TEACHING ENTREPRENEURSHIP:
TO BE THE WIND UNDER STUDENTS' WINGS

Suzanne Hallenga-Brink

The Hague University of Applied Sciences
Sustainable Talent Development Research Group

ABSTRACT

The CDIO network works with the extended CDIO syllabus version 2.0 (Crawley et. al., 2011), in which two learning goal sections were added: leadership and entrepreneurship. This paper focuses on entrepreneurship and uses a case study of the Eye on Entrepreneurs (EoE) initiative in the Netherlands to reflect on the similarities and differences between the CDIO learning goals in entrepreneurship and the unconventional approach of EoE in teaching (engineering) students entrepreneurship in practice. Eye on Entrepreneurs (EoE) offers a student an intense learning experience in an informal but authentic learning context. What are the perceived strengths of their approach when it comes to effectively teaching entrepreneurship? When translating this back to the formal learning context of a university, how does this relate to the CDIO framework and syllabus especially? And what would this mean for the lecturer's competencies? Based on a case study discussion with practitioners an answer to these questions was sought. Both stakeholders from the (entrepreneurial) professional field (including talented students) and (entrepreneurship-) educators in general and from the CDIO-network were involved. The results show that what translates back to formal education is for teachers to be open minded, give space to manoeuvre and make mistakes, and have reciprocal dialogue and reflection with students when teaching entrepreneurship. Their main role should be to recognize talents and stimulate them to take initiative, show empathy and take risks in creativity.

KEYWORDS

Entrepreneurship, Authentic Learning Environment, Integrated Learning Experiences, Teacher Attitudes, Teaching Competencies, Standards: 2, 3, 7, 8, 9.

INTRODUCTION

Entrepreneurship in CDIO

Crawley et. al. (2011b) present the updated version of the Extended CDIO Syllabus v2.0. The syllabus is a blueprint for the learning goals of undergraduate engineering programs worldwide to educate engineers who can engineer. Together with the CDIO standards it forms the basis of the CDIO framework, which is used by over 120 universities worldwide. The syllabus was extended with leadership and entrepreneurship. Entrepreneurship involves the redirection and mobilization of capital and human resources to form a new economic

activity within an established firm, or to start a new company altogether (Crawley 2011a). It was established that engineering education should prepare students for both forms of entrepreneurship. One of the reasons to teach future engineers entrepreneurship is that innovative and viable business ideas are more likely to emerge in technical and creative programs compared to business schools (Kontio, 2010). Therefore, it was also recommended by the OECD (Organisation for Economic Co-operation and Development). For successful engineering entrepreneurship three ingredients were mentioned: engineering, engineering leadership, and specific domain knowledge associated with business formulation and start-ups.

Leadership was the other added learning goal in the CDIO Syllabus v2.0, which was also seen as intrapreneurship or leading innovation. There is an overlap between leadership and entrepreneurship, and between the two of them and the skills already in the CDIO Syllabus v1.0 such as Ethics, Equity and Other Responsibilities (2.5), Teamwork (3.1), Enterprise and Business Context (4.2) and System Thinking (2.3) (Crawley et. al, 2007). But in order to capture the additional skills needed to lead innovation and start a new business, section 4.7 and 4.8 were added to the Extended Syllabus v2.0, see table 1.

Table 1. The added items to the CDIO Syllabus v2.0.

4.7 Leading Engineering Endeavours
Creating a Purposeful Vision
4.7.1 Identifying the Issue, Problem or Paradox
4.7.2 Thinking Creatively and Imagining Possibilities
4.7.3 Defining the Solution
4.7.4 Creating New Solution Concepts
Realizing the Vision
4.7.5 Building and Leading an Organization and an Extended Organization
4.7.6 Planning and Managing a Project to Completion
4.7.7 Exercising Project/Solution Judgment and Critical Reasoning
4.7.8 Innovation – the conception, design and introduction of new goods and services
4.7.9 Invention – the development of new devices, materials or processes that enable new goods and services
4.7.10 Implementation and Operation – the creation and operation of the goods and services that will deliver value
4.8 Engineering Entrepreneurship
4.8.1 Company Founding, Formulation, Leadership and Organization
4.8.2 Business Plan Development
4.8.3 Company Capitalization and Finances
4.8.4 Innovative Product Marketing
4.8.5 Conceiving Products and Services Around New Technologies
4.8.6 The Innovation System, Networks, Infrastructure, and Services
4.8.7 Building the Team and Initiating Engineering Processes (conceiving, designing, implementing and operating)
4.8.8 Managing Intellectual Property

Mäkimurto-Koivumaa et. al. (2013) confirm that developing an entrepreneurial mind-set and behaviour is needed and valued in today's working life and that these abilities should be acknowledged when designing curricula for an engineering education (CDIO standards 7 and 8). They also indicate that teachers' pedagogic skills in higher education need attention. They recommend teachers to learn about entrepreneurial learning and action-based learning methods, and to utilize them as well. Their action plan also includes personal development plans for students and utilizing or developing networks.

Norrman et. al. (2014) recommend incorporating four elements crucial for learning in CDIO-based engineering education in entrepreneurship and leadership: a flipped classroom, experiential learning activities, sharp live cases and theory-based practical exercises. The flipped classroom can enhance self-paced learning that according to Hattie (2008) is one of the more important aspects of learning and can also enhance a reciprocal student-teacher interaction. Learning activities let students experience forms of problem-solving, role-playing, or other engaging kinds of "doing". Real life cases where students work for or together with a real client make it clear that there is not one true answer only and increase student engagement. And theory-based practical experiences prevent problems students typically have, applying what they have only learned in theory during classes in a more complex context, by offering theory during dedicated workshops. This is in line with the just-in-time approach to offer knowledge in complex learning processes of Merriënboer & Kirschner's 4C/ID method (2012).

Kozlinska (2016) challenges the belief that learning by experience is most effective in teaching entrepreneurship at business school universities in her doctoral thesis. Contrary to expectations, 'learning-by-doing' approaches did not necessarily lead to better outcomes for the over 500 students she studied, or even have adverse effects in some instances. Given the nature of entrepreneurship entailing uncertainty, ambiguity and dynamism, learning by doing seems intuitively right, but often students aren't as experienced in this learning style as they are in more traditional educational settings and haven't learned how to reflect on their doing for the learning to become effective. Secondly often educators either are entrepreneurs with little teaching experience, or teachers with limited or no entrepreneurial experience or experience in industry. And last courses in entrepreneurship often aren't long enough to create a measurable impact. Looking in hindsight, successful graduates proved to have a high level of creativity and self-confidence, a strong passion for entrepreneurship and a tolerance to failure.

Informal Entrepreneurship Education: Eye on Entrepreneurs

Eye on Entrepreneurs (EoE, 2017) is an ongoing collaboration between entrepreneurs, investors, medium-sized companies, and regional universities and vocational schools around The Hague in the Netherlands. It started in 2014 with a coaching project for talented entrepreneur-students at university. The mission of the organization is to facilitate entrepreneurial talents' development to become the best entrepreneurs of the Netherlands. In the vision of EoE this will further the prosperity of society. For this purpose, students are put in charge of a medium-sized enterprise with a 'challenge' for a year. There are mentors and coaches available to scaffold the steep learning curve of the talents on demand.

What are the perceived strengths of this approach when it comes to effectively teaching entrepreneurship? When translating this back to the formal learning context of a university what would this mean for the teacher's competencies? And how does this relate to the CDIO framework? Based on studying the case of EoE and discussing it with practitioners these questions are answered in this paper. First the method steps are explained, next the results are summarized, and finally the conclusions are drawn based on these results.

METHODS

To become familiar with the Eye on Entrepreneurs (EoE) initiative and its way of working, over the course of a year four network meetings and talent selection sessions were observed

and interviews were held with the two founders of EoE and one of the talents, an Industrial Engineering student of The Hague University of Applied Sciences, who later on became director of EoE. Based on this information the EoE approach has been described.

EoE Network Workshop

To establish the perceived strengths of EoE, question 1, two parallel workshop sessions were organized for stakeholders of EoE during a monthly gathering of the network. 21 people participated, a mix of entrepreneurs, advisors, board members, new talents, 'old' talents, and educators of universities and vocational schools. They were asked what they thought were 3 important (educational) strengths or factors of success for EoE why talents learned so much about entrepreneurship in a relatively small amount of time. Everybody wrote their answers down for him/herself before they discussed them in the group. The factors that were mentioned more often and were perceived as important by the participants were written down on a central flip-over. Then the question was asked if these factors could be translated to a formal educational setting and if so, which competencies would teachers in their eyes need to make this happen (question 2)?

Interactive Case Study discussion

The resulting perceived strengths and competencies of effectively teaching entrepreneurship by the EoE stakeholders were clustered and listed. They were used in an interactive case study presentation at an educational practitioners' research conference: the European Association for Practitioner Research on Improving Learning (EAPRIL) conference in Porto, November 2016. During this session, the input of educators on the matter was compared to the input of the EoE stakeholders. Four European educators in higher education were present and one of the EoE talents. First the participants were asked to write down their opinion: What teaching competency is decisively important when teaching entrepreneurship to 17-25 year olds? The answers were compared with the outcome of the EoE workshop. And the talent who was present at the interactive presentation gave his view on the matter. Next the participants wrote down: What elements have you just heard that resonate with you? Why? This was discussed as well. Next the challenges of EoE when it comes to teaching were presented together with the strengths from the EoE workshop. The session was concluded with the question: To which of these strengths could you as an educator contribute in a formal educational setting? How? Again, the opinions of the talent were taken along in the discussion to get input from the students' perspective as well.

CDIO Educators' Online Questionnaire

To answer the question how EoE's findings relate to CDIO, question 3, a questionnaire was sent out to educators from universities of the CDIO network. There were 26 respondents from different European and South-American CDIO universities, of which two were applicant universities: The Netherlands, Sweden, Denmark, UK, Ireland, Finland, Portugal, Spain, Brazil, Chile, and Colombia. Respondents could choose factors of success combined with the CDIO syllabus items on entrepreneurship and the teaching skills that came out of the first two sessions. They were asked what teaching competency they deemed decisively important when teaching entrepreneurship to 17-26 year olds, and which factors (personal teacher traits, didactic principles and content building blocks) they would use in an entrepreneurship course. In these lists the CDIO learning goals of table 1 were added. Would they choose these learning goals or other things to make the course effective?

RESULTS

The EoE approach

Observation and interviews gave insight into the way EoE works. EoE's talent scouts operate in business and schools to recruit young entrepreneurial talent. When interested, these potentials have to pitch themselves and their plan for one specific company-case at an EoE board meeting. They also have to do a Big Five test, the personality test that looks at extraversion, agreeableness, conscientiousness, neuroticism and openness, for more background information (Hensel, 2010). If selected, the talents get the opportunity to be the CEO of the existing medium-sized company they pitched for, for a full year. The company typically has up to 50 employees, and a minimal turnover of 200.000 euro per year. Talents get a coach to support their personal development and help them reflect. They also get a mentor who is specialized in the sector to share his/her own entrepreneurial expertise, e.g. business models, finance or marketing. The business networks of all these EoE's accelerators are at the disposal of the student. It is a demand-driven, one-one-one guided educational model.

Eye on Entrepreneurs goes beyond teaching the theoretical basis of entrepreneurship, by teaching practical skills in a truly authentic, yet guided learning environment. EoE believes in learning by doing and making mistakes. The learning is reciprocal, like Norrman et. al. (2014) discuss, and the student is treated as a professional from day one. There is pressure on the learning process, as the students solve problems for an existing company with real employees, revenues etc. But the learning is also self-paced and just-in-time by learning on demand, instead of by being offered a pallet of workshops, classes or introductions on certain topics. Besides discovering and applying domain specific knowledge, talents get opportunities to practice personal and interpersonal skills in investor meetings, dealing with personnel, and (re)starting company processes. Students are activated; already during the admission process they do their research in advance, pitch convincingly, and support their plans with solid arguments. This way, a talent can gain ten years of entrepreneurial experience in one year in both mind-set and behaviour.

One of the talents stated in an interview "I don't need a teacher to give me a lecture, I can learn more by googling what I need to know at a certain moment to solve a problem or face a challenge". Like Mäkimurto-Koivumaa et. al. (2013) EoE feels too much emphasis is placed on innovation and ideas in education, while the focus on personal development is often underappreciated. EoE leans on the ideas of Sarasvathy (2008) of effectuation. An entrepreneur takes decisions in a complex and uncertain context based on available means and resources, utilizing networks and leaning on an awareness of personal skills and competences. For this the entrepreneurial mind-set that is needed is one of being dynamic, flexible and self-regulating.

So far four talents have been placed in a company to become skilled entrepreneurs. One of the students has successfully run an indoor climbing hall for a year and then became director of the EoE organization.

EoE Network Workshop

The EoE network gathers frequently in the indoor climbing hall café, which has become their base. During these network meetings entrepreneurs, university lecturers, talents, mentors and coaches and other interested stakeholders gather. If there is a talent presentation, the

EoE council is the jury and others present are asked for their advice. During one of these meetings a workshop was organised to reflect on the strengths and success of EoE. The main question was: what are EoE's strengths, and what can formal education learn from this?

What the EoE stakeholders indicated during the workshop were the strengths of the EoE initiative to teach talented students entrepreneurship so effectively within one year time is shown in table 2.

Table 2: Stakeholder Perception of the EoE Strengths.

Eye on Entrepreneurs strength			
Focus	*Content*	*Didactics*	*Attitude*
• Practice-based* • Wide network • Talent recognition & selection on passion and involvement • Connecting*	• The company is the starting point • Talent needs to recognize the problem • Know the company and make it better: Sometimes it needs to be deconstructed and rebuild • Know what kind of plans to have and when to sell • Personal development • Gather people around you who can add to your talents	• Challenging, exciting cases* • Real, authentic setting, with real responsibility* • Experience with practice* • DO, not just theory* • Coaching on case & on demand by expert entrepreneurs • Flexible, tailor-made • Freedom • Take talent seriously, consider them as full professionals • Students can get 'mildly hurt'. • Out of comfort zone. • Cushioning, room to fail	Personal traits of the talent: • Personal ambitions, passion, and drive • Awareness • Dedication • Trust • Pride • Creativity • Be an adrenaline junky

The focus and attitude factors show how personal development are central to EoE. Also, the content factors are more behaviour-oriented than theoretic-knowledge-based. During the workshop session, one of the coaches explained:

"…We have met a lot of people who were great at finances, but were terrible entrepreneurs. And vice versa. Therefore, the Big 5-tests we let students do are so interesting: what kind of a person is this? What are his talents? What is he incapable of? He could choose to devote a lot of attention to improving on what he cannot, but that's a shame really. Because if he starts to excel in what he can do very well, he can become a fine entrepreneur."

While interviewing one of the founders of EoE, the difference in didactics with formal educational settings and teaching became clear right away:

"…You have to keep an eye on them, but also give space. All sorts of crazy things can happen. You need to have faith; they won't fall in the ditch right away. They have common sense, just like you. They must push the limits, let it happen. It is sometimes so exciting, and sometimes quite uncomfortable. But you have to give them space. You have to dare to do that. It will trigger people with ambitions. Yes, even an 18-year old (former athlete) can lead a gym and learn in one year what normally would take about 5 years. He does have to prove that he knows the challenges of the company and learn to sell his plans at a shareholders' meeting. He has to try out creative, eccentric stuff to get people's attention. Cramming essential entrepreneurial experience in one year; We are the wind beneath his wings. He must fall, absolutely, but must also land gently because he has to get up again and continue. That's what we provide for. "

Next the question was posed what formal higher education could learn from EoE. Focus was put on the role of the lecturer who teaches entrepreneurship. In table 3 important teacher characteristics are listed for effective entrepreneurship education in a formal educational setting, according to the participants of the workshop.

Table 3: Perceived Teaching Competencies for Entrepreneurship Education

Teacher characteristics to teach the 'Eye on Entrepreneurs' way		
Personal traits	*Didactic:*	*Content*
• Show initiative* • Entrepreneurial (or intrapreneurial) * • Guts • Empathy* • Enthusiasm* • Stamina • Open mind* • Open to the world* • Inquisitive	• Give room to manoeuvre* • Coach students* • Be flexible towards students • Feedback (give and receive) * • Reward students • Know the rules, don't use them • Out-of-the-box in teaching	• Knowing what entrepreneurship is • Have an eye for entrepreneurial behaviour • Able to recognize talent • Able to acknowledge talent • Experience in entrepreneurship/practice • Link with professional world

The participants talked a lot about the ability to recognize talent, and then facilitate those students with openness and flexibility via a reciprocal dialogue, based on equality. A link with the professional world was emphasized important as well.

Interactive Case Study discussion

The lists of tables 2 and 3 represented the perception of the stakeholders around EoE. With the input of table 3, the competencies that lecturers need to have according to the EoE stakeholders, a follow-up was done during the EAPRIL conference with a panel of educators in order to find a balanced answer to question number 2, what EoE meant to. Before the participant panel of educators at the interactive case study presentation at EAPRIL got to see these lists, they were asked what teaching competency (attitude, knowledge, skill…) they thought was decisively important when teaching entrepreneurship to 17-25 year olds. Despite the small size of the panel, and unaware that they did so, they picked several factors from table 3, see table 4. They also added two new factors: to have a work attitude, and personal self-efficacy related to entrepreneurship. The first was about giving the right example. The latter dealt with the self-perception of the lecturer's abilities on entrepreneurship.

Table 4: Perceptions of the EAPRIL educators on teaching entrepreneurship

Perceptions EAPRIL educators panel		
	Overlap with EoE list:	*New aspects:*
What competency is most important for an educator when teaching entrepreneurship	• To be open minded and curious* • To be ready to take risks* • To think outside the (school)box* • Have knowledge about entrepreneurship • Have economic skills	• Have a work attitude • Personal self-efficacy related to entrepreneurship
Added after the discussion:	• Recognize talent	• Reciprocal dialogue with talents • Offer opportunities for failure • Coaching on attitude

In the discussion that followed the comparison to the EoE list, the talent of EoE emphasized the importance of 'acknowledging talent' and 'be flexible' for him as a student. When asked after the discussion, the participants indicated they were most struck by his remark that teachers are experts in learning and thus they should focus on what they are good at and organize the rest. For instance, they could use real entrepreneurs as coaches. Also, the autonomy of the talent was mentioned by the panel. He chose his own mentor and the moments he wanted to be taught or try out things on his own.

Finally, when asked how they saw themselves contribute to entrepreneurship education as educators in a formal setting, they agreed they needed to listen more to students: when they succeed but also when they fail. They should offer them opportunities/possibilities instead of assessments, give the student room and help him to realize the right attitude. Also, they could facilitate building up a basic network. But before all of that they agreed it was important to recognize talent and have a reciprocal dialogue with them.

CDIO Educators' Online Questionnaire

With the insights of the EoE workshop and in-depth discussion with the participants at EAPRIL, a first insight was obtained of what formal education could learn of the strengths of the EoE approach, specifically looking at what is offered in what way to the student by the lecturer. The last question addresses the relationship with CDIO. In table 2 ingredients for CDIO standards such as integrated learning experiences (3), experiential learning in the 'operate' phase (7), and just-in-time activating learning (8) are covered in:

- Challenging, exciting cases
- Real, authentic setting, real responsibility
- Experience with practice
- DO, not just theory

These aspects have an asterisk in table 2.

Even the aspects Kozlinska (2016) mentions that often miss to experiential learning successful are covered in the EoE approach: talents prove to have enough time to learn entrepreneurship by being a CEO for one full year full time, and mentors are entrepreneurs themselves, or hybrid academics with first-hand entrepreneurial experience.

Besides looking at the overlap between the perceived strengths of EoE and the CDIO framework and its engineering education research outcomes, there is also an overlap between the contents of entrepreneurship education mentioned by EoE and the EAPRIL educators on the one hand, and the CDIO syllabus list in table 1 on the other, see table 5.

Table 5: What to teach (engineering) students in entrepreneurship education

CDIO Syllabus items/learning goals for Engineering Entrepreneurship	Content mentioned by EoE during network workshop	Content mentioned by Educators at EAPRIL conference	Chosen by CDIO educators in questionnaire
4.8.1 Company Founding, Formulation, Leadership and Organization	Not mentioned	Not mentioned	Not mentioned
4.8.2 Business Plan Development	Not mentioned	Have knowledge about entrepreneurship	Mentioned by 19% of participants
4.8.3 Company Capitalization and Finances	Knowing what entrepreneurship is	Economic skills	Mentioned by 4%
4.8.4 Innovative Product Marketing	Not mentioned	Not mentioned	Mentioned by 15%
4.8.5 Conceiving Products and Services Around New Technologies	Not mentioned	Not mentioned	Mentioned by 8%

CDIO Syllabus items/learning goals for Engineering Entrepreneurship	Content mentioned by EoE during network workshop	Content mentioned by Educators at EAPRIL conference	Chosen by CDIO educators in questionnaire
4.8.6 The Innovation System, Networks, Infrastructure, and Services	Link with professional world	Not mentioned	Not mentioned
4.8.7 Building the Team and Initiating Engineering Processes (conceiving, designing, implementing and operating)	Experience in entrepreneurship/practice Have an eye for entrepreneurial behaviour	Not mentioned	Not mentioned
4.8.8 Managing Intellectual Property	Not mentioned	Not mentioned	Mentioned by 15%

A short digital questionnaire was send out to CDIO members. The questions asked resembled those used in the EAPRIL discussion. The EoE strengths, which had some learning goals in it besides attitudinal and didactic elements, were supplemented with the CDIO learning goals for entrepreneurship in the questionnaire. Respondents received no prior information on the EoE initiative and why the EoE strengths were in the list. Without influencing their choices by any background information, they were asked to choose the 5 most important building blocks they would put in a course of project aimed at teaching entrepreneurship, and which they would absolutely not put in. Most votes went to:
- offering an authentic learning environment with real responsibilities (74%)
- getting a student out of his/her comfort zone (48%)
- let the student formulate the entrepreneurial challenge him/herself (44%)
- taking students seriously and consider them to be professional colleagues (41%)
- creativity (33%)

The CDIO learning goals weren't in the top ten of building blocks, and business plan development got the most votes (5 out of 27 respondents). Remarkably, all syllabus elements that were mentioned (see table 5) also were mentioned by 1-3 participants each under 'what would you absolutely NOT put in your course'. In total 33% of the participants mentioned one or more CDIO syllabus learning goals in answer of this question.

When asked what were important competences for lecturers in entrepreneurship enthusiasm again was thought important, just like being open to the world outside the university. Being entrepreneurial, showing initiative and having empathy were following in the list. They wanted to give students room to manoeuvre in the course, coach them by giving and receiving feedback and think out of the box in their educational design(s). Also, an eye for entrepreneurship and active links with the professional world were deemed important. Their answers did lean towards the teacher knowing what entrepreneurship is, instead of (merely) facilitating the (reciprocal) learning process. All these aspects have an asterisk in the tables 2, 3 and 4.

CONCLUSION

Although it is mainly anecdotal and has its limitations, this study gives some clear hints into the current perceptions of what role a teacher could play in effective entrepreneurship education. The answer to the questions were not meant as a search for something new, a success formula or fix for all. It was more concerned with listening to what is the common perception amongst education innovators, and not overlooking the insights already out there, be it in education or in practice.

What is so interesting about studying an entrepreneurship case like EoE is that it becomes more and more clear that to breed successful entrepreneurs, strengths often heard were giving students space and time and mutual dialogue. This was said even in a non-formal educational setting with lots of pressure on the (real) solutions, as real people and resources are involved. EoE says they pack ten years of experience in one, yet giving space, time, room to manoeuvre and room to fail are central themes. As one of the network workshop participants mentioned: *"...Many entrepreneurs are lifelong learners by trial and error (especially the latter). They didn't get the how to write your business plan classes, or practiced on theoretic cases. They learned by doing."* This notion seems to have been picked up by CDIO educators too, who in the questionnaire did not choose en masse for the well-known CDIO syllabus items for successful entrepreneurship education, but for the more attitudinal coaching on open mind, empathy and enthusiasm.

The question is if the aspects that did matter to the participants and respondents are captured in the CDIO framework as it is right now. Looking at the nature of the aspects mentioned, this should come back in standard 9: enhancement of faculty competence, and standard 7: integrated learning experiences. This research is a small beginning of giving direction to the personal and interpersonal skills of a teacher, integrated in the context of entrepreneurship.

The interactive case study discussion session was quite small-scaled, but none the less gave rich insights into the deliberations of the educators to see value in, or counter, the strengths of EoE in a formal learning setting. The educators who had experience in teaching entrepreneurship were quite on the same road as the EoE stakeholders. Best of all, the reciprocal dialogue which was mentioned as one of the important factors in the results took place during the discussion when the talent and educators together came to new insights in an open conversation on what value each could add to the learning process.

REFERENCES

Crawley, E. F., Malmqvist, J., Lucas, W.A., & Brodeur, D. R. (2011a). The CDIO Syllabus v2.0: An Updated Statement of Goals for Engineering Education. *Proceedings of the 7th International CDIO Conference*, Copenhagen.

Crawley, E.F., Malmqvist, J., Östlund, S., & Brodeur, D.R. (2007). *Rethinking Engineering Education: The CDIO Approach*. Switzerland: Springer International Publishing.

Crawley, E.F., Malmqvist, J., Östlund, S., Brodeur, D.R., & Edström, K. (2011b). *Rethinking Engineering Education: The CDIO Approach*. Switzerland: Springer International Publishing.

Eye on Entrepreneurs (January, 2017). Retrieved from http://www.eyeonentrepreneurs.com/english

Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.

Hensel, R. (2010). The sixth sense in professional development: a study on the role of personality, attitudes and feedback concerning professional development. *Doctoral thesis*, TU Twente.

Kontio, J. (2010). Inspiring the Inner Entrepreneur in Students – A Case Study of Entrepreneurship Studies in Tuas. *Proceedings of the 6th International CDIO Conference*, Montréal.

Mäkimurto-Koivumaa S., Väänänen, M. & Belt, P. (2013). Developing Engineering Education to Support Entrepreneurial Behaviour. *Proceedings of the 9th International CDIO Conference*, Cambridge, Massachusetts.

Merriënboer, J. G., & Kirschner, P. A. (2012). *Ten Steps to Complex Learning: A Systematic Approach to Four-component Instructional Design*. Abingdon, UK: Taylor & Francis.

Norrman, C., Bienkowska, D., Moberg, M., & Frankelius, P. (2014). Innovative Methods for Entrepreneurship and Leadership Teaching in CDIO-Based Engineering Education. *Proceedings of the 10th International CDIO Conference*, Barcelona.

Kozlinska, I. (2016). *Evaluation of the Outcomes of Entrepreneurship Education Revisited* (Doctoral Thesis, University of Turku, Finland and University of Tartu, Estonia). Retrieved from https://www.doria.fi/handle/10024/129981

Sarasvathy S. D. (2008). *Effectuation, Elements of Entrepreneurial Expertise*. Cheltenham, UK: Edward Elgar.

BIOGRAPHICAL INFORMATION

Suzanne Hallenga-Brink, *M.Sc., M.Sc.* is Head of Industrial Design Engineering [Open] Innovator. She has a background in Industrial Design Engineering and Educational Sciences. She is also the process director of CDIO at all twelve programs of the Faculty of Technology, Innovation and Society. Her current research focuses on innovative, 21st century curriculum development and the teaching skill development needed for it.

Corresponding author

Suzanne C. Hallenga-Brink
The Hague University of Applied Sciences
Faculty Technology, Innovation and Society
Johanna Westerdijkplein 75,
2521EN The Hague, The Netherlands
+31 70 445 7717
s.c.hallenga-brink@hhs.nl