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Equal Partnership Between Engineering Education And Industry – A Needs Analysis

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Equal partnership between engineering education and industry – A needs analysis

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ABSTRACT

One of the aims of the TALENTS-project is to create (interdisciplinary) learning communities in which engineering professionals, students, teachers, and researchers can learn together and collaborate as equal partners, within the context of authentic challenges, starting from their individual learning goals. To what extent are partners willing to participate in this partnership and under which conditions do they consider it to have added value? We conducted individual interviews with engineering students (N=11), teachers (N=12) and professionals (N=10) about what they require to participate in the learning community, employing epistemic, spatial, instrumental, temporal, and social elements of learning environments. We also inquired which resources participants were willing to invest. Data were summarized on group level in a within-group matrix, following these elements. Next, we employed a cross-group analysis, focusing on commonalities and differences. The most striking results were found in the epistemic, social, and instrumental elements. Respondents have similar

needs when it comes to improving dialogue to formulate a challenge. However, professionals prefer to have more influence on formulating this challenge and its output, whereas teachers wish to focus on students' development. Students wish to co-create with partners and they place importance on matching students with a challenge that aligns with their educational background and personal interest. To create an environment based on equality, students need traditional roles of teachers, clients, and students to be less apparent. Ultimately, almost all respondents are willing to co-operate as equal partners in the learning community because they can see it leads to added value.

1 INTRODUCTION

One of the directions (vocational) education is heading, is to create programs that form a reflection of professional work practice. Educational organizations seek collaboration with industrial partners, such as government agencies, corporations, and research institutions, aiming to prepare students for ever-changing career possibilities.

Simultaneously, professionals are asked to continuously develop to keep up with and adapt to societal developments (lifelong learning and development). Collaboration between education and professional work practice could therefore be a plausible step to bridge the gap between the two worlds, and for these worlds to beneficially contribute to their development and to solving societal challenges (Wagner et al., 2019).

As plausible as this seems, collaboration between education and professional work practice comes with challenges. Namely, each partner, educational or professional, enters this collaboration with expectations, hopes and specific perspectives. To be able to cooperate as *equal partners*, there should be room for each partner's needs. How should these cooperations function in an equal manner? What is needed in order to reach equality when starting from these different perspectives?

This study was conducted as a part of the nationally funded TALENTS innovation project which aims to develop authentic learning environments on the border of education and work practice to prepare students for their professional careers. Personal and professional development of students, teachers, and industrial partners is a central element. Participants are part of a learning community where they learn and work on an authentic challenge in an equal partnership.

In this study, an equal partnership is defined as a group of students, teachers, and professionals from various domains, that collectively develops, implements, and learns in an authentic learning environment. Equality is sought in employing and respecting each other's perspectives, needs, and expertise, meaning that one expertise is worth the same as the other as a steppingstone for working on a challenge. Moreover, each partner shares equal responsibility in the challenge. This way, traditional roles, and relationships, such as the teacher-student relationship, or the client-role, disappear to

some extent and education becomes learner-centered, and each partner is a *learner* in the learning community.

An authentic learning environment (ALE) is defined as a setting that resembles real-world settings and situations in which learners learn to apply skills and knowledge that they were taught (Herrington and Herrington 2008). Moreover, by collectively working on a task in an ALE, learners acquire new knowledge. Learners engage in complex (often interdisciplinary) tasks, which are called authentic challenges, that are meaningful for their personal development and relevant in today's society. Learners solve topical problems collaboratively. Whilst collaborating, learners share and learn from each other's different (disciplinary) perspectives. As a partner of the learning community, Teachers are also seen as learners, as are other professionals. Teachers, however, also adopt the role of coach. They support, scaffold, and monitor the learning processes (Herrington and Herrington 2008).

Learning in an ALE cannot be designed, as the output of learning cannot be predefined in an authentic environment which enables learners to interact with different situations, activities and other learners (Bouw 2021; Zitter 2021). However, there are elements in an ALE that *can* be designed. Zitter (2021) defined five educational design elements, building on the work of Bouw et al. (2021): epistemic, spatial, temporal, social, and instrumental elements. These elements can be used to design educational settings on the boundary of education and work practice: so-called hybrid practice where learners can learn and work at the same time (Bouw et al. 2021). Epistemic elements refer to the task characteristics and arrangements (Zitter 2021). For instance, the manner in which the authentic challenge is formulated, who plays a role in formulating this, and the content of the task. A task refers to the whole activity solving an authentic challenge, for instance: designing a drone that supports farmers in protecting their crops (Zitter, 2021). Spatial elements refer to the spaces in which task-related working and learning take place (Zitter, 2021). Temporal elements are related to the time learners work on the task, the pace, and the schedules and deadlines they employ (Zitter, 2021). Social elements refer to the learners themselves, the roles they take on, and how these roles are filled and distributed (Zitter, 2021). Instrumental elements relate to the tools and artefacts that are needed to learn and work together in the learning environment (Zitter, 2021). Instruments can range from online platforms to communicate between different learners, to manuals and assessment portfolios, to support from staff, or specific physical supplies. These design elements are developed for the design of independent learning environments (Bouw et al., 2021). Timmerman et al. (2022) have demonstrated that these elements are applicable to multiple educational and vocational settings and domains.

The aim of the study was to determine how partners (engineering professionals, students, and teachers) in an ALE can learn from one another and collaborate as equal

partners. Therefore, the following general research question is put central: To what extent are partners willing to participate in an equal partnership and under which conditions do they consider it to have added value?

2 METHODOLOGY

2.1 Research questions

We answered the general research question through the following sub-questions:

- RQ1: What wishes, requirements and ideas do respondents have regarding the design of the equal partnership within an authentic learning environment, distinguishing between epistemic, spatial, instrumental, temporal, and social elements?
- RQ2: To what extent are partners willing to invest in this partnership?
- RQ3: What are the opportunities and obstacles for cooperating in an equal partnership according to partners?

2.2 Respondents

The respondents consisted of 12 teachers of a Saxion University of Applied Sciences who were coaches in interdisciplinary student groups that also worked with industrial partners; 10 industrial partners from engineering corporations, research departments, or governmental organizations; and 11 full-time 4th year bachelor students, studying Mechanical Engineering (N=3), Technical Physics (N=2), Business Administration (N=2), Creative Business (N=1), Commercial Economics (N=1), Spatial Planning (N=1), Urban Planning (N=1), or Climate and Management (N=1). All respondents were part of interdisciplinary groups. Respondents were approached via targeted e-mail invitations. 13 Industrial partners were approached, of which the response rate was 77%. 16 teachers were approached, of which the response rate was 75%. 61 students were approached, and the response rate was 18%.

2.3. Data collection and analysis

To answer the research questions individual interviews were conducted with each respondent. An interview was chosen as this would provide more in-depth information and the opportunity to ask follow-up questions. Individual interviews were chosen in order to get individual perspectives, rather than having respondents possibly being influenced by others. Individual interviews were possible because of the small respondent groups.

In the interviews, respondents' requirements to participate in the equal partnership were explored, distinguishing between epistemic, spatial, instrumental, temporal, and social elements of learning environments as initiated by Bouw et al. (2021) and elaborated on by Zitter (2021). These elements have been chosen to get a more nuanced picture of the respondents regarding the implementation of authentic learning environments

(RQ1). Next to these elements, it was inquired which resources respondents were willing to invest (RQ2) and which opportunities and obstacles respondents identified for cooperating in an equal partnership (RQ3).

Interviews lasted 45 minutes and took place online via Teams in the period between January 2022 and December 2022, due to COVID19 restrictions. After given consent, the meeting was recorded. Respondents were first given a definition of equal partnership. They were asked about their view on this matter, whether they would be willing to participate in such a partnership, and what they think the added value would be. Subsequently, questions based on the five educational design elements were asked by the interviewer. These questions focused on respondents' *experiences* in current educational settings, and their *needs* and *wishes*. Finally, questions regarding possible future participation in equal partnerships were asked, such as 'Which aspect would prevent you from participating in a learning community the most?'. After each interview, the data were partially transcribed and summarized based on the recording. Data were then coded with codes based on the elements of Zitter (2021). Three codes were added: investment, opportunities and obstacles. Following Miles and Huberman (1984) data were first summarized on group level in a within-group matrix, following these elements. Next, a cross-group analysis was employed, recording which topics were mentioned by the respondents and focusing on commonalities and differences in each element. This served as the basis for the description of the results.

3 RESULTS

The results are described, employing the elements of Zitter (2021), focusing on what needs and requirements partners have for participation (RQ1), whether partners are willing to participate in a partnership (RQ2), and what obstacles and opportunities of such a participation are (RQ3). In table 1, a short summary of partners' needs and requirements can be found.

3.1 Epistemic element

Industrial partners, teachers, and students require more dialogue in order to formulate the challenge and to make collective agreements for the implementation of the equal partnership. Industrial partners would like to play a more prominent role in formulating the challenge to maximize the relevance of the challenge and possible output for them. Teachers, on the other hand, require open and complex challenges with room for exploration for students. They indicate the development of students should be central and there should be room for students to fail. Students require challenges that are aligned with their interest and backgrounds. They prefer challenges that provide them with (new) knowledge and allow them to develop a concrete product. They value personal development and working on personal goals.

More dialogue is also needed to create desirable matches, as students' interests, or educational backgrounds do not always match well with the content of the challenge, the discipline or with the organization involved. Industrial partners point out that it is also important to find a suitable match with the teachers in terms of their expertise and the content and discipline of the challenge. They prefer teachers to complement their expertise.

3.2 Spatial element

All partners prefer a combination of working together online and working at school or at the organization. They all express a need to be flexible and to work in a place that is relevant for the specific task at hand. Teachers and industrial partners wish for a room at the university dedicated to the projects to land and to meet each other.

3.3 Temporal element

Teachers and students stress the importance of finding enough time for the start-up phase, namely, time needed to find suitable partners for the partnership and for dialogue to make collective agreements for the implementation of the equal partnership. When it comes to working hours, most partners desire flexibility. They prefer setting major deadlines, such as presentations of products, but other, smaller deadlines should be more flexible and plannable by students.

3.4 Social element

Partners are all willing to participate and invest time in the equal partnership, but not all industrial partners lay emphasis on the learning aspect of the collaboration. Some industrial partners view equal partnership as an opportunity to develop themselves or their organization in terms of lifelong learning. However, some are willing to invest if their problems are solved, if they gain extra hands to do their jobs, or if they gain inspiration from students. Students and teachers see similar opportunities in learning and working in an equal partnership. They both see it as a chance to broaden their knowledge about specific topics outside of their expertise and to expand their professional network. Teachers also want to learn in their role as coach. Students desire to co-create with industrial partners and teachers to learn from their different perspectives.

Up until now, partners often do not experience equality in partnerships they are involved in. Students view industrial partners as clients, and they are focused on satisfying them by performing well or by providing a solution or a product. This aligns with industrial partners, who focus on output as opposed to the learning process. This particular focus, and the lack of presence and involvement students experience from industrial partners, plays a part in their own focus and the extent to which students do not always experience equality. Moreover, teachers and students wonder to what extent equality is realistic within an equal partnership when teachers are not only learners but also assessors. Another factor that plays a role is that teachers see themselves and industrial partners as experts on the subject and having more life experience and

different learning needs. They do not think these aspects align with equal partnership with students. Students also feel that they cannot make an equal contribution due to this difference.

To be able to accomplish equality in learning together in an equal partnership, students need traditional roles of teachers, industrial partners, and students to be less apparent. Instead of focusing on how to behave as a teacher, student or client, students require each partner to focus on their individual learning needs. This way, all partners can collaborate in an equal way. As a prerequisite, students indicated that industrial partners first need to understand the importance of learning and working together before an equal partnership can be formed.

3.5 Instrumental element

Industrial partners and teachers both desire more knowledge exchange in the form of (expert) workshops or clips for students as well as industrial partners. Industrial partners also prefer teachers to have knowledge of relevant topics. Moreover, they feel that there should be more dialogue between the industrial partner and the teacher to coordinate the project.

According to both teachers and students, assessment criteria play an important role in learning together in an equal partnership. Criteria should not be too restrictive because it is difficult to predict learning when working together on an authentic challenge in an equal partnership. In fact, it is difficult to assess whether students learned enough for their bachelor programs, according to teachers. Students find it important to learn from one another and to be given the chance to be innovative and go off the beaten track. Moreover, industrial partners see it as an obstacle that they are not involved with the assessment as they are convinced that they have enough knowledge to assess students' products.

Table 1. Summary of partners' needs: industrial partners (IP), teachers (T), and students(S)

Epistemic element	Partners	Spatial element	Partners
Dialogue to formulate challenge	IP, T, S	Dedicated room at the university	IP, T
Focus on output	IP, S	Hybrid locations	IP, T, S
Focus on development students	T, S	Flexible locations	IP, T, S
Dialogue to create desirable matches	IP, T, S		
		Social element	Partners
Temporal element	Partners	Willing to learn as equal partners	IP, T, S
Enough time for the phase before and after the project	T, S	Learn in role as coach	T
Flexible working hours	IP, T, S	Learn new specific knowledge	T
Set major deadlines flexible small deadlines	IP, T, S	Wish to co-create	S
		Need other partners to understand importance of learning together	S
Instrumental element	Partners	No more strictly divided roles	S
Knowledge exchange	IP, T		
Knowledgeable teachers	IP		
Assessment criteria not too restrictive	T, S		

4 DISCUSSION

Based on our research, we may conclude that true equality in partnership is not yet attained in our education, because of various obstacles that partners experience. However, based on the results we do see opportunities for growth towards this desired future. In fact, students, teachers and industrial partners are willing to participate and invest in an equal partnership as a learner, although they have different perspectives on learning. Partners have both similar *and* different needs regarding equal partnership within an ALE, the most striking differences were found in the epistemic and social elements.

An important difference between the partners is that industrial partners focus more on the output of the challenge, whereas teachers and students focus more on the development of students' skills and knowledge. Next to their own development, students also seek co-creation with industrial partners and teachers. Despite these differences, all partners agree that more dialogue is required to match partners with suitable authentic challenges and to formulate the challenge together. Dialogue is needed because there is not a one-size-fits-all approach to forming an equal partnership as authentic learning environments (in interdisciplinary groups) involve different partners from different domains and settings (Zitter 2021). More dialogue could help bridge the gap between the contrasting needs of the partners and help build an equal partnership. Also, sharing each other's expertise and formulating the challenge together stimulates learning, since these are regarded as two necessary processes in reaching synthesis, which is regarded a crucial prerequisite for successful results in interdisciplinary collaboration and learning (Boix Mansilla 2016; Repko and Szostak 2017).

Doing so, however, requires important steps to consider. Firstly, the *learning* aspect of the equal partnership could be made extra apparent to all partners to prevent them from taking on 'traditional roles'. This is in line with Timmerman et al. (2022), who found that it is important to make the added value in learning explicit for each partner. This promotes understanding of the added value of learning and working together in an equal partnership (Timmerman et al. 2022). Secondly, careful attention should be paid to matching students with teachers, industrial partners and an authentic challenge, by taking personal interests and disciplinary expertise into consideration, to ensure that all partners will be able to learn and to contribute equally. This could be done, for example, by organizing a matching event where industrial partners, students and teachers meet. Here, industrial partners could inform students and teachers about the challenge they are facing. Subsequently, students and teachers could consider if the challenge would allow them to learn and contribute from their expertise. In dialogue, partners could discuss how they would collectively take steps to solve the challenge. Then, partners could decide which challenge they want to be matched with.

Apart from more dialogue, another intervention seems crucial for teachers to not fall back to their 'traditional role'. The fact is that teachers are both coaches *and* assessors, which prevents them from being an equal partner to students. To overcome this, these teachers could solely take on the role of a coach and have another teacher assess the students, or *all* partners could play a role in the assessment, such as in collaborative assessment where all partners determine the assessment criteria and grade (Falchikov 1986). Another way to achieve more equality in the partnership is to have all partners assessed.

As the groups of respondents was small, it would be interesting for future research to explore larger groups across different universities and perhaps other educational levels, to see whether there are similar needs when it comes to designing an equal partnership in the context of authentic challenges.

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