

Chapter 13

Action-Based Education in Academic Entrepreneurship: A New Role of the Student?

Lene Foss, Elin M. Oftedal, and Tatiana Iakovleva

1 Introduction

The scope of entrepreneurship programs offered by academia has expanded significantly in many areas around Europe, Asia, North America, Australia, and New Zealand (Gartner and Vesper 1994). With reference to the theory of planned behavior and the literature on entrepreneurship education, research has confirmed that students involved in entrepreneurship programs increase their competencies and strengthen their intention towards self-employment (Fayolle et al. 2006; Mwasalwiba 2010; Sanches 2010). In examining the literature, more economically oriented studies with ex ante and ex post survey responses find that students learn about their entrepreneurial aptitude through entrepreneurship education (von Graevenitz 2010). Based on previous research, Dutta et al. (2011) conclude that specialized entrepreneurship education has a significant positive impact on the likelihood of future venture creation. However, a diverse and broad-based educational experience seems to make a critical difference in terms of the entrepreneurs' personal income and net worth. Thus, the former facilitates venture creation, whereas the latter adds to entrepreneurial success. Further, it has been noted that academic entrepreneurship is regarded as an experience or outcome, rather than a clearly defined role (Jain et al. 2009). Interestingly, in research on entrepreneurial universities (83 studies in all) revealing organizational designs that encourage commercialization of university innovations, a focus on entrepreneurial education is not apparent. The term academic entrepreneurship has been treated as a task academics can perform, but not as a role in itself (Jain et al. 2009). Thus, we reveal a blank spot in previous literature on how the new action-based entrepreneurship programs offered

L. Foss (✉) • E.M. Oftedal
Tromsø University Business School, N-9037 Tromsø, Norway
e-mail: lene.foss@uit.no

T. Iakovleva
Stavanger Business School, N-4036, Stavanger, Norway

by universities affect the role of students (Foss and Lozano 2012; Ollila and Williams-Middleton 2011; Rasmussen and Sørheim 2006).

In this paper we therefore ask: *How do action-based entrepreneurial programs aimed at commercializing RBIs affect the role of the entrepreneurial student?*

In answering this question we develop a model which expands prior research on academic entrepreneurship, entrepreneurial education, and role theory. In developing propositions we use quotes from students' experiences with an action-based entrepreneurial program aimed at commercializing RBIs¹ to support our arguments. Our main thesis is that the role of the entrepreneurial student is one that evolves and changes due to different institutional settings and individual skills and motivation.

This paper is structured as follows: we firstly give a brief description of the way entrepreneurial teaching has developed over the years, and then we review the literature on the role of entrepreneurs in academic entrepreneurship to establish the dimensions of the role of the student. We illustrate discussion with quotes from interviews. We develop three propositions followed by a model and conclude with a discussion on the limitations of the study and the implications for theory and policy.

2 Can Entrepreneurship Be Taught?

Entrepreneurship studies can be broadly divided into three categories—teaching *about*, *in*, and *for* entrepreneurship (Hytti and O’Gorman 2004; Kirby 2004). Teaching *about* entrepreneurship is aimed at giving students a general understanding of entrepreneurship as a phenomenon (Hytti and O’Gorman 2004). The objective is to educate different stakeholders, including policy makers, financiers, and the general public on the role of entrepreneurs in the community. The training of individuals *in* entrepreneurship is aimed at making them more entrepreneurial in their work as well as increasing their innovativeness and creativity. Educating *for* entrepreneurship refers to the creation of an entrepreneur, the individual who decides to start his or her own business.

Educating *for* entrepreneurship is actually the most beneficial to society. There is a discussion in the literature on the most suitable teaching methods for educating students for entrepreneurship. Here “traditional” methods of teaching are not always the most suitable and appropriate. The benefits of action-based entrepreneurship education built upon a venture creation approach have been discussed in previous research, along with the challenges of facilitating such learning experiences (Kirby 2004; Ollila and Williams-Middleton 2011; Rasmussen and Sørheim 2006; Siegel

¹ This program is the Master of Science in Business Creation and Entrepreneurship at Tromsø University Business School in Norway. The two-year program which builds on a co-creation model with collaboration between the BCE program at the Business School, the inventors at the Tromsø University, and the Technology Transfer Office (TTO) started in 2008 and has produced several spin-offs where students are co-entrepreneurs. This paper uses quotes from the 25 interviews (with students, inventors, and TTO) reflecting collaborative challenges.

et al. 2003). For such learning to happen, it is necessary to stimulate entrepreneurial processes, providing students with the tools to start a business. Educators can use new venture creation to help students acquire a range of both business understanding and skills (Kirby 2004).

In a review of 103 peer-reviewed articles dealing with entrepreneurship education B  chard and Gr  goire (2005) investigate the main elements in entrepreneurship teaching. The authors find the focus to be mainly on the social and economic role of entrepreneurship education for both individuals and society. Furthermore, there is apparent interest in systemizing entrepreneurship education, i.e., in how to develop a curriculum, as well as a focus on the content to be taught and how it should be presented to the students. Finally, there is an interest in how to meet students' individual needs by structuring the teaching activities. The three subjects not addressed included contributions from a social-cognitive approach, a psychological-cognitive approach, and a spiritual and ethical approach. Thus, B  chard and Gr  goire (2005) conclude that research on entrepreneurship education generally fails to consider the reasons that motivate particular educational choices.

3 The Role of the Entrepreneurial Student in Academic Entrepreneurship

The academic entrepreneurship literature points to an essential conflict between the primary motivations of the university scientist on the one hand and the firm or entrepreneur on the other (Siegel et al. 2003). Recent research suggests that the relationship between these two actors may take different constellations (Jain et al. 2009; Spilling 2008) and that some scientists manifest disparate concerns and attitudes regarding research commercialization (Owen-Smith and Powell 2011). This illustrates the challenges of commercializing university-based research, as science and industry are based on different types of logic and knowledge; while science is reflective and future-oriented, industry is more action-oriented and needs short-term results.

Additionally, these conflicting motivations are continually reinforced by the demands of the different institutional environments of science and business. The role of the scientist may therefore be hard to combine with the role of the entrepreneur as cultural differences are many and extensive (Cunningham and Harney 2006). Thus, the relationship between institutions and roles in academic entrepreneurship needs to be explored.

In role theory, the concept of role ambiguity refers to the lack of specificity and predictability of a specific role (Beehr 1976; Kahn et al. 1964). Unclear role-related information may lead to role ambiguity. Moreover, role conflict results from two or more sets of incompatible demands involving work-related issues (Kahn et al. 1964; Katz and Kahn 1978). As such, the organizational and role context of their behavior is deemed to distinguish academic entrepreneurs from others who are engaged in entrepreneurial activity. We claim that this represents an understudied issue and that we need more knowledge of how and why role ambiguity develops.

Jain et al. (2009) identify a fundamental difference in the role of the academic and the role of the entrepreneur when it comes to norms, processes, and output. Whereas the norms of the academic are universalism, collectivism, disinterestedness, and skepticism; the norms of the entrepreneur are uniqueness, private property, passion, and optimism. The processes of the academic are characterized by experimentation, long-term perspective, and individualism, while the processes of the entrepreneur have a narrower focus, a short-term perspective, and are more team oriented. Finally, the output of the academic is measured in publication and peer recognition, while the output of the entrepreneur is measured in products and profits.

These role differences may raise the barriers for academics to commit to academic entrepreneurship. This argument is supported by other research (Owen-Smith and Powell 2011) and points to a possible division of labor where the scientist remains in his/her role as the inventor of ideas and other actors explore and develop the commercial potential of the idea. This role of co-entrepreneur may be assigned to a student. Students are academically educated and have a network within academia through other students and professors, but they are not rooted in academia in the way scientists are, and they have their eyes on business as their future work medium. In addition, students may have the quality of an entrepreneurial change agent as they are not yet deeply embedded within any specific institutional setting. The quote below illustrates this notion:

These guys are relatively young people and I think the advantage has been that they are eager to expand their knowledge, not only in the entrepreneurship sector, but also in the technology sector. They asked a lot of relevant questions regarding the technology and they forced me to communicate in a way so that they really understood the technology idea, which I think is really important. When it comes to the other part, everything dealing with administration and the non-technology part, I am confident that they have contributed a lot. It's very difficult for me again to say exactly what sort of contribution they made other than saying that these are young enthusiastic people and I would think that they are more enthusiastic than older people so to speak, in the same positionthey ask a type of question that might not have come from a person who is supposed to be experienced.... They have nothing to lose in a way. They have everything to learn.... (Inventor)

However, when an entrepreneurial student takes on this role, there is a clear discrepancy in education, work experience, and age between a scientist in life sciences and a student of entrepreneurship. The role of co-entrepreneur is more active compared to the more passive student role. We believe that a more active student role enhances entrepreneurial intentions and capabilities and creates a stronger understanding of oneself as an entrepreneur. The quote below shows a student group with a clear understanding of their own role in the process.

In our case I think we were the engine. Because the idea was for a long time only a plan to be commercialized, but they maybe didn't have the right force to push it. I think we were really crucial for the idea because we put our brains into it, we put our time in. It started with the students. (Student)

Based on the discussion above we assume that the role of the student entrepreneur revolves around three dimensions: co-entrepreneurship, entrepreneurial intentions and capabilities, and the understanding of oneself as entrepreneur. Each of these dimensions will be further discussed in relation to entrepreneurial education.

4 Action-Based Entrepreneurial Education: A New Context for Developing the Role of the Student

The dominant pattern of education has been based on an individualized mind-set, with the aim of modeling single individuals to become entrepreneurs (Laukkanen 2000). In short, the candidates receive knowledge and capabilities through a linear educational process, or what Gibb (1993) refers to as a didactic model. This approach is debated in the literature, as entrepreneurship has come to be seen as the concrete enactment of new ventures. According to Gibb (2002), this calls for an action-oriented approach.

As an alternative to the individual focus, Laukkanen (2000) conceptualizes the business generation model” as an educational strategy for entrepreneurship education. Its aim is to foster the necessary conditions for new ventures and for the strategic expansion of regional SMEs: the emergence and fusion of viable business concepts, entrepreneurial actors, resources, and a munificent environment. In an educational setting, students should meet and internalize a realistic business concept from the outset and should be operationally involved in real business contexts. In such a model there is room for including opportunities and contexts (Gartner 1985; Shane 2003), which emphasizes learning-by-doing (Fiet 2001). Action-based entrepreneurship education can be accomplished in many different ways, depending on both the operational context and the university’s ambitions (i.e., whether their primary focus is on teaching or being actively engaged in the business generation process). The operational context is related to both internal university support and the entrepreneurial environment in the region. Rasmussen and Sørheim (2006) argue that, by broadening the perspective and actually including the formation of new ventures as a part of education, a better match with these conceptions can be achieved. In addition, new venture creation will be in line with the overall mission of the university by contributing to economic development. Such action-oriented or learning-by-doing processes often rely heavily on student involvement. In such a context, we seek to generate knowledge on the emerging role of the student as a co-entrepreneur of research-based innovations (RBIs).

Neck and Greene (2011) also suggest that teaching entrepreneurship does not imply a new pedagogy but basically a new method. The method is teachable and can be learned, but the outcome is not predictable, as it depends on and is influenced by the participants. Entrepreneurship as a method does not only give students understanding and knowledge but also requires that they put this knowledge into practice. The authors claim that learning the method is more important than learning specific content, due to the real-life changes the student will face after education.

Lackéus and Middleton Williams (2011) argue that the action-based method is essential for achieving important learning outcomes such as tacit learning, personal development, and self-awareness. One important benefit of this pedagogy is that it allows higher-level learning from highly emotional and critical incidents in the venture creation process, provided that action is also paired with opportunities for

reflection together with experienced mentors. In some instances, a real-life learning environment can provide for what Fayolle terms an emergency learning situation, especially when economic and personal stakes are high (Fayolle et al. 2006).

Bager (2010) demonstrates that the camp model (changing the learning situation by switching to another location and including students from other disciplines as well as business leaders and experts) gives other learning outcomes such as application of knowledge, faster learning, idea generation, problem-solving, self-efficacy, creativity, dealing with complexity and ambiguity, and training presentation skills. Timmons and Spinelli (2004, p. 66) argue that there is a limit to what can be taught in entrepreneurship education. They also add that the only way to learn is through personal experience. Institutions of higher learning, such as colleges and universities, have to put together a curriculum which provides for experiential learning and personal experiences. Botha et al. (2006) emphasize the fact that most programs pay great attention to the knowledge aspects but are weaker when it comes to teaching the skills and attitudinal aspects that are crucial to the success of any potential or start-up entrepreneur. In addition, he argues that lecturing as a teaching method needs to be changed because this approach often reveals more about the teacher than the subject being taught.

This literature review shows that while there are a variety of classifications of entrepreneurship education, these seem to be converging towards a single framework for entrepreneurship education. We conclude that the field develops towards the attitude-changing perspective on entrepreneurship. Most scholars conclude that there is a need for a more innovative design of modules of entrepreneurship education that will enable students to achieve their desired outcomes in learning either for, about, or in entrepreneurship. This leads us to the following proposition:

Proposition 1. *Action-based entrepreneurship education aimed at commercializing RBIs expands the role of students towards co-entrepreneurship.*

5 A Variety of Learning Methods as a Context for Developing a New Student Role

According to role theory, each social role is a set of rights, duties, expectations, norms, and behavior a person has to face and fulfill. Moreover, the environment accepts and prefers some type of behavior over the others (Mead 1934; Ajzen 1991). As a result, people often behave in a predictable way, and each individual's behavior is context specific, based on social position and other factors (Kahn et al. 1964). In relation to entrepreneurship education, it raises a much debated question of whether or not entrepreneurship can be taught and if so, what the appropriate methods are.

The underlying assumption is that, for learning to take place, experiences have to occur. Nonaka in his classical article of 1994 speaks about knowledge transformation cycles—from tacit to explicit. He describes this process as a spiral, arguing that

tacit knowledge goes through codification and becomes more explicit. Each individual possesses tacit knowledge, and it is possible to exchange this knowledge with others through shared experience or socialization. At the same time, some knowledge is explicit, and exchanging explicit knowledge between individuals, leading to new knowledge creation, is called combination. However, tacit and explicit knowledge are two parts of the same system. We thus need knowledge conversation that combines tacit and explicit knowledge. One process is to convert tacit knowledge into explicit knowledge, which is called externalization. Another way is to convert explicit knowledge back into tacit through learning, which is labeled internalization. Hence, the spiral of knowledge goes from socialization and combination towards externalization and then back to internalization. More recently, these ideas have been incorporated into entrepreneurship literature, with studies theorizing on the decision of individuals to become entrepreneurs as involving a transition in their role identity (Hoang and Gimeno 2005). Experiential learning is the process whereby knowledge is created through the transformation of experience (Kolb 1984, p. 41). Learning is often a subconscious, internal process (Marsick and Watkins 1990).

Politis (2005) further acknowledge that *entrepreneurial learning* is an experiential process in which knowledge develops through experiencing, reflecting, thinking, and acting. As such, students are thrown into the “unknown,” since no one can guarantee the outcome. This type of learning corresponds to higher-level learning that appeals to a person’s critical thinking, reflection challenging deeper personal values and interpretation, and develops tacit as well as explicit knowledge (Cope and Watts 2000).

It has been argued that going through acute situations where the individual has to make critical decisions fosters deep-rooted learning (Cope and Watts 2000). Letting the students go through the commercialization process simulates real entrepreneurial experience. Therefore, students are not only gaining academic knowledge but also developing tacit knowledge, something that is important for an entrepreneur (Rotefoss 2001). The quote below demonstrates a student’s level of learning in an action-based entrepreneurial program.

I knew some of the theoretical frameworks before, but not at a practical level which I learned in this program. I have learned how to use these theoretical skills and frameworks.I gained a lot of knowledge about commercializing the ideas from university and how this processes evolves. How this processes evolved from the scientist to the company . . . and the legal side of commercialization process. I didn’t know much about universities and their role in this industry. ... That’s what I think I gained the most, but also a bit of marketing and a how to write a business plan and also how to interact with investors because we also had some presentations with private investors and banks. How to be confident, what are the important things you have to present, what is not important and how to maybe act in front of them. All these things were new for me and I gained this knowledge during the program. (Student)

This quote supports our theoretical notion that the student learning is two-dimensional, where one element is tacit (i.e., commercialization) and the other explicit (i.e., academic). The two levels of learning that the students achieve during

the program alter their role within the innovation system. The student develops unique knowledge that both university faculty and industry may actively use. In the autonomous and independent student role which is created through practicing actual entrepreneurship, and not learning only along the “academic” axis, students become an important resource for the university in their commercialization activity. They learn to be outwardly focused and acquire network capability while balancing their academic efforts against the challenges of “real” life. As such, students are no longer apprentices but become active participants in the innovation system.

There is a balance between tacit and explicit knowledge, or between experience-gained and academically gained knowledge, that allows students to become active in the knowledge transfer process. Based on the above discussion, we argue that students in practical entrepreneurship programs learn in a more integrative way, as proposed below:

Proposition 2. *A combination of different teaching methods (tacit as well as explicit knowledge components) will shape the entrepreneurial intentions and capabilities of students.*

6 Cooperation and Interaction in Academic Entrepreneurship: Shaping the Role of the Student

Although the student has much in common with the scientist and the entrepreneur (see Table 13.1), the role as co-entrepreneur is still different from that of the scientist and that of the experienced entrepreneur. Tan and Ng (2006) point out that entrepreneurship education should be supported by three pillars: industry, academia, and public policy (government.) Funds should also be obtained to support these linkages. Commercializing RBIs involves many actors from different institutional affiliations, thus involving a higher degree of cooperation and interaction between various actors. As Rasmussen and Rice (2012) state, “The major channels for technology transfer are the transfer of people, especially graduate students, and research cooperation.” Concluding their review of the academic entrepreneurship literature, Djokovic and Souitaris (2008) suggest that research on academic entrepreneurship needs to explore the interaction between networks and other potential determinants of spinout structure and performance, such as personal values and the behavior of academic entrepreneurs. Further research on the intermediaries of academic entrepreneurship, i.e., the technology transfer offices (TTOs), indicates that they are not always effective in commercializing knowledge (Gregoro and Shane 2003; Rothaermel et al. 2007; Muscio 2010; Siegel et al. 2003). Thus, in her literature review, Foss (2012) urges future research to grasp the complexity of actors, agency, motives, values, institutions, and culture involved in transforming scientific ideas to commercialized products. In conclusion, previous research points to the various roles of academic staff in commercializing RBIs (Owen-Smith and Powell 2011; Spilling 2008). Recent research indicates that the

Table 13.1 Differences between scientists and entrepreneurs

	Scientist	Entrepreneur
Norms	Universalism, collectivism, disinterestedness, skepticism	Uniqueness private property, passion, and optimism
Processes	Experimentation, long-term perspective, individualism	Narrow focus, short-term perspective, and team management
Outcome	Publication, peer recognition	Products and profits

Source: Jain et al. (2009)

interaction between actors in academic entrepreneurship has not been a research priority (Foss 2012). This gives us an opportunity to explore how increased interaction between students, scientists, and TTOs in action-based entrepreneurship programs affects the role of students. The following quote lends support to the idea that the cooperative elements between the various actors in the commercialization of RBIs seem to be a crucial research stream:

We had a good relation with the inventor from the very beginning . . . We really had a good collaborative relationship and still have, even though not all of us are involved as much at the moment, but the inventor is always there if you need him to help you. So I can just say positive things about that relationship. . . We had good feedback from the university commercializing system (TTO). . . In our case, the TTO was really important. . . they have facilities, equipment of their own, so we have to rent and have a good, clear contract between the TTO and the company. That was really important, they were like the key stakeholder for this idea. (Student)

From identity theory we know that students learn “who they can be” by constructing stories of “who they want to be” (Rae and Carswell 2000, p. 151). Thus they work towards enacting their “storied identity.” This implies that students should have role models who reinforce their entrepreneurial belief systems. Students have a different concept of self before they enter the entrepreneurship program and existing industry knowledge, prior knowledge of markets, and customer problems increase the likelihood of entrepreneurial recognition (Corbett 2005, p. 476). The student who participates in the commercialization process gains an understanding of “what they can be” and “who they want to be” in communication with other actors in the innovation structure. Thus, their “me” develops differently than their “I” (Mead 1934). First, in dialogue with the actors in the innovation system, students see their part differently and have the opportunity to develop their role accordingly. Second, the new self-concept may, in turn, contribute to the very context in which students find themselves, thus making the student an important resource within the innovation system. Therefore, their concept of self, as student and co-entrepreneurs, will evolve as they enter into, communicate with, and relate to the commercializing context. This is illustrated in the quote below:

I think that the BCE program was a huge personal change. . . I am a completely different person from when I actually started the program and now. . . my confidence, my skills sets in general. I feel I know a little bit of everything. You know if the CEO of my company talks about some pretty deep financial stuff I know that I can sort of relate and know enough to feel comfortable and discuss it. Maybe not contribute so much always, but I can discuss it and I know what he is talking about and I know why it’s important. So I have a completely different confidence level than I had previously. (Student)

This discussion leads us to our last proposition:

Proposition 3. *Cooperation and interaction with other actors in commercializing RBIs within an action-based entrepreneurship education affect the concept of self among students.*

7 Discussion

The argument in this paper is that we must improve our understanding of the relationship between action-based entrepreneurship education aimed at commercializing RBIs and the changing role of entrepreneurship students. We argue that the role of the entrepreneurial student is a crucial component in a knowledge-based economy where universities need to contribute to regional innovation by helping to commercialize research-based ideas. Thus, universities need to educate students on how to take ideas to the market, to collaborate with inventors and TTOs, and to develop skills and self-esteem that make them capable in terms of technology transfer and starting university spin-offs. Our contribution has been to theorize and illustrate, with real-life examples from students and inventors, an action-based entrepreneurial program and to develop a (theoretical) framework with propositions for future testing.

The propositions can be summarized in Fig. 13.1.

Our theoretical argument is coupled to how factors at the system level (action-based entrepreneurship programs), educational level (different teaching methods), and interactional level (cooperation and interaction) affect three aspects of the student role, which includes capabilities and intentions, the role of the student as co-entrepreneur, and the concept of self.

We propose that students in a practical entrepreneurship course may create a role for themselves that deviates from the classical student role because of different learning methods. Further, we claim that student entrepreneurs can bridge the gap between academia and industry. Finally, we argue that students who attend practical entrepreneurship programs evolve their role based on their interaction with diverse actors involved in the commercialization process, including scientists, TTOs, investors, and customers. Thus, the external context influences their concept of self.

8 Implications for Theory

Examining the role of the student in entrepreneurial education can provide insights into the causes and consequences of a more active and expanded role of the student within today's universities. More specifically, we outline a framework integrating research from various strands of literature: entrepreneurship education, academic

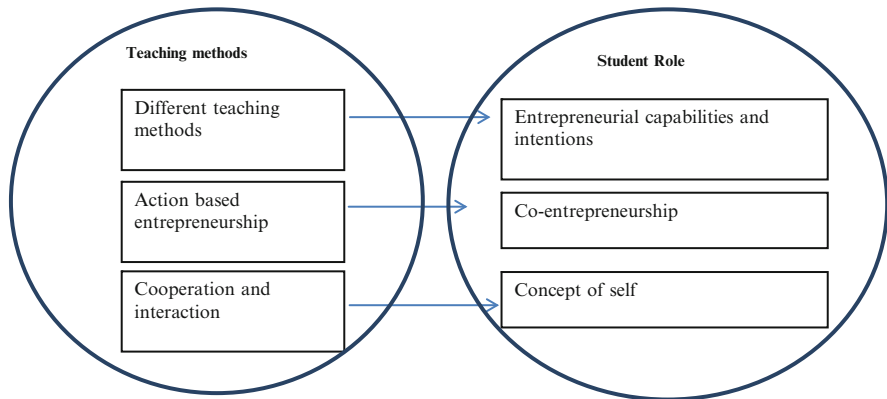


Fig. 13.1 The relationship between teaching methods and the student role

entrepreneurship, and role theory. Our model is parsimonious and should be seen as a first attempt to integrate previous research supported by anecdotal empirical quotes. Yet our view departs in several aspects from previous research, by taking an integrative approach to explanatory factors and by developing an explicit focus on the role of the entrepreneurial student in academic entrepreneurship.

9 Limitations and Implications for Future Research

This exploratory study is theoretical in nature and based on an inductive research paradigm. As such, it has its limitations. First, the case of the active learning form is used as illustration, which allowed us to draw preliminary results/conclusions and to shape propositions. It does not, however, allow for the testing of theory. Secondly, as in any qualitative study, conclusions do not allow for generalizations, although we argue that the position derived from this research could be tested using a more quantitative approach. In particular, our second proposition of how a combination of different teaching methods shapes students' intentions can be tested through a comparative and longitudinal survey conducted with two or more student groups—those involved in intensive action-based education versus those being taught by more traditional methods. Propositions one and three can be tested with more advanced qualitative methods than those applied in our research. A longitudinal multiple case study that accounts for multilevel modeling problems would enable future research to clearly define the role of students in RBI processes and their role in commercializing innovations.

We hope to motivate future research to make use of our ideas in this paper and to refine the propositions and our model according to a more fine-grained causal picture that allows a more precise operationalization of variables. The various

action-based entrepreneurial programs being taught (throughout the world) would make an interesting empirical background for developing theories of the role of the student in academic entrepreneurship.

Future research should examine the intermediate effects of other variables on education—commercialization relationships. One way of refining the model would be to differentiate the proposed effects by applying psychological variables as intermediate ones. Hence, the independent variables may be assumed to work differently, with regard to the personal characteristics of the individual.

We argue that there is a need for future research to address the question of how the co-creation of values happens during the educational process, how the self-perception of students is changing, and how the new role of students as co-entrepreneurs can impact educational programs, universities, and commercialization actors. We hope to motivate further work that links the role of students and commercialization outcomes. There is a need to take a closer look at students as groups, as many action-based entrepreneurial programs involve student *teams* as co-entrepreneurs. Thus, these relational dynamics and processes may affect the co-creation of values as well as the ways in which they impact the research-based innovation system.

10 Implications for Policy

In light of universities' new responsibilities in commercializing research-based ideas in order to generate innovation and regional development, the role of the entrepreneurial student is under scrutiny. From learning *about* entrepreneurship, students are now supposed to learn *how to become* an entrepreneur. In this chapter, we have used this change in context to discuss the challenges being faced by students in developing their role in a new institutional terrain, where they have to relate to inventors of RBIs, as well as the support system in terms of TTOs. In order to gain a deeper understanding of the role of the student in this context, it is necessary to generate knowledge of comprehensive practices. Thus, this paper discusses different aspects of the role of the student in the commercialization process.

We argue that the actions and development of students are the most important elements of learning, and that the focus in educational programs should be on stimulating this self-development, and on helping students to take on the role of real co-entrepreneurs. Recognizing the impact that students can have on the knowledge transfer in the form of commercialization of innovations is highly important to community development and should be appreciated by both policy makers and practitioners.

References

- Ajzen I (1991) "The theory of planned behavior", organizational behavior and human decision education and incubation at the university. *Int J Entrep Innov Manage* 13:161–178
- Bager T (2010) The camp model for entrepreneurship teaching. *Int Entrep Manage J* 7(2):279–296
- Bécharad J-P, Grégoire D (2005) Entrepreneurship education research revisited: the case of higher education. *Acad Manage Learn Educ* 4(1):22–43
- Beehr TA (1976) Perceived situational moderators of the relation between subjective role ambiguity and role strain. *J Appl Psychol* 61:35–40
- Botha M, Nieman G, Vuuren J (2006) Enhancing female entrepreneurship by enabling access to skills. *Int Entrep Manage J* 2(4):479–493
- Cope J, Watts G (2000) Learning by doing—an exploration of experience, critical incidents and reflection in entrepreneurial learning. *Int J Entrep Behav Res* 6(3):104–124
- Corbett A (2005) Experiential learning within the process of opportunity Identification and exploitation. *Entrep Theory Pract* 29(4):473–491
- Cunningham J, Harney B (2006) Strategic management of technology transfer: the new challenge on campus. Oak Tree Press, Cork
- Djokovic D, Souitaris V (2008) Spinouts from academic institutions: a literature review with suggestions for further research. *J Technol Transf* 33(3):225–247
- Dutta DK, Li J, Merenda M (2011) Fostering entrepreneurship: impact of specialization and diversity in education. *Int Entrep Manage J* 7(2):163–179
- Fayolle A, Gailly B, Lassas-Clerc N (2006) Assessing the impact of entrepreneurship education programmes: a new methodology. *J Eur Ind Training* 30(9):701–720
- Fiet JO (2001) The theoretical side of teaching entrepreneurship. *J Bus Venturing* 16(1):1–24
- Foss L (2012) The university-industry interface: a collaborative arena. In: Johnsen H-CG, Ennals R (eds) *Creating collaborative advantage. Innovation and knowledge creation in regional economies*. Gower, Aldershot
- Foss L, Lozano F (2012) Innovation through academic entrepreneurship: How to develop new collaborative models to educate entrepreneurs? Paper presented at INBAM, 20–23 March 2012
- Gartner W (1985) Conceptual framework for describing the phenomenon of new venture creation. *Acad Manage Rev* 10(4):696–706
- Gartner WB, Vesper KH (1994) Experiments in entrepreneurship education: successes and failures. *J Bus Venturing* 9(3):179–187
- Gibb A (1993) The enterprise culture and education. *Int Small Bus J* 11(3):11–34
- Gibb A (2002) In pursuit of a new 'enterprise' and 'entrepreneurship paradigm for learning: creative destruction, new values, new ways of doing things and new combinations of knowledge. *Int J Manage Rev* 4(3):233–269
- von Graevenitz G (2010) The effects of entrepreneurship education. *J Econ Behav Organ* 76:90–112
- Gregoro DD, Shane S (2003) Why do some universities generate more start-ups than others? *Res Policy* 32:209–227
- Hoang H, Gimeno J (2005) Entrepreneurial identity: theory and measurement. Presentation at the first annual Smith entrepreneurship research conference, University of Maryland, College Park, 22–23 April 2005
- Hytti U, O'Gorman C (2004) What is 'Enterprise education'? An analysis of the objectives and methods of enterprise education programmes in four European countries. *Educ Training* 46(1):11–23
- Jain S, George G, Maltarich M (2009) Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity. *Res Policy* 38(2009):922–935

- Kahn RL, Wolfe DM, Quinn RP, Snoek JD, Rosenthal RA (1964) *Organizational stress: studies in role conflict and ambiguity*. Wiley, New York
- Katz D, Kahan RL (1978) *The social psychology organizations*. Wiley, New York
- Kirby D (2004) Entrepreneurship education: can business schools meet the challenge? *Educ Training* 46(8/9):510–19
- Kolb F (1984) *Experiential learning: experience as the source of learning and development*. Prentice Hall, Englewood Cliffs. <http://www.learningfromexperience.com/images/uploads/process-of-experiential-learning.pdf>. 31 May 2006
- Lackeus M, Middleton Williams K (2011). *Venture Creation Programs: entrepreneurial education through real-life content*. Paper presented at interactive paper session BCERC 2011 conference, Syracuse
- Laukkanen M (2000) Exploring alternative approaches in high-level entrepreneurship education: creating micro-mechanisms for endogenous regional growth. *Entrep Reg Dev* 12:25–47
- Marsick V, Watkins K (1990) *Informal and incidental learning in the workplace*. Routledge, London, p 270
- Mead GH (1934) In: Morris CW (ed) *Mind, self and society from the standpoint of a social behaviourist*. University of Chicago Press, Chicago
- Muscio A (2010) What drives the university use of technology transfer offices? Evidence from Italy. *J Technol Transf (Springer)* 35(2):181–202
- Mwasalwiba ES (2010) Entrepreneurship education: a review of its objectives, teaching methods, and impact indicators. *Educ Training* 52(1):20–47
- Neck H, Greene P (2011) Entrepreneurship education: known worlds and new frontiers. *J Small Bus Manage* 49(1):55–70
- Nonaka I (1994) A dynamic theory of organizational knowledge creation. *Organ Sci* 5(1):14–37
- Ollila S, Williams-Middleton K (2011) The venture creation approach: integrating entrepreneurial education and incubation at the university. *Int J Entrep Innov Manage* 13(2):161–178 (Processes, vol. 50, pp. 179–211)
- Owen-Smith J, Powell WW (2011) Careers and contradictions: faculty responses to the transformation of knowledge and its uses in the life sciences. *Res Soc Work* 10:109–140
- Politis D (2005) The process of entrepreneurial learning: a conceptual framework. *Entrepreneurship Theory Pract* 29(4):399–424
- Rae D, Carswell M (2000) Using a life-story approach in researching entrepreneurial learning: the development of a conceptual model and its implications in the design of learning experiences. *Educ Training* 42(4–5):220
- Rasmussen E, Sørheim R (2006) Action-based entrepreneurship education. *Technovation* 26(2):185–194
- Rasmussen E, Rice M (2012) A framework for government support mechanisms aimed at enhancing university technology transfer: the Norwegian case. *Int J Technol Transf Commercialization* 11(1–2):1–25
- Rotefoss B (2001) *A resource based approach to the business start up—a longitudinal investigation*. Doctoral Thesis, Henley Management College, London Routledge
- Rothaermel FT, Agung SD, Jiang L (2007) University entrepreneurship: a taxonomy of the literature. *Ind Corp change* 16:691–791
- Sanches JC (2010) University training for entrepreneurial competencies: its impact on intention of venture creation. *Int Entrepreneurship Manag J* 7(2):239–254
- Shane S (2003) *A general theory of entrepreneurship: the individual-opportunity nexus*. Edward Elgar, Cheltenham
- Siegel D, Waldman DA, Atwater LE, Link A (2003) Commercial knowledge transfers from universities to firms: improving the effectiveness of university–industry collaboration. *J High Technol Manage Res* 14:111–133

- Spilling OR (2008) On the role of academic staff as entrepreneurs in university spin-offs: case studies of biotechnology firms in Norway. In: Landström H, Crinjs H, Laveren E (eds) *Entrepreneurship, sustainable growth and performance. Frontiers in European entrepreneurship research* Cheltenham. Edward Elgar, UK, pp 267–298
- Tan SS, Ng CKF (2006) A problem-based learning approach to entrepreneurship education. *Educ Training* 48(6):416–28
- Timmons JA, Spinelli S (2004) *New venture creation: entrepreneurship for the 21st century*. McGraw-Hill/Irwin, New York