

FACULTY EXPERIENCES IN INTERDISCIPLINARY PROGRAMS: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

Changes in the business environment (such as shorter product lifecycles, globalization, and digitalization) while contributing to a sustainable development, have formed new conditions for companies and organizations. In this new situation, problems encountered cannot be answered within a single discipline. Interdisciplinary programs where students from different disciplines interact in learning and knowledge creation is a way to meet these changes in society. An interdisciplinary program also requires interaction on staff level: Meaningful collaboration brings together expertise from different disciplines so the fundamentals of a given discipline are clarified, and the connections to other disciplines are described, reaching a synergy effect by utilizing the strengths of each area. This, however, puts demands on the curriculum design and on the interaction of the teachers. This paper explores the teachers' perspective of an interdisciplinary program at Linnaeus University. The program is a 2-year master program entitled "Innovation through business, engineering and design", recruiting students from the engineering, business and design disciplines. The teaching staff represents different subject areas, and the teachers interact in an interdisciplinary mode in the first year, while the second year mainly contains disciplinary courses. In two focus group interviews, teachers were asked about opportunities and challenges in participating in the interdisciplinary program, as well as their view and how interdisciplinarity is considered in the program. The purpose of the paper is to identify how teachers perceive teaching in an interdisciplinary program as well as to distinguish perceived opportunities and challenges for teachers to participate in interdisciplinary programs. This paper concludes that teachers perceive interdisciplinary learning to take place in the project context, where students come from different disciplines work together to solve a complex real-life assignment. Moreover, the hindrances appear to outweigh the possibilities in participating in an interdisciplinary program. Amongst challenges the teachers perceive lack of resources, such as appropriate learning environments, required competence, and unclear decision channels.

KEYWORDS

Interdisciplinary, Focus groups, Master program, Innovation, Standards 3, 7, 9, 10, 12

INTRODUCTION

The core at most university's missions is mainly education and consequently a majority of faculty time involves activities relating to students (Kennedy, 1997). At the same time one main task for universities is to conduct education meeting the needs from external stakeholders. Few of the questions posed by industry can be answered within a single discipline (c.f. Bolman and Deal, 2014, p 101). One way for universities to meet the needs from the industry is to develop and realize interdisciplinary programs (Gustafsson, 2015). The academic workplace is becoming increasingly complex (O'Meara, Rivera, Kuvaeva, and Corrigan, 2017). In general faculty members are dedicated to their work and in order to maintain a stable worklife, reducing complexity is needed (Johnsrud and Rosser, 2002).

The case, serving as an example throughout this paper, is an interdisciplinary two-year master program involving three faculties: the Faculty of Technology; the School of Business and Economics and the Faculty of Arts and Humanities hosted by Linnaeus University, Sweden (further on referred to as LNU). The program has been running for four years. According to Kans and Gustafsson (2016), the program holds the following dimensions of interdisciplinarity:

- **Student groups:** The students work together in groups with students from the other faculties/disciplines. Each group consists of an equal number of students from engineering, design, and business administration.
- **Problem/task for the student groups:** The briefs are interdisciplinary in nature and the students are expected to balance the different process parts with respect to function, design, durability, production conditions, and business administration. In order to do this, the students require knowledge of, and interaction between, different disciplines where different perspectives and approaches are utilized.
- **Faculty members, curriculum, and administrative task:** The students have facilitators from LNU including faculty members, curriculum, and administrative tasks; Faculty members hold lectures and provide tutoring both individually, and in interdisciplinary groups. The curriculum states that the students should be able to demonstrate an understanding of the increase in value of interdisciplinary collaboration. The administrative tasks are carried out together in order to solve the practical problems that appear, and to prevent future problems.

Interdisciplinarity will increase the ability to understand complex challenges (Annan-Diab and Molinari, 2017) and consequently there is and will be a need for teaching institutions to teach interdisciplinarity. Interdisciplinarity breaks traditional teaching structures and encompasses many aspects. For teaching institutions that want to be at the forefront, and keep a stable work environment for faculty members, the question arises; *how do involved teachers perceive interdisciplinarity, which are the opportunities and challenges?* The question constitutes the purpose of the paper; identify how teachers perceive interdisciplinarity as well as to distinguish perceived opportunities and challenges for teachers to participate in interdisciplinary programs.

METHOD

The focus group method is a well-known method for allowing researchers to examine how different people together interpret the general phenomenon that the researcher is interested in studying (Bryman and Bell, 2013). Focus groups are particularly suitable for studying perceptions in social processes (Sim, 1998). Consequently, empirical data to this study has

been gathered through focus groups using open questions focusing on specific phenomenon (interdisciplinarity). Suitable participants in a focus group are members who were known to possess certain experience to be interviewed in an unstructured way about the experience (Bryman and Bell, 2013). The authors (of this paper) have an in-depth previous understanding of the program and its contents. Thus, they could take active part in the focus groups (Frey and Fontana, 1991). Teachers teaching at the program participated together with the interviewers and in total two focus groups were conducted with 8 faculty members. The interview guide is presented in Appendix 1. The interviews were held in both English and Swedish and hence the quotations either stem directly from respondents or have been translated from Swedish to English. Further the interviews were recorded and transcribed. The authors applied the analysis method of patterns of association (Bryman and Bell, 2013) where they mapped empirical data with theoretical concept, first individually and thereafter comparing the results with each other. Both of the authors had done the mapping in the same manner and consequently validity was achieved.

THEORETICAL FRAMEWORK

The definition of interdisciplinarity

In Table 1, an overview of different definitions is given together with authors' comments describing the main focus of the definition.

Table 1. Definitions of interdisciplinarity

Source	Definition	Authors' comment
Meeth (1978)	Interdisciplinary programs attempt to integrate the contributions of several disciplines to a problem, issue, or theme from life. In interdisciplinary studies integration means bringing interdependent parts of knowledge into harmonious relationship. It involves relating part to part, part to whole, and whole to part.	Focus is on the integration of disciplines for solving a problem.
Roger et al. (2005)	the emergence of insight and understanding of a problem domain through the integration or derivation of different concepts, methods and epistemologies from different disciplines in a novel way	Focus is on the understanding of a problem through integration of disciplines.
Porter et al. (2006)	a mode of research by teams or individuals that integrates <ul style="list-style-type: none"> • perspectives/concepts/theories, and/or • tools/techniques, and/or • information/data from two or more bodies of specialized knowledge or research practice	Focus on the integration of disciplines.
Davies and Devlin (2007)	integration of two or more disciplines in the education	Focus on the integration of disciplines.
Pharo et al. (2012)	the integration of disciplinary perspectives to produce insights that are more than the summing of disciplinary knowledge	Focus on the integration of disciplines to create insight.

A common determinant in all definitions is the integration of disciplines. The definitions differ in respect to why this integration is made. Some definitions only identify that integration is made (Porter et al, 2006; Davies and Devlin, 2007), while others also identify problem solving as an area for the integration (Meeth, 1978; Roger et al. 2005). The intention is indicated in two of the definitions (Roger et al., 2005; Pharo et al. 2012), i.e. to create deep knowledge by integration of disciplines. Synthesizing the definitions, interdisciplinarity could be seen as *the integration of disciplines as a means to create deepened knowledge of a problem.*

Opportunities and challenges as reported in literature

Interdisciplinary education is facing a number of challenges. For the individual participant **intellectual challenges** arise in terms of conflicting terminology and perspectives (see Boden et al., 2011; Turner et al., 2015). The disciplinary language, theoretical constructs and preferred methods might differ from those of the other participants, and those applied in the interdisciplinary setting. In addition, a schism between disciplinary work and interdisciplinary work exists. Disciplinary work is seen as the natural mode of research and interdisciplinary work seen as an addition to disciplinary work rather than a legitimate basis for research. This gives rise to “addition transaction costs” for those who involve themselves in interdisciplinary settings (Sá, 2008). In addition, **organizational challenges** are often at hand according to Boden et al. (2011). Universities are structured according to disciplinary thinking; resource allocation, decision channels and reward systems are based on disciplines, which makes it hard to align and support interdisciplinary initiatives. A crucial resource is time, as interdisciplinary education tend to consume more time than traditional education (Pharo et al., 2012). Another important resource is financing. Due to current scholarly reward systems, promoting disciplinary research, it could be hard to convince scholars to participate in interdisciplinary collaborations, especially those in their early careers, (Sá, 2008; Turner et al., 2015). Schmidt et al. (2012) point out PhD students and other researchers might need training in interdisciplinary skills and crossing organizational borders. Little research on such training programs are to be found in literature, according to Schmidt et al. Townsend et al. (2013) focus on the role of leadership. For interdisciplinarity to thrive at a university, leadership on overall level as well as on the institutional level has to be offered. This kind of support is often missing or inadequate though.

For succeeding with interdisciplinary education programs challenges must be understood and addressed. Several factors, such as students’ previous experience, gender, language and ethnicity, influence the outcome of interdisciplinary research projects (Ryser et al., 2009). Also, the project finances and student-faculty relationships are affecting the outcomes. Duffield et al. (2012) propose following measures for succeeding with collaboration between higher education institutions:

- Create a clearly defined governance model including policies and procedures
- Choose the participants with care
- Arrange face-to-face meetings
- Allocate resources such as time and funding
- Define areas of mutual benefits

Fostering interdisciplinarity could be seen as a socialization process where the faculty engagement and curriculum design are crucial factors for interdisciplinary programs at doctoral level (Holley, 2015). According to the author, a common research laboratory could serve as a key platform for the development of individual and interpersonal skills.

RESULTS AND DISCUSSION

Teachers' perception of interdisciplinary

In the theory chapter, the term interdisciplinary was defined as *“the integration of disciplines as a means to create deepened knowledge of a problem”*, focusing three aspects: integration, the creation of deepened knowledge, and on problem solving. The teachers had somewhat different views of interdisciplinary, but most statements could be found within these three aspects, see Table 2.

Table 2. Teachers' perception of interdisciplinarity

<i>The integration aspect</i>	<i>The creation of deepened knowledge aspect</i>	<i>The problem solving aspect</i>
<p>Most teachers expressed a view where interdisciplinary was created by joining different disciplines or as the activities that takes place between disciplines. <i>“learning and working between different disciplines”</i></p> <p>It could also be about finding a communality between disciplines without losing the essence of the discipline: <i>“to see what can be seen as a common platform perhaps also keeping the specialties in the different disciplines”</i></p> <p>One teacher stressed the approximate closeness between disciplines, which affects the possibilities to interact and cooperate between disciplines: <i>“there are reasons why these disciplines are involved in the specific program”</i></p>	<p>This aspect is brought up indirectly when discussing the nature of the interdisciplinary person and the context in which this person acts. The interdisciplinary person could be seen as being able to apply a broader perspective like a versatile genius: <i>“there are some polymaths like da Vinci, they were really interdisciplinary”</i></p> <p>These kind of geniuses are not common, but one can find similarities in classical industrial design project, where disciplinary knowledge is not enough: <i>“a good designer has large knowledge of engineering and smaller knowledge about economy”</i></p> <p>The interdisciplinary capability is seen as an outcome of a socialization process: <i>“interdisciplinarity is a competence that is being built up”</i> <i>“in an operational level confusion, but creative for learners, teachers. It is a scope where teachers become learners. We are learning a lot of this along with the students. It is a journey.”</i></p> <p>The outcome is not necessarily deepened knowledge for each individual but rather a synthesis of knowledge within the project team: <i>“interdisciplinarity is synthesis - instead of breaking down, you can see the whole”</i> <i>“the synthesis occurs in the projects”</i></p>	<p>Interdisciplinary was seen as an activity of problem solving, working together: <i>“where you have to solve the task, complex issue with all three disciplines”</i> <i>“when persons from different disciplines work together in a course//... you are working on a joint examination assignment”</i> <i>“synchronized subject disciplines meet to deliver towards a common goal”</i></p> <p>Interdisciplinarity is also connected to creating new things, innovations: <i>“it is the new things that are developing, innovations, are between disciplines”</i></p>

One teacher connects disciplinary knowledge with interdisciplinary education. Interdisciplinary education is based on disciplinary knowledge, the teacher claims: *“You need to be more disciplinary when working in an interdisciplinary program, especially if you work with industry; what could I contribute with? If I am not useful, I can be replaced!//..//You must be disciplinary in order to contribute in an interdisciplinary context.”*

Acquiring disciplinary knowledge takes time, so it is hard to give students disciplinary depth in an interdisciplinary program: *“things that have too high threshold to learn in this short time fits better for disciplinary [learning], things that have a lower threshold fits better for interdisciplinary [learning]”.*

Interdisciplinary is tightly connected with the mode of learning, i.e. project based learning and working in teams. It is hard to be interdisciplinary by yourself, teachers are reasoning in this dialogue:

“The interdisciplinary does it not require [interaction] between people? The disciplinary you can do by yourself”.

“Yes, it is hard to be interdisciplinary by yourself”.

“At the same time, you may need to reflect on the interdisciplinary yourself”

The last statement expresses that there are both an interpersonal and a personal aspect in interdisciplinary learning; you create new knowledge in collaboration with others, but you also reflect on your learning individually. Interdisciplinary learning is a process, as any other learning process. The student thus becomes more skilled over time: *“There is a big difference when they have done it some time, I really like when they do it the third time – you have different language and different way of keeping up the work.”*

Teachers’ perceptions of opportunities and challenges

The teachers recognize several challenges with interdisciplinary education. The most obvious challenge is lack of resources or the risk of not having appropriate resources. Resources seen as important are people willing to teach in the program and that have required skills and knowledge, facilities that support interdisciplinary learning, and financial resources. Also recruiting the “right” kind of students was mentioned. Scarcity of resources is partly connected to the current decision channels. When the program was developed it was supported by the rector’s office and received dedicated financial support. Today, the program is run as a regular program. Resource decisions and budgets are made on departmental or faculty level, while the program is a cross-faculty initiative. The line managers do not feel responsibility for resource planning, and might hinder personnel to be utilized in the interdisciplinary program, if they are needed in the regular programs of the department. The organizational structure also adds fuzziness to who has decision making power and who handles resources. One current challenge is for instance that the program has not a manager with full decision making. The findings furthermore shows that it is hard to recruit people to interdisciplinary programs as there are no obvious benefits for the teacher, several teachers express, which in turn is connected to the current reward systems. The reward system promotes conducting disciplinary research, and therefore staff are reluctant to join an interdisciplinary program; it puts an additional workload to already high work pressure. Teachers then do not have time enough to engage in the interdisciplinary teaching. In addition, people need to have a positive attitude towards interdisciplinary teaching. The

aspect regarding having a positive attitude is connected with intellectual challenges of language and constructs.

The teachers see language as a challenge mainly within the student group. Cultural and language differences were something that was not getting attention in the teachers group from beginning, and which caused problems for both students and teachers. These challenges are reduced during the education though, and the students eventually create a common language. Interdisciplinary is seen as a socialization process where teachers have an important role – they need to teach the students to learn to see things in different ways. The silo mentality of higher education and research is seen as a challenge, and it is hard to show evidence on when learning has taken place, as interdisciplinary knowledge is something different from disciplinary knowledge. Moreover, one teacher reflects on the coordination of different teachers' contribution; teachers deliver what they think a coordinated and holistic interdisciplinary picture of for instance product development, while the students perceive the same as chunks of disciplinary knowledge with no clear connection. The methods of disciplinary teaching and research and those in interdisciplinary contexts also differ. The innovation master is highly built up on project work, open problems and creative innovation processes, which differs from the disciplinary methods. During the focus group sessions however, the teachers do not discuss methods as a challenge. Results in form of quotes related to challenges are summarized in Table 3.

Table 3. Perceived challenges

Intellectual	Language	<p><i>"then also the language barrier..."</i></p> <p><i>"when they present in the beginning you can really hear that they speak their own language"</i></p> <p><i>"That is an aspect we did not fully understand when we started the program – these cultural aspects need to be taken into consideration"</i></p> <p><i>"how they from the start speak different languages and then they slowly understand that they talk about the same thing in different way"</i></p>
	Construct	<p><i>"Students are trained to focus on silo activities"</i></p> <p><i>"Our way of creating deliveries at universities is disciplinary. Interdisciplinary is rather a way of delivering an education rather than teaching."</i></p> <p><i>"in the beginning of the program, we as the teachers need to push the ideas to the students that it will be of value to them because they do not understand that."</i></p> <p><i>"You should also stress the quality of interdisciplinarity – as it takes place everywhere.//...//That is a problem with the program – we do not when the value comes and we cannot see it. When will it come in the student' life? Who knows?"</i></p> <p><i>"We as teachers think we deliver a coordinated image, but students see individual lectures."</i></p> <p><i>"We need to be more interactive in our way of communicating our message and knowledge."</i></p>

	Method	---
Organisational	Resources	<p><i>"find competences"</i></p> <p><i>" I get really frustrated that people do not have time to help the students. We as a university have not solved all the practical things."</i></p> <p><i>"Resource-intensive, if you want to do academic career this takes too much time and is divisive"</i></p> <p><i>"The university is very driven by the faculties, and personality driven. If it is going to work over the faculty boundaries, it depends on the people. The people make sure that it happens."</i></p> <p><i>"The education should be as a small company, with facilities, class room, and workshops"</i></p> <p><i>"a physical meeting place"</i></p> <p><i>"Everybody says that they lack money and it is complicated...discussion regarding money requirements"</i></p>
	Decision channels	<p><i>"It is administratively difficult. I get frustrated after I know how easy it should be to solve."</i></p> <p><i>"The program would have a leader, but there is someone higher up who decides..."</i></p> <p><i>"When we developed the education we had a focus that was partly directed by the Rector's Office, then we entered the line organization and then I experience something happening - the focus disappeared and the program became one of all programs"</i></p> <p><i>"requires leadership, coordination, follow-up, //...//teachers miss it if it is not there"</i></p> <p><i>"The university's control system - trends in the university world towards disciplinary, being a program manager is an ungrateful task"</i></p>
	Reward systems	<p><i>"I am involved in disciplinary research - so in my research I have no use of this."</i></p> <p><i>"Resource-intensive, if you want to do academic career this takes too much time and is divisive, also one has a publishing requirement"</i></p>

While challenges are many and of diverse nature, the opportunities mentioned during the focus group interviews are few. One benefit is seen in the mode of teaching – interdisciplinary education often involves active and student-centered learning where the teacher’s role is rather the one as a facilitator, and where knowledge is created together with students. As one of the teacher states:

"the possibility for the teacher is to learn themselves"

The teaching is seen as a knowledge creation process for students and teachers alike, and some teachers really like the close interaction with the students: *"It is a scope where*

teachers become learners.” “We learn a lot of this along with the students. It is a journey.” “possibility to follow the students, in different contexts, in two years’ time and see how they develop”

Some teachers also mention benefits on the institutional level in form of increased reputation and positive impact in the competence acquisition process: *“a good education provides promotion for the university”, “we identify the stars that we can employ”*

CONCLUSIONS, IMPLICATIONS AND FUTURE RESEARCH

Introducing interdisciplinary programs into a traditional university structure has to be conducted with caution: being interdisciplinary stresses the faculty members and challenge them to widen their comfort zone. Therefore, it is important to know challenges as well as opportunities that are ahead along the introduction of interdisciplinary programs. The teachers perceive interdisciplinary learning to take place in the project assignments: the projects integrate different disciplines and the students become forced to find ways of effective working, as the project assignment.

The study shows that there are more challenges in relation to opportunities working on an interdisciplinary program. Both intellectual and organizational challenges seem to occur in the studied program. Most tangible are the lack of resources and unclear decision channels. This affects the individual teacher in form of confusion regarding teaching assignments as well as leadership. An interdisciplinary program resembles a matrix organization, while the university is organized as a hierarchal structure. This is one of the reasons behind the apprehended complexity. In addition, the teachers indicated the lack of incentives such as reward systems. Instead, the individual teachers seem to enter the program based on personal interests. As stated by one teacher: *We do not do this for convenience, we are urged to do something good... it is our passion*. The teachers recognize that interdisciplinary learning is different from disciplinary learning, especially from the students’ perspective. Students need to learn how to conduct interdisciplinary work, but it is hard to know how to teach and when interdisciplinary learning occurs. The teachers perceive that students become more interdisciplinary along the projects, but they are not sure how this is done.

For the individual teacher there are few incentives to participate in an interdisciplinary program, and working in an interdisciplinary manner is a learning process even for the teachers. This implies that more focus should be given to the education and training in interdisciplinary work for faculty members. Moreover, it is vital for the success of an interdisciplinary program that resources and decision channels are established both in present and in long term. Interdisciplinary programs require structural changes and non-traditional management, as they cross both departmental and faculty borders. Interdisciplinarity is an embryo to a coming subject entering academia, which is in its infancy. Therefore, it becomes important to identify ways to establish interdisciplinarity into the traditional university structure. This constitutes base for further studies.

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BIOGRAPHICAL INFORMATION

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Appendix 1

Interview guide

1. How do you define interdisciplinary?
2. Where/how does interdisciplinary take place?
3. How could interdisciplinary be thought?
4. What opportunities and challenges are there for you as a teacher/researcher participating in the program?
5. What does interdisciplinarity mean for you?