EVALUATION OF THE ENTREPRENEURSHIP EDUCATION PROGRAMME IN UNIVERSITY: A NEW APPROACH

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Abstract
In entrepreneurship education, the development of entrepreneurial thinking and acquiring of relevant knowledge and skills for conducting the tuition process for the development of entrepreneurial initiative are very important. Besides this, it is important to also find different ways to measure the impact of the courses. The evaluation of the educational programme is a complex matter, as the question arises – what are we measuring, what indicators should be used and how should they be measured.
The current study is an attempt to develop a new approach in the evaluation of entrepreneurship education programme in university - the assessment of entrepreneurship training results through changes in metacognitive awareness of participants. Students were asked to complete, both at the beginning and at the end of the training course, a cognitive adaptability questionnaire (by Haynie). The extent to which students reflect, think strategically, plan, recognize useful knowledge-skills and analyse/control themselves was uncovered based on the results. For analysing the changes in metacognitive awareness of respondents, both the Likert Scale and Bayesian Dependency Modelling techniques are used. A Comparison of average assessments at the beginning and at the end of the course shows a small rise. Moreover, considering the strengths of the dependencies between the most important statements of thinking process, participants present a trend of growing stronger after the training course.

Keywords: entrepreneurship education, knowledge and skills, metacognitive awareness

JEL Classification: A22, C81, L26, M53

Introduction

The role of entrepreneurship in societies has grown and entrepreneurship education is seen as a mean of raising the entrepreneurial spirit and behaviour of people. There is an increasing need to include entrepreneurship education into different levels and forms of education and entrepreneurship among students has become an important topic in universities. As a number of studies show, student interest in entrepreneurship as a career

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choice is growing (Brenner et al., 1991; Fleming, 1994; Kolvereid, 1996). At the same time, the importance of entrepreneurship as a source for economic development is growing which by the opinion of policy makers can be promoted by entrepreneurship education (European Commission, 2006). Therefore entrepreneurship education is promoted and implemented into school curricula in many of the European member countries (European Commission, 2006) and the United States (Kuratko, 2005). As the education programmes can vary by schools and countries the need to develop a framework to evaluate the impact of entrepreneurship programmes have appeared a key issue in research.

In this paper an attempt is made to develop a new approach in evaluation of the impact of entrepreneurship education based on changes in students' thinking process, which may help to increase the effectiveness of entrepreneurship training courses in the future. In the article, after the conceptual framework, study design and data collection methods are covered. Following this, the results of the study are presented. The article concludes with a discussion.

1. Theoretical framework

Recent studies have tried to fill in the gaps in entrepreneurship education research, e.g. by studying changes in learners values, attitudes and intentions in terms of desirability and feasibility of starting a business (Pihkala and Miettinen, 2004; Peterman and Kennedy; 2003; Fayolle and Gailly, 2005; Volery and Mueller, 2006), by looking at the role of metacognition in training, self-regulated learning and self-regulatory skills (Haynie and Shepherd, 2007; Bryant, 2006; Ramocki 2007), and by suggesting the need for different learning environments that would entail a teaching style that is action-oriented, supports experiential learning, problem-solving, project-based, creative approach and involves peer evaluation which is close to how entrepreneurs live and learn (Jones and English, 2004; Löbler, 2006; Lengnick-Hall and Sanders, 1997; Pittaway and Cope, 2007; Collins 2006; Brătianu and Nistoreanu, 2008). At the same time, there is a related debate about the degree to which entrepreneurship can be taught, and if so, how. On the one hand, if one accepts that key attributes of entrepreneurship are based on personality traits (e.g., Stewart et al, 1999), then education and training are unlikely to have a fundamental impact because they rarely alter a person's underlying personality. On the other hand, if one accepts that entrepreneurial cognition and skills are largely acquired through experience (e.g., Neck et al, 1999); then education and training may have a significant impact on decision-making and other key aspects of entrepreneurship (e.g. Bryant 2006, 280;Tăchiciu et al, 2010),).

As Mitchell et al. (2004, p. 508) note, previous researchers in entrepreneurial cognition have investigated topics such as: (1) whether entrepreneurs' thinking patterns differ from those of non-entrepreneurs (Busenitz & Barney, 1997; Gaglio & Katz, 2001; Mitchell et al, 2002), (2) the reasons that some individuals become entrepreneurs while others do not (Simon et al, 2000), (3) the issue of why opportunities are recognized by some individuals and not others, and (4) the question of how entrepreneurs think and make strategic decisions (Busenitz & Barney, 1997; Mitchell et al, 2000; Mitchell et al., 2002). Each of these topics of investigation relates to the way that thinking affects entrepreneurial outcomes. Thus it appears, that individuals who understand the thinking patterns related to entrepreneurship — and desire to become entrepreneurs — can alter their own thinking patterns accordingly.

Metacognition refers to 'thinking about thinking'(Jost et al, 1998) and has been defined as "the ability to reflect upon, understand, and control one's learning" (Schraw, 1998). In their study, Mitchell et al proposed that metacognitive thinking can be deliberately practiced in an entrepreneurial context. Further, they suggested such metacognitive thinking will lead to the creation of entrepreneurial expertise by facilitating the self-reflection, understanding and control of one's own entrepreneurial cognitions. (Mitchell, et al. 2005).

Considering the dynamic and unstable environment of entrepreneurship, metacognition also plays a role in how people adapt to their developing and changing circumstances (Haynie & Shepherd, 2007). In their article, Haynie and Shepherd investigated the roles that metacognition and feedback-type play in facilitating cognitive adaptability: the ability to inform and adapt a previously learned decision heuristic given a dynamic task environment. Findings of the study suggested that cognitive adaptability is important in an entrepreneurial context, that metacognition does promote cognitive adaptability and thus improve performance on an entrepreneurial task. The concomitant implications of the theoretical model and empirical findings were hopeful in that metacognitive abilities can be improved by learning, thus cognitive adaptability can be enhanced and entrepreneurial performance consequently improved. Additionally, this indicates an important link between entrepreneurial education and the domain of cognition-metacognition which is investigated in this paper, considering that it is broadly agreed that aspects of self-regulation, such as self-efficacy and metacognition, play important roles in educational and entrepreneurial outcomes (Bryant, 2006; Kickul & Krueger, 2005).

Supported by this the hypothesis the following can be drawn:

H1: Outcomes of entrepreneurship training courses that intentionally aim at changing metacognitive abilities of students have a positive correlation with a student's willingness to engage into entrepreneurial activities.

By taking a metacognitive approach to education, educators can thereby induce metacognitive thinking and thus enable students to better gain knowledge about cognition and knowledge about the regulation cognition (Schraw, 1998). Therefore, Mitchell, et al. suggest that entrepreneurship students who engage in metacognitive exercises—in the form of coached scripting exercises –will be more likely to gain entrepreneurial expertise than students who do not engage in metacognitive exercises (Mitchell, et al. 2005). According to Mitchell, the inclusion of metacognitive elements in teaching curriculum would be considered to be just as important as the content of the teaching curriculum itself; and entrepreneurship educators would then be responsible to understand how to develop such a metacognitive curriculum.

However, being able to define metacognition is not all that matters. In order to successfully adapt the full extent of metacognition, one has to be aware of the importance of it and be capable to use it in a concious and systematic manner. It needs to be noted that results of entrepreneurship training have been assessed less through changes in metacognitive awareness of participants when compared with more traditional approaches (e.g. attitudes, intentions etc). It is so, although many scholars have investigated acquired characteristics of entrepreneurs; such as entrepreneurial cognition, which includes mental models, heuristics, intuition, and self-regulatory skills as key factors in entrepreneurship (Baron, 2004; Busenitz & Barney, 1997). Moreover, the study by Bryant was aimed at measuring and identifying relationships between three self-regulatory constructs: self-regulation,

metacognitive awareness, and entrepreneurial self-efficacy by entrepreneurs (Bryant, 2006). Results of the study suggested that educational programs should seek to nurture and strengthen the relationships between students' sense of prior success in achieving positive goals, their sense of efficacy for entrepreneurial tasks, and self-awareness of their cognitive skills. In addition, it is already known that self-efficacy and metacognition can be improved by education, training and experience (Schraw, 1998), and regulatory pride can be primed situationally (Higgins et al., 2001).

The current study aims to assess the results of entrepreneurship training through changes in metacognitive awareness of students. For that purpose a cognitive adaptability questionnaire originally developed by Haynie ("Generalized measure of adaptive cognition") was used to evaluate the awareness of the participants, to what extent they reflect, think strategically, plan, know which are useful knowledge-skills for them and analyse-control themselves. This allows to identify a research question as: Are the five dimensions of metacognitive awareness identified in the survey data?

Some explanations of results are found from the analysis of the components of the thinking process (goal orientation, metacognitive knowledge, metacognitive experience, metacognitive choice, monitoring). For measuring the changes in metacognitive awareness of respondents, both the Likert Scale method and Bayesian Dependency Modelling have been used. Results of the study should contribute to the methodology of assessing the impact and results of entrepreneurship training courses to the metacognitive awareness of students. In addition it is the aim of this paper to make a contribution to the knowledge of how to teach students with the aim of widening their metacognitive awareness. Based on this, it is possible to formulate the following hypothesis:

H2: different components of metacognitive awareness are differently influenced by entrepreneurial training.

At the same time, a number of factors may influence the development of metacognitive awareness, e.g. students' personality traits, their self-efficacy, attempt to be independent, and readiness for risk-taking, etc. Previous pilot survey has showed also, that students participating a training course (camp model) with higher intention/ motivation towards entrepreneurship showed a higher impact to the changes of their metacognitive awareness than for those students of compulsory course (Ling et al, 2009). Therefore the factor of entrepreneurial intention via assessing students's personality traits has been used also in this analysis.

2. Research methodology

2.1 Participants

During the fall semesters of 2008 and 2009, two entrepreneurship training courses were held at Tallinn University of Technology (TUT) for bachelor and master degree students in engineering-related disciplines. The final database contains the datasets of 195 individuals between 20 and 34 years of age (59.3% of the total number of respondents). The overall structure of the respondents is given in Figure no 1.

It also has to be noted that the survey was carried out among the students studying different engineering-related disciplines, i.e. students of infotechnology, applied chemistry, physics,

logistics, genetechnology, geology, mechatronics, transportation technology, product development etc were represented. This leaves us 14 engineering disciplines in total. In relation to this fact it can be said that the data retrieved are representative, since a large variety of engineering discipline students taking both bachelor and master studies have been included.

2.2 Study design

Research design has been centered on a questionnaire developed to measure metacognitive awareness. In order to find an evidence supporting hypothesis, H1, a frequency analysis has been utilized to evaluate the answers given to the respective statements. This provides the statistical properties (specifically mean and standard deviation, StDev) for each statement asked, as far as the distribution of the datapoints on the Likert scale is concerned. Additionally, analyzing these results gives an opportunity to assess whether they could be dominated by certain values or not. As a second step in the analysis of statistical properties it was designed to look at the difference of means before and after the course. This would allow extracting an indication about the impact of a training course.

In order to provide evidence of whether the subdomains of metacognitive awareness could be identified in the actual datasets, factor analysis (FA) was carried out. As using FA calls for confirming the strength of interconnections between variables, an additonal correlation analysis has been implemented.

However, it does not give any indication of what is causing the actual change. For capturing more scientific evidence supporting hypotheses H2 it has been concluded to look in more details at what subdomain of metacognitive awareness is more influenced than other. In order to do so the Bayesian Dependency Modelling technique has been used. Specifically an application called B-Course (http://b-course.cs.helsinki.fi/obc/) has been utilized, mainly because it's a simple-to-use interface and the possibility to get necessary results in a fairly short interval of time.

2.3 Procedure

The purpose of the courses was to introduce participants with the concept of an entrepreneurial mindset and widen the horizon of the respective knowledge among students. The content of the course in entrepreneurship and business planning included lectures and exercises, solving teaching cases and writing business plans. It lasted throughout the whole semester (i.e. total 16 weeks and 48 hours).

In order to collect the necessary data samples, participants were asked to fill out a questionnaire about cognitive adaptability. It was originally developed by Haynie as a "generalized measure of adaptive cognition". The questionnaire included 35 different statements and it was asked to be filled out both at the beginning and immediately at the end of the training courses. The statements covered five distinctive areas; such as goal orientation, metacognitive knowledge, metacognitive experience, metacognitive choice and monitoring. This original questionnaire was translated into Estonian in order to avoid the possibility to get false readings due to possible misunderstanding of the text. For measuring the respective ratings a 10-step Likert Scale was introduced. Respondents were asked to

answer the statements by rating each of them on the provided scale of 1 to 10, based on their own judgment where: 1 being equal to "Not very much like me" and 10 being equal to "Very much like me"

Prior factor analysis to Pearson correlation matrixes were built up using an SPSS statistical computation package for the data collected before and after the training course. It allowed coefficients not in a range of .3 to .7 to be discarded from further statistical analysis statements. This gave an opportunity to run factor analysis using SPSS on the remaining statements for checking whether the structure of metacognitive awareness provided in the questionnaire is present in the actual survey data.

As far as the Bayesian modelling is concerned, there were two models constructed involving all of the 35 statements. These models are based on survey results collected both before and after the training courses. In order to bring more scientific content into the discussion the models are complemented with data describing both the strengths of dependencies retrieved from B-Course and the Spearman rank order correlation coefficient values retrieved from SPSS.

3. Results

3.1 Cognitive adaptability of students

Evidence supporting the initial hypothesis H1 is presented in Annex. The survey shows how cognitively adaptable are the students participating in the training course. Presented are the average ratings over all the respondents before and after the training course. Looking at these ratings it could be seen that they are located at the end of the scale “very typical of me”. Higher scores on the Likert Scale means that a person is more metacognitively aware, which helps to provide cognitive adaptability, i.e. the ability to reflect upon, understand, and control one’s thinking and learning. The fact that ratings are located more in one end of the 10-step scale also presents evidence that answers are dominated by higher scores (values between 7 to 10). Based on this it is not possible to expect the normality assumption to be fulfilled.

In addition, it is interesting and needful to turn attention to the standard deviation (StDev) of students’ answers: the values provided are also rather high which characterises different levels of the thinking of students participating in the courses. The question arises whether entrepreneurship training can still influence students’ assessments of the behavioural statements brought in the questionnaire. The other interesting aspect evident regarding standard deviation is that values tend to grow smaller after the training in the majority of cases. The trend of StDev values getting smaller suggests that after the training there has been a change in participants thinking – ratings of the statements are, more than before, concentrated around average values. Although at some level this could be considered to be the expected outcome of a group-learning process, the results retrieved do not allow to draw such conclusions without additional analysis. However the changes described suggest that the training course has had an impact to participants’ metacognitive awareness – meaning they are more aware of their own thinking processes.

Analysis of the results continued with examining all of the statements in order to see if they were applicable for factor analysis (research question Q1). In order to use factor analysis for assessing whether 5 subdomains of metacognitive awareness are evident in the actual

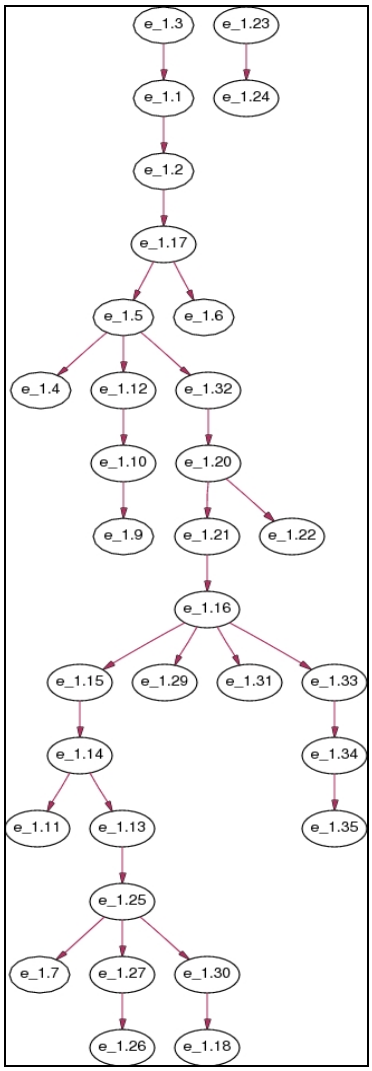
survey data, correlation coefficients were evaluated for all the statements. Based on Nokelainen (2007) the most commonly used criteria for accepting variables are, among others: (1) a standard deviation of no more than half the mean and (2) correlation between +/- .3 - .7. During the examining of all the 35 statements, both before and after the training, it was found that all of them passed the first criteria. Applying the second criteria, on the other hand, gave a result that before the training course 30 statements passed (rejecting 1.6; 1.9; 1.11; 1.23 and 1.28) and after 32 of them passed (rejecting 1.8, 1.23 and 1.28, the content of statements is brought in Annex).

Factor analysis with the principal components extraction and the varimax rotation method was conducted on the remaining statements in datasets before and after the training course. The solution provided 8 factors in both cases that did not entirely correspond to the 5 sub domains division presented in the original survey questionnaire. The fact that there is a slight discrepancy in dividing the statements according to what is described in the questionnaire could be an indication of instrumental failure. Nevertheless it can be concluded that factor analysis is indicating the presence of structure of the initial questionnaire in the general level.

3.2 Changes in students' metacognitive awareness

It was decided to use Bayesian Dependency Modelling (BDM) for both finding evidence to support hypothesis H2 and for revealing additional scientific evidence about aspects underlying the changes in students' metacognitive awareness. This was run on both complete datasets independently; ie one included datasets retrieved before the training and the other right after it. The resulting model based on the data before the training is presented in Figure no. 1 and after the training in Figure no. 2. Probability ratios in the figure indicate to which level the probability of the model would be decreased if the respective dependency is removed. Based on the order of dependencies given, ie the strongest dependencies on top and weakest on bottom of the column, it could be said that the higher position dependency has the bigger is its importance to the model in general. Spearman rank order correlation coefficient values are given for bringing complementary information into the analysis. It indicates the strength of correlation of each dependency at the level p=.01.

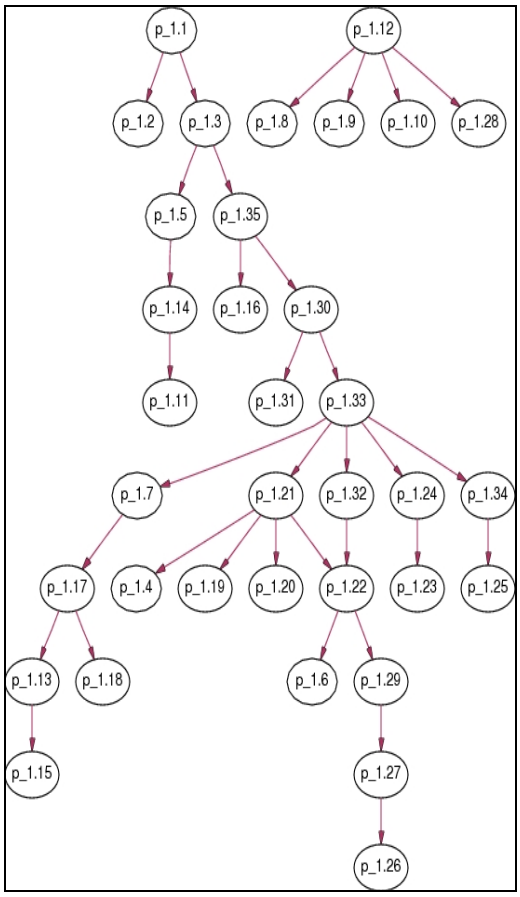
On the basis of BDM it is possible to find deeper changes among assessments of the components of students' metacognitive awareness, as well as different statements. If to take into consideration the strengths of dependencies between different behavioural statements of students before the training course, the dependencies between the most important items have in average grown stronger after the course. Although some of the stronger dependencies have weakened after the course, more changes have still occurred in the structure and the order of statements in the network model. This is also supported by the values of the Spearman rank order correlation coefficient (ie dependency between items 1.23 and 1.24. (see annex) has changed from .687 to .702; between 1.27 and 1.26 from .627 to .709; between 1.20 and 1.21 from .598 to .553)



Dependency			Probability ratio	r_s
e_1.23	-->	e_1.24		.687
e_1.20	-->	e_1.21		.598
e_1.1	-->	e_1.2		.530
e_1.16	-->	e_1.15		.434
e_1.25	-->	e_1.27		.579
e_1.5	-->	e_1.4		.515
e_1.27	-->	e_1.26	1 : 86887	.627
e_1.14	-->	e_1.11	1 : 79753	.424
e_1.10	-->	e_1.9	1 : 79573	.399
e_1.33	-->	e_1.34	1 : 68825	.488
e_1.15	-->	e_1.14	1 : 33284	.432
e_1.21	-->	e_1.16	1 : 13810	.403
e_1.32	-->	e_1.20	1 : 6684	.394
e_1.12	-->	e_1.10	1 : 2839	.314
e_1.17	-->	e_1.5	1 : 2015	.396
e_1.2	-->	e_1.17	1 : 522	.386
e_1.25	-->	e_1.30	1 : 420	.398
e_1.13	-->	e_1.25	1 : 326	.386
e_1.16	-->	e_1.33	1 : 253	.414
e_1.5	-->	e_1.32	1 : 113	.293
e_1.14	-->	e_1.13	1 : 78	.393
e_1.20	-->	e_1.22	1 : 56	.521
e_1.25	-->	e_1.7	1 : 49	.430
e_1.30	-->	e_1.18	1 : 33	.341
e_1.16	-->	e_1.31	1 : 26	.321
e_1.3	-->	e_1.1	1 : 3.57	.390
e_1.5	-->	e_1.12	1 : 1.98	.227
e_1.34	-->	e_1.35	1 : 1.88	.439
e_1.16	-->	e_1.29	1 : 1.85	.309
e_1.17	-->	e_1.6	1 : 1.27	.254

Figure no. 1: Bayesian model based on the data before the training

Note: r_s denotes Spearman rank order correlation coefficient (significant at p=.01)



Dependency			Proba-bility ratio	r_s
p_1.22	-->	p_1.6	1 : 838	.382
p_1.21	-->	p_1.4	1 : 379	.349
p_1.1	-->	p_1.2	1 : 349	.524
p_1.22	-->	p_1.29	1 : 280	.372
p_1.1	-->	p_1.3	1 : 252	.452
p_1.32	-->	p_1.22	1 : 149	.407
p_1.17	-->	p_1.18	1 : 129	.485
p_1.35	-->	p_1.16	1 : 108	.271
p_1.13	-->	p_1.15	1 : 78	.356
p_1.12	-->	p_1.8	1 : 70	.204
p_1.21	-->	p_1.22	1 : 46	.508
p_1.5	-->	p_1.14	1 : 40	.317
p_1.17	-->	p_1.13	1 : 25	.334
p_1.3	-->	p_1.35	1 : 11	.271
p_1.33	-->	p_1.24	1 : 4.44	.241
p_1.12	-->	p_1.28	1 : 2.02	.211

Figure no. 2: Bayesian model based on the data after the training

Note: r_s denotes Spearman rank order correlation coefficient (significant at p=.01)

The results of BDM showed that the theoretical model of five domains is derived from the empirical sample from before and after the course, although considerable changes have happened between the dependencies of the different statements. This may indicate the influence of the course on the thinking process of students. Although in the importance of ranking variables (dependencies between statements) some dependencies have remained strong in both cases (e.g 1.23-1.24 in metacognitive experience, 1.26-1.27 in metacognitive choice), a number of dependencies in the network have changed; a large part of the dependencies are still rather weak.

The analysis of students' metacognitive awareness on the basis of different components in the models shows, for example, that goal orientation (item 1.5) has a significantly weak connection with the knowledge (item 1.12, see annex) domain. It shows that setting goals in the learning process is not so much related to the knowledge of metacognition, but has its

foundations in past experiences. Although the connection between these two domains remains weak after the course, there has occurred a small improvement. Based on how the items can be grouped into domains on the models, it could be concluded that domains' metacognitive knowledge and metacognitive experiences have had more change in their structure than others. Moreover it has to be noted that, for example, monitoring had dependencies before the course only with metacognitive experience, but after the course there is evidence about connections with metacognitive knowledge as well. On the other hand, it is interesting that although domain choice had connections before the course to knowledge and monitoring, the connection to knowledge disappeared after the course. It is also noticeable that the thinking process under each component became somewhat more logical and systematical after the course. Also, not all the statements under the components came out having dependencies before the course (statements 1.8, 1.19 and 1.28 were excluded from the model as indipendent ones), but all (100%) of the statements were included into the related model after the course. One can make a conclusion that the students' thinking process has become more substantial. The analysis is confirming that students' metacognitive awareness has been widened, and the importance of different statements has changed – which does support hypothesis H2.

For finding the evidence about factors contributing to the changes in students metacognitive awareness the students were divided into two groups based on the extent they were inclined towards being entrepreneurial. For this purpose the students were asked to fill out additional 22-item questionnaire about their psychological profile (Hisrich & Peters, 1989). Based on the models it became evident that the two groups of students are significantly different. As the model of non-entrepreneurial students includes significantly lower number of items, i.e. the statements about goal orientation (items 1-5) were missing, it is possible to conclude that the skills related to goal-setting and reflection of goals when solving entrepreneurial tasks are not significantly developed. By the contrast, at the entrepreneurial students, the items of all 5 domains in the questionnaire were present in the model. In addition as there are more items present in the second model it is possible to say that entrepreneurial students are more metacognitively aware about how they set up goals, what kind of a strategy they adopt in finding solution and at what level they are able to monitor the progress.

Discussion and Conclusion

In conclusion, the article provides an assessment of some of the results on the influence of entrepreneurship training courses on the metacognitive awareness of students. The survey showed rather high scores on the Likert Scale (7-10) of students participating in the training course, meaning that they are cognitively aware. The comparison of the average assessments at the beginning and at the end of the course shows a small rise in average assessments. Changes were more evident in the domains of knowledge and monitoring, although experience-related issues had significant importance as well. These changes confirm that after the entrepreneurship course the respondents' awareness, reflection, strategic thinking, planning, self-analysis and control have on average increased to some extent.

A Bayesian Dependency Modelling showed that the dependency between some behavioural statements has grown stronger after the course and some of them have weakened, but more

changes have occurred in the structure and importance of statements in the network model assessed on the basis of the Spearman rank order correlation coefficient. The analysis of changes among different components of the thinking process (goal orientation, metacognitive knowledge, metacognitive experience, metacognitive choice, monitoring) showed that the thinking process under each component became more systematic after the course. Therefore, the current study demonstrates a possibility to assess the results of entrepreneurship training through changes in metacognitive awareness of participants. The results of the study may help to increase the effectiveness of entrepreneurship training courses in the future.

The empirical study showed that the training course has had a varying impact to the domains of students' metacognitive awareness. Still these changes were rather modest and therefore, the inclusion of metacognitive elements into the training program would be desirable. It would provide a possibility to get a deeper knowledge about the influence of training courses, and consequently help to find better solutions for the contents and methods of entrepreneurship training courses with the aim of increasing students' metacognitive awareness. Although in order to find more scientific evidence about the recommendable content of the course, it calls for additional research in the future.

In addition - considering the fact that the 5 domain structure of metacognitive awareness model was not undeniably prominent in the empirical data might bring up the need to modify the initial questionnaire to better fit the empirical data. One also has to keep in mind that this particular questionnaire was never tested before in similar settings, i.e. as it is also referred to in this paper – it has been the first attempt to use the questionnaire for assessing the effectiveness of entrepreneurship training. It has been more an exploration for bringing new ideas and methodological aspects into the discussions of the scientific community.

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Annex Descriptive statistics, comparison of results before and after the training course

Statements	Before course		After course		Mean difference (4-2)
	Mean	StDev	Mean	StDev	
1	2	3	4	5	6
Goal orientation					
1.1. I often define goals for myself	8.1	1.494	8.3	1.303	0.2
1.2. I understand how accomplishment of a task relates to my goals	8.1	1.501	8.0	1.507	-0.1
1.3. I set specific goals before I begin a task	7.4	1.818	7.8	1.555	0.4
1.4. I ask myself how well I have accomplished my goals once I have finished	7.2	2.118	7.7	1.741	0.5
1.5. When performing a task, I frequently assess my progress against may objectives	7.3	1.938	7.6	1.714	0.3
Metacognitive knowledge					
1.6. I think of several ways to solve a problem and choose the best one	8.1	1.607	8.1	1.561	0.0
1.7. I challenge my own assumptions about a task before I begin	6.9	1.949	7.2	1.776	0.3
1.8. I think about how others may react to my actions	6.7	2.356	6.9	2.135	0.2
1.9. I find myself automatically employing strategies that have worked in the past	7.5	1.807	7.9	1.500	0.4
1.10. I perform best when I already have knowledge of the task	8.9	1.431	8.9	1.463	0.0
1.11. I create my own examples to make information more meaningful	8.1	1.762	8.5	1.622	0.4
1.12. I try to use strategies that have worked in the past	7.5	2.352	8.0	1.550	0.5
1.13. I ask myself questions about the task before I begin	6.6	2.155	7.2	1.636	0.6
1.14. I try to translate new information into my own words	7.3	2.189	7.8	1.810	0.5
1.15. I try to break problems down into smaller components	7.3	2.070	7.4	2.014	0.1

Statements	Before course		After course		Mean difference (4-2)
	Mean	StDev	Mean	StDev	
1	2	3	4	5	6
1.16. I focus on the meaning and significance of new information	7.8	1.545	7.9	1.309	0.1
Metacognitive experience					
1.17. I think about what I really need to accomplish before I begin a task	7.9	1.505	8.1	1.455	0.2
1.18. I use different different strategies depending on the situation	7.6	1.739	8.0	1.420	0.4
1.19. I organise my time to best accomplish my goals	7.4	2.143	7.4	2.073	0.0
1.20. I am good at organising information	7.3	1.699	7.5	1.493	0.2
1.21. I know what kind of information is most important to consider when faced with a problem	6.9	1.700	7.4	1.506	0.5
1.22. I consciously focus my attention on important information	7.4	2.218	7.8	1.579	0.4
1.23. My "gut" tells me when a given strategy I use will be most effective	7.0	1.987	7.3	1.942	0.3
1.24. I depend on my intuition to help me formulate strategies	7.1	1.953	7.2	2.087	0.1
Metacognitive choice					
1.25. I ask myself if I have considered all the options when solving a problem	7.2	1.843	7.4	1.822	0.2
1.26. I ask myself if there was an easier way to do things after I finish a task	7.0	2.442	7.3	2.155	0.3
1.27. I ask myself if I have considered all the options after I solve a problem	6.8	2.166	7.0	1.830	0.2
1.28. I re-evaluate my assumptions when I get confused	6.7	2.139	7.0	1.968	0.3
1.29. I ask myself if I have learned as much as I could have after I finish the task	6.3	2.164	6.8	2.155	0.5
Monitoring					
1.30. I periodically review to help me understand important relationships	7.4	1.720	7.6	1.663	0.2
1.31. I stop and go back over information that is not clear	7.6	1.827	7.9	1.719	0.3
1.32. I am aware of what strategies I use when engaged in a given task	6.4	1.818	7.0	1.687	0.6
1.33. I find myself analysing the usefulness of a given strategy while engaged in a given task	6.4	1.858	6.9	1.884	0.5
1.34. I find myself pausing regularly to check my comprehension of the problem I situated at hand	6.7	2.088	7.0	1.899	0.3
1.35. I ask myself questions about how well I am doing while I am performing a novel task. I stop and re-read when I get confused	8.4	1.631	8.3	1.521	-0.1