requires a shift from I-thinking to we-thinking. They propose ‘that individuals can we-reason successfully by asking: what would we agree, if we discuss and bargain?’. In co-creation processes this social interaction, the development of we-reasoning and the building of shared mental models, could consist of discussing and bargaining how to collaborate and how to understand the complex issues at hand.

4.1 Creative Community

The PCA indicated that the items belonging to the constructs ‘creativity’ and ‘community identity’ loaded on one component only. We renamed this component ‘creative community’.

Therefore, we needed to re-consider the two prior constructs. We described that creativity is often the result of the collaborative effort of a community. We also found in the literature that when there is a strong sense of community, group members will allow themselves to take risks, and that risk taking, being tolerant of making mistakes and regarding this as an essential part of the process, can foster creativity (Starko, 1995; Gibson, 2010). We conclude that a strong community identity relates significantly to being creative as a group. Inspecting the items that were part of the former creativity construct, we found that we had formulated or had chosen items for creativity that have an emphasis on group processes. The word ‘group’ is in every item. In the context of co-creation and in retrospective, we regard the merging of the prior constructs ‘community identity’ and ‘creativity’ rather logical.

4.2 The Questionnaire in Practice

Now that we know that the components of the questionnaire are reliable and correlated, we regard the questionnaire useful to map the process of co-creation in higher education.

We assume the best moment for using the questionnaire by co-creating teams would be after at least two group meetings, but preferably after some more, because then there will have been enough collaborative meetings to reflect on. Using the questionnaire at that moment will provide chances to improve the ongoing process.

When group members of a co-creation project are collaborating and fill in the questionnaire, this results in a mean score per component per group. There are several possible outcomes: 1) one or some scales have a lower mean score than other scales (disharmonic profile), 2) all the mean scores are low (generic low profile), or 3) all the mean scores are high (generic high profile).

4.2.1 Disharmonic Profile

In figure 1 an example of a disharmonic profile of a co-creation group is displayed. The mean scores of the different components differ. In this example, the component ‘collaboration’ has the lowest mean score, and individual accountability also has a low mean score. In contrast, other components have higher scores. Such a disharmonic profile may hinder the process of co-creation, which influences the outcomes negatively.

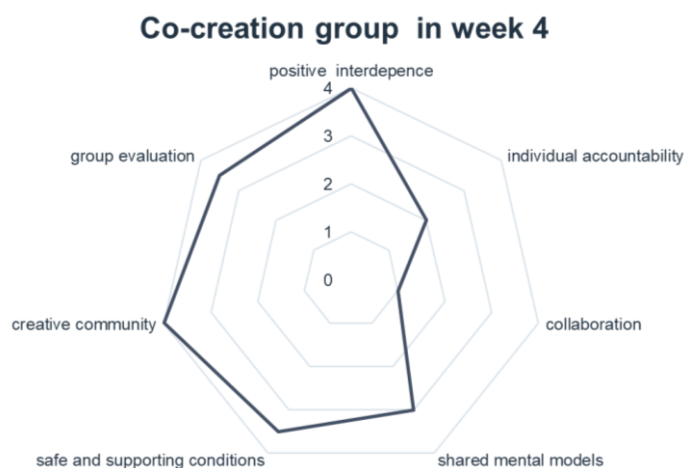


Figure 1. Example of a disharmonic profile

When a co-creation group has such a disharmonic profile, the advice is to work on the component(s) with the lowest mean first. In this example, the group could be involved in activities to improve individual accountability and collaboration. We assume that when group members feel more individually accountable for the process and

the collaboration improves, this will lead to a more harmonic (high) profile and may result in higher learning outcomes (De Hei et al., 2017) and contribute to the innovation to which the co-creation process would lead.

Another example: what to do when ‘group evaluation’ has a relatively low score? The group could purposefully intervene in the process by evaluating the way they work together every meeting. How to evaluate the group process is described by, for example, Schwartz (2016) and Katzenbach and Smith (2015). We conclude that a disharmonic profile is relatively easy to fix: the group searches for activities to support and develop this component of co-creation.

4.2.2 Generic Low Profile

Low mean scores on all or almost all components are an indication of a poor and ineffective co-creation process.

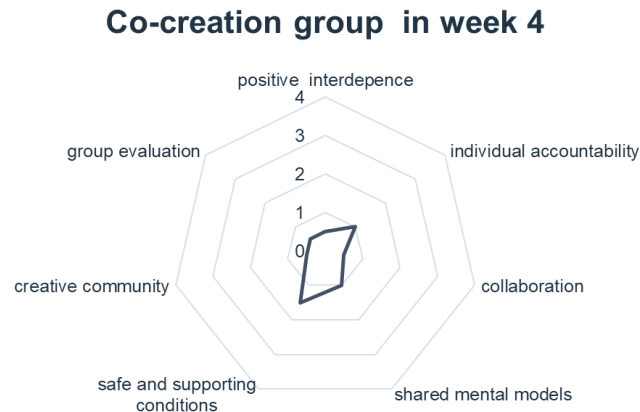


Figure 2. Example of low mean scores

We assume it is best to start with creating safe and supporting conditions, as this has the strongest correlation with the other components (i.e. Lubicz-Nawrocka & Bovill, 2021). In such groups, too little time could be spent on getting to know each other, to develop an atmosphere of shared ownership (Wilson et al., 2004), to listen well to what the values and interest of the other group members are, to put effort in building mutual trust, and to respect each other (Fransen et al., 2011).

4.2.3 Generic High Profile

High mean scores on all or almost all of the components are an indication of a good and effective co-creation process.

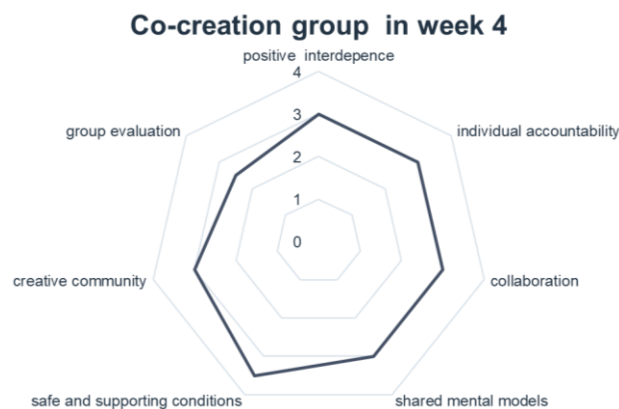


Figure 3. Example of high mean scores

However, it is important for the group to explicate why the collaboration works so well in order to keep up the good work and not to assume this will continue naturally; it needs maintenance (Johnson & Johnson, 2009). Evaluating the co-creation could be done by discussing the scales of the questionnaire and explain to each other

why individual group members assess this aspect positively. Although a generic high profile indicates a good co-creation process, it is wise to realize that there may be bias. There is a chance that group members filled in the questionnaire giving socially desirable answers. Evaluating the co-creation 'live' during a group meeting may lead to more openness. Group members may specify their answers, leading to insights where some improvement may be in place.

5. Limitations and Further Research

We used a PCA to explore the components that our narrative review of literature indicated as essential for a good co-creation process in HE. This led to seven instead of eight components of effective co-creation processes. A PCA is used to transform a set of possibly correlated observations into a set of (principal) components (Cross, 2015). Although the reliability analyses showed sufficient reliability of the individual components, a Confirmatory Factor Analysis (CFA) could be the next step to confirm these findings (Harrington, 2008). To further improve the validity of our instrument, we recommend that this study be replicated using a new dataset. In this new study, we suggest adding an open-ended question, asking participants what they think was essential for successful co-creation. A qualitative analysis could indicate what components of co-creation are valued highest for good collaboration, and this analysis may even reveal new components that are not yet represented in the questionnaire.

In the end, we think it would be useful to further explore the correlation between the different components and how they influence each other. This may lead to more specific recommendations about how to improve the co-creation process.

Further research could focus on the relation between the outcomes of the questionnaire and the different phases of team development (i.e. Middelkoop et al., 2018). This may generate insights that may also contribute to knowledge about how to improve co-creation processes.

6. Conclusions

The components of effective co-creation processes we found proved to be sufficiently reliable. The correlation between each of the components was significant. Therefore, we conclude this questionnaire* as valid to evaluate the process of co-creation in HE.

The final questionnaire consists of seven scales/components: positive interdependence, individual accountability, collaboration, shared mental models, safe and supporting conditions, creative community, and group evaluation.

Professionals, teachers, and students have to live and work in a fast and ever-changing world, and therefore they have to develop competences in order to deal with the complex issues in this changing world. They need another kind of expertise to deal with these issues (Bovill & Bulley, 2011). Co-creation can enhance (future) professionals' skills and innovative processes and/or outcomes in co-creation teams. Higher education may prepare students for their professional future by implementing co-creation in their educational programs, often in multi- or transdisciplinary teams. However, not all of these co-creation initiatives may lead to desired co-creation processes and to usable and innovative outcomes.

This research has resulted in a questionnaire which measures the quality of the process of co-creation in the setting of HE. When co-creating groups use the questionnaire to get insights in their collaborative process, the results offer guidance to the members to optimize the process. Even though we promote involving working field professionals in co-creation projects in HE, we assume this co-creation questionnaire can also be useful in other kinds of co-creation projects with different stakeholders as group members.

Our current study has delivered a tool that can be important in educational practice when co-creation is implemented. Co-creation stimulates lifelong learning for the group members, it contributes to a smoother transition from university to a professional life for students, it may increase the universities' agility by involving practice, it supports professionalizing their teachers, and it enriches their curricula with actual knowledge and experience from the working field.

Although our ultimate goal is improving HE by optimizing co-creation processes, we do not advocate that every course at universities should involve co-creation – that may be unrealistic and undesirable. However, HE is strongly advised to focus on learning processes such co-creation processes and not solely on learning outcomes (Bovill et al., 2018). Implementing co-creation projects will stimulate an appropriate equilibrium between a focus on outcomes and processes.

We do emphasize the need to provide the opportunity for all students to experience co-creation in at least one of their courses at university. We strongly advise considering the need for staff and working field professionals to

experience co-creation. It stimulates boundary crossing in HE to address wicked problems (Veltman et al., 2019). The transformative nature of co-creation will alter the co-creation group members' ways of thinking and teaching. However, universities will need to think carefully about how they will support staff and students to co-create (Lubicz-Nawrocka & Bovill, 2021) and work on wicked problems in education and those experienced by organizations and society. In co-creation processes each stakeholder contributes to the process equally, resulting in a continuous interaction between the two dimensions of working and learning. As Boud (2001) wrote: "Work is ever changing, and learners change along with it".

Clarification

* The questionnaire is open access available:

Hei, M. de (The Hague University of Applied Sciences) and I. Audenaerde (The Hague University of Applied Sciences) (2023): Quick Scan Co-creation in Higher Education. DANS. <https://doi.org/10.17026/dans-xgc-dagw>.

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