TRAINING THE STAFF – HOW TO DEVELOP PERSONAL AND INTERPERSONAL COMPETENCIES AT FACULTY LEVEL

Jane Flarup

Associate Professor, MA, GDBA, Head of the Business Engineering Studies, Department of Business Development and Technology (BTECH), Aarhus BSS, Aarhus University.

Helle Wivel

Associate Professor, M.Sc.Mech.Eng., e-MBA, Head of the Mechanical Engineering Studies, Aarhus School of Engineering (ASE), Science and Technology, Aarhus University.

ABSTRACT

This paper aims to complement two previous papers by the authors (Flarup & Wivel, 2013; Flarup, Wivel & Munk, 2017) about how to design process enablers to strengthen project work at the mechanical engineering studies. Joining the CDIO Initiative in 2010, it has been the management's strategic focus at ASE to apply the rationale at all levels. Starting with the students, we recognized – as a surprising finding – that our work during the past years has increased the students' general well-being and, at the same time, dramatically reduced the dropout rate of the study program. We then realized that we needed to train the trainers to strengthen this positive process. The purpose of this paper is thus to illustrate how we work and intend to work with the staff, especially on the mechanical engineering studies, in order to fulfill the intention of the CDIO rationale. This article adopts the theory of self-efficacy, collective efficacy, and well-being (Bandura), as the supervisors and student tutorial supervisors are important as role models for the students in the project work. The conclusion is that the trainers are highly important as change agents at the faculty level and that an increased focus on staff training is very useful in this cultural change of mindset and practice to a CDIO rationale. The article is related to CDIO standard 9 – Enhancement of Faculty Competence.

KEYWORDS

Well-being, self-efficacy, role model, project work, process enablers, coaching, supervision, dropout, retention, mechanical engineering, personal and interpersonal competencies, faculty competencies, standard 9.

INTRODUCTION

The phrase "personal and interpersonal skills" is mentioned in six out of twelve CDIO standards, and in a seventh, the phrase "social learning" is used. The CDIO framework focuses strongly on a new engineering profile which includes a more holistic view on the professional engineer. For the future, we need to develop, in the words of Professor Edward Crawley (MIT), "whole, mature, and thoughtful individuals" (Crawley, 2001, op.cit. Flarup & Wivel, 2013, p. 7).

In 2013, we wrote our first article about process enablers for strengthening project work (Flarup & Wivel, 2013). In that connection, we realized that grades or exams was not the most important parameter for the quality of the project work. Instead, we found that the students' well-being and social competencies in the team's collaboration process were

crucial for the quality of the report and the engineering solution and that this well-being was an influencing factor in a significant retention rate, especially at the 1st and 2nd semester. At that time, we did not know how fundamental this tendency was.

TACIT KNOWLEDGE

In the article, we concluded, “Personal and interpersonal skills are tacit knowledge, learned and performed by the student through social and professional relations” (Flarup & Wivel, 2013, p. 1).

The intention of this paper is to elucidate the following issues: how is this tacit knowledge transmitted to the students and by whom? How do the students learn tacit knowledge and how do they learn to behave and think as an engineer in order to be a full member of an engineering culture?

In the article, we describe activities that already take place and activities we intend to organize in order to implement the CDIO rationale at all levels. In short: how can tacit knowledge be explicated to the new students by older student colleagues, supervisors and teachers in the learning environment at the mechanical engineering study program? And how is this process of transmitting tacit knowledge attached to the staff’s and the students’ personal and interpersonal competencies?

The CDIO Syllabus

In the CDIO Syllabus (Crawley, 2001), we recognize that personal and interpersonal competencies are the basic skills for an engineer. The left side of the model below depicts professional skills with detailed descriptions, and the right side shows teamwork and communication, which are less defined and seem to derive from the professional skills.

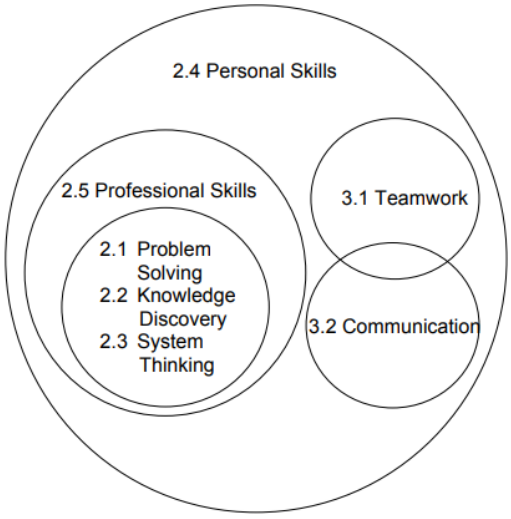

Figure 1: Venn diagram of the CDIO rationale (Crawley, 2001, p. 7).

As we mentioned in 2013 (p. 3), we found the description of personal and interpersonal competencies too vague:

> "[…] personal skills are an immanent competence for professional skills, teamwork skills and communication skills. But while the area of professional skills is well described in the model we assess that it is insufficient to define personal skills by just mentioning the other features. We think that the thinking underneath this model lacks specific terms of how to train the students' personal skills."

Over the years, the CDIO rationale has been extended with further specifications. In Crawley (2007), the model has been developed into the diagram below:

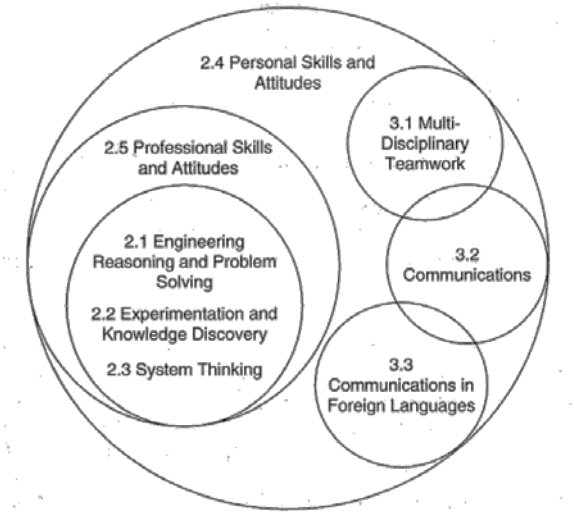

Figure 2: Venn diagram of the CDIO rationale (Crawley, 2007, p. 52).

Professor Crawley now defines personal skills and attitudes as social competencies in the learning environment, "*Interpersonal Skills* are a distinct subset of personal skills that divide into three overlapping subsets: *Multidisciplinary Teamwork* (3.1), *Communications* (3.2) and *Communications in Foreign Languages* (3.3)" (Crawley, 2007, p. 52).

In our second paper (Flarup et al., 2017), we demonstrate how we at the mechanical engineering study program since 2012 have trained students in these social skills by focusing on teamwork, communication, and project management. It is exactly by this combination of personal and interpersonal competencies that we see a dramatically reduced dropout rate on the first two semesters. The table below shows tools that stimulate the students' engineering skills and their psychological competencies. The tools and teaching are related to an overall approach to the student activities (from the beginning of their studies to their graduation) that is based on a human relations management four-phase framework (attraction, retention, development, dismissal/parting (Armstrong, 2008; Arthur, 1995).

	Tools	Processes	Teaching	HRM
1st semester	Psychometric test: Insights Discovery (see: www.insights.com). A work profile. Teams write a report to document the team work process.	Coaching of teams (two lessons per semester) according to the individual work profiles.	Introduction to Insights, including teaching in communication and perception (two lessons per semester).	Introduction to the engineering culture.
2nd semester	Conflict behavior test.	Coaching of teams (two lessons per semester). Focus on teamwork, project management tools, and conflict behavior.	Introduction to team theory, conflict theory, and collaboration theory (two lessons per semester).	Retention to the engineering culture and learning environment.
4th semester	Leadership test (e.g., Addize).	No coaching. If the team has problems, it is possible to ask for coaching (most often, the teams only need one extra coaching session (equal to two lessons)).	Introduction to organization theory, business life, professional behavior, and communication (two lessons).	Development of the individuals in the learning environment.
6th semester	In progress: the VIA character strengths – psychological test showing individual character strengths (see www.VIA.org).	Coaching in the use of tools if needed, e.g. project management tools, conflict management tools.	Introduction to career planning and individually organized project teams.	Adjourning phase.

Table 1: Tools for training the mechanical engineering students' personal and interpersonal competencies at ASE.

These activities are constantly refined in order to motivate all kinds of mechanical engineering students, despite their sometimes skeptical attitudes towards personal and social development, to participate more comprehensively. We conclude in the article, "we see an increase in the overall well-being of the students, and in general, they proactively tackle any collaboration issues of the teams and exhibit a higher motivation for engaging in social activities" (Flarup et al., 2017, p. 2).

SELF-EFFICACY

The concept of mastering a task is crucial for understanding our student and staff training program (Flarup et al., 2017). Based on Bandura's social cognitive theory of self-efficacy (1987, 1994), self-efficacy is the feeling of mastery.

There are four sources for developing personal self-efficacy:

1) An experience of being able to master life in general and a challenge in particular.

2) Influence from a role model – a teacher, a supervisor, a mentor, an older student, or someone you resemble and admire.

3) Influence from social persuasions, meaning that the role model or other sources of influence convinces you that you are able to master a situation or a challenge, for instance a study.

4) Positive emotions, meaning that the way you handle your feelings about your ability to master something is crucial for whether you are a success or a failure.

It is important to work with your positive and negative emotions about yourself, as these emotions are predictive for the result. Bad thinking makes things go bad, whereas positive thinking increases the chances of success (Baumeister et al., 2001). Training your positive emotional competencies makes you believe in yourself in any respect. The more you master your life in general and the more you believe in yourself, the higher the level of well-being and the stronger the feeling of inner motivation for performing well will be. Bandura's theory self-efficacy corresponds to the motivation theory of Deci and Ryan, which is also very important for understanding our activities. The motivation theory stresses that inner motivation is rooted in a person's feeling of autonomy and independence, but also a strong sense of kinship with other people and a feeling of mastery and competence (Deci & Ryan, 2000). This leads to the third basic element of our program: how to train the students' feeling of flow in team work. Flow is connected to a high feeling of individual and collective mastery and a high level of inner motivation (Csickszentmihalyi, 1989).

Based on research, we have earlier argued (Flarup et al., 2017) that university students who have high levels of general efficacy, positive emotions about themselves and high levels of well-being and inner motivation for studying have a much lower risk of dropping out of their studies – even in the face of overwhelming challenges – because general self-efficacy is linked to a greater sense of purpose in life. By contrast, students with lower general self-efficacy perceptions have a much higher risk of dropping out, even though they might get good grades in the exams or are very socially active in their study environment. The conclusion is that we train our students to achieve an improved sense of general self-efficacy, a positive attitude towards themselves and a general personal grit to resist challenges in the study and in their encounter with the engineering career and culture. The result is that the dropout rate of the mechanical engineering studies has fallen dramatically, especially on the first two semesters.

COLLECTIVE EFFICACY

For the mechanical engineering project student teams, it is very important to work with the team members' collective efficacy. Bandura (1987, p. 477) highlights that collective efficacy is based on the individual member's feeling of positive self-efficacy as described above. In order to enhance professional skills in project work, it is firstly important to train the individual to work together with other individuals in the team. Bandura defines collective efficacy as the team's perceived collective mastery of the project work, and this perception is more than the sum of the people and their competencies: it is the team's synergetic belief in itself. Other criteria for the well-functioning team are how well it is organized, how the team roles are distributed, and how well the team is run (management). The most influential factor for a high level of collective efficacy in a mechanical engineering team is an empathetic communication style that

encourages the members to commit to the work by drawing on their inner motivational resources as described theoretically above. Bad communication creates conflicts and demotivates the team members.

The team members' sense of doing well is crucial for the quality of the project work, and it is the fundamental issue when we design activities to enhance professional skills. The psychometric test profile, process reports, and team coaching are tools that are basically introduced at the mechanical engineering studies in order to train individual and collective efficacy. All teachers are offered an education in the psychometric test system, which is, as mentioned above, the basic tool in our understanding of good communication in team work. This leads to the question: how to train the trainers as role models in Bandura's understanding in order to fulfill the above-mentioned activities?

ROLE MODELS, MASTERY, AND PEER TRAINING

In mastering a task, the influence of a role model is very important. Since introducing the tools at the mechanical engineering studies, we have designed a program for the first two semesters that includes a central role model: a team coach. On the first semester, we have chosen a mechanical engineer (female), and on the second semester, there is a team coach who has a background in Human Relations Management and project management experience from the business life. The coaches have not been chosen randomly, as both are expected to instill trust in the students: for the new students a mechanical engineering coach is exactly what they need in order to feel safe in the new environment, imparting them with a sense of 'if she can do it, I can too'. On the second semester, the students feel more included in the engineering culture and focus on an engineering career. For this, we have chosen an HRM-trained coach, but it could be any kind of coach, depending on the issues we want to the coaching sessions to train.

Our next step in introducing the students to the engineering culture is to train the trainers to acquire a deeper understanding of the role they play in the students' success. The trainers are at several levels, as illustrated in the table below:

Trainer	**Task**	**Tools**
Teachers	Classroom teaching.	Cases, dialog based on teaching, lab work, peer discussions, exercises, tasks, e-learning. These teachers are professional role models.
Supervisors	Supervising project work in teams.	Engineering subjects, revising projects. The supervisor is a professional role model.
Three student tutorial supervisors per course – three lessons per tutor per week.	Individual training: teaching exercises, demonstrating engineering tools, helping with professional issues.	In class. Revising tasks and teaching subjects from the curriculum. The older students are peer role models.

Table 2: Three levels of trainers – teachers, supervisors and student tutorial supervisors, and their tasks and tools.

All staff at ASE is educated in the Insights Discovery work preference test tool, which ensures that there is a common language to understand colleagues and students. In addition, we intend to organize an onboarding team at the mechanical engineering studies for the new teachers and supervisors in order to introduce them to the learning environment and the CDIO rationale. This onboarding team could focus on three issues:

- Personal and interpersonal competencies: how and why we use the Insights Discovery preference test tool, how and why we teach in personal skills, and the relationship to the CDIO syllabus.
- Professional competencies: how we supervise project work in this learning environment related to the CDIO rationale.
- Strategic and organizational competencies: how and why we seek to strengthen supervising methods and teaching and the general relationship to the CDIO rationale.

The onboarding team also has the opportunity to invite new colleagues to attend the coaching and supervising sessions, and the new colleagues are free to invite experienced colleagues to observe their coaching and supervising project work in order to receive valuable peer feedback and to create more standardized supervision methods. One of our colleagues has filmed his project planning and work process in order to exchange ideas with his colleagues and to strengthen and standardize a supervision method at the mechanical engineering studies.

TEACHING – CONSULTING – SUPERVISION – INTERVISION

The organizational culture at ASE is generally hallmarked by a close relationship between students and teachers. Even though we have classes of 100 or more students, the culture is characterized by a flat organizational structure and an open and informal communication style, which is a significant trait of the Scandinavian culture (Hofstede, 1993). For us, teaching, supervising, tutoring, and discussing are seen as ways of coaching (Loew, 2009, p. 39), and by doing so, coaching is represented in the following model as several steps in the space between giving answers and asking questions depending on the situation:

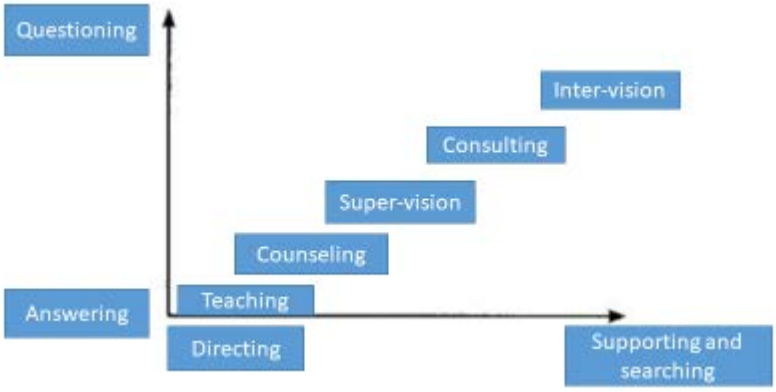

Figure 3: The teaching, counseling, supervision, consulting, and inter vision positions in project work. Team coaching can be viewed as a more consulting or inter visionary way of teaching (Loew, 2009, our adaptation and translation).

The scale demonstrates several positions for the teacher in the classroom and the supervisor in the project work. Teaching in the classroom will take a more directing and instructive position in contrast to supervision of a project work (super in Latin means ‘over’), which includes a more searching position in interaction with the students. Supervision or guidance

of project work will assume a more counseling form, whereas team coaching includes a more personal and interpersonal supportive attitude that relies on a mutual, equal, and inter-visionary (inter in Latin means 'between') position, as the students are experts on their own lives and the coaching sessions aim to elicit the teams' strengths and weaknesses (Cooperrider et al, 2008; Kauffman, 2006).

Student tutorial supervisors are seen as possible coaches for the new students, and we intend to do more training of older students in personal and interpersonal skills as a part of the onboarding team activities. This student tutorial activity will be organized as six months of supervision of the tutors, after which they will receive a diploma with details about the content of this training in professional teaching, supervising, and coaching in personal and interpersonal competencies.

This leads to a discussion of the symmetric and asymmetric roles in the relationship between students and teachers, supervisors and tutors. In other words: why can't teachers be personal and interpersonal coaches for the student teams?

ASYMMETRIC AND SYMMETRIC RELATIONSHIPS

In general, the mechanical engineering students increasingly expect their teachers to change their attitude and supervise in the language of the psychometric personal work profile. The students prefer supervisors who demonstrate empathetic competencies and are willing to enter into a more supportive and personal relationship with the teams. Research has shown that the better the relationship between supervisor and teacher, the higher the quality of the students' learning (Hattie & Yates, 2014).

On the other hand, research in leadership and coaching shows that an equal relationship between employee and coach (in this case, student and teacher) is problematic because of power imbalances (Hersey & Blanchard, 1982). The question is: will the students open up about personal and interpersonal issues to the coach when he or she is the one who evaluates the team and gives grades?

Another challenge is the roles of the teacher as supervisor and coach in project work counseling. This dual role can destabilize his or her role as an expert, because coaching includes questions and a mutual relationship in contrast to the supervising role, which is based on professional expertise and the act of giving answers.

Research about coaching in leadership and the asymmetric relationship is well-known. The famous model of Hersey and Blanchard demonstrates that the manager and leader can use different styles in managing the staff according to the person's maturity (a combination of motivation and competencies). The model is shown below:

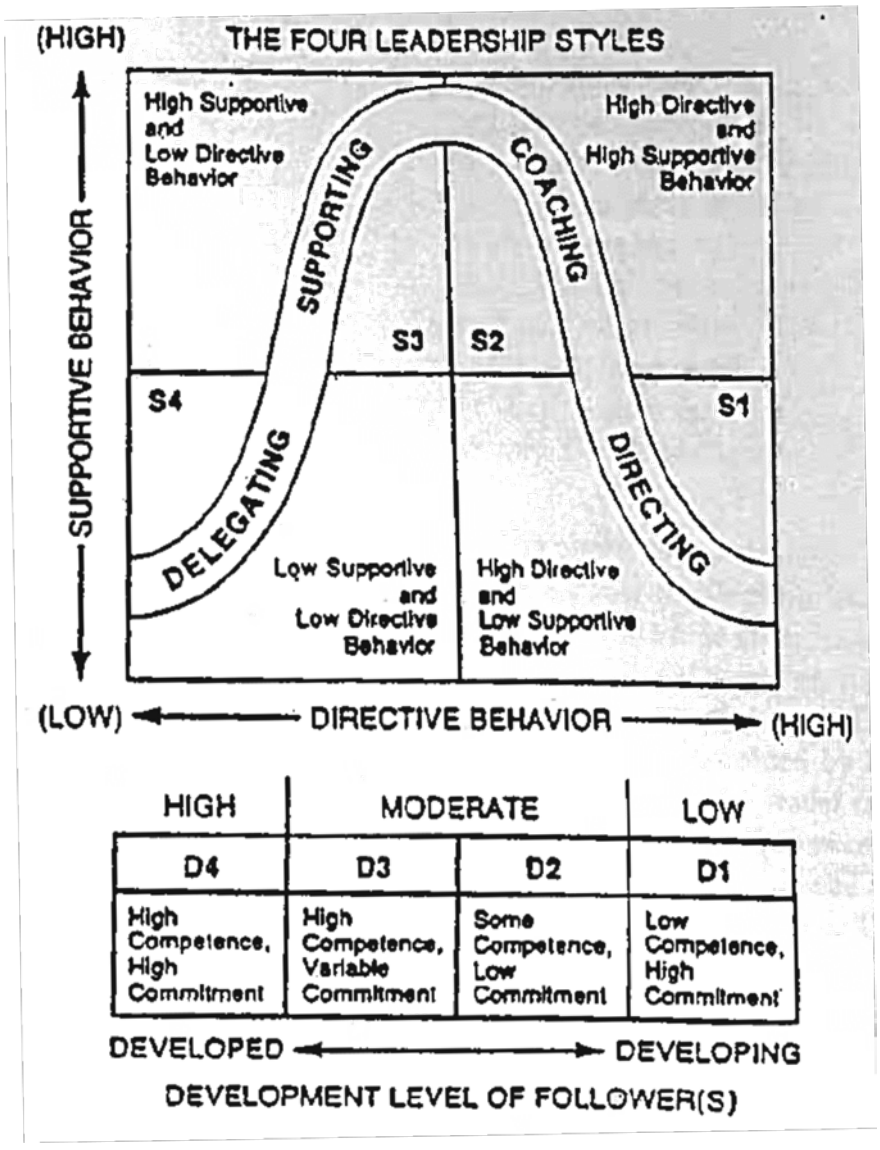

Figure 4: Hersey and Blanchard (1982): situational leadership.

The model illustrates that a coaching leadership style (S2) refers to an employee (in this case, the student) with some experience and low commitment. A teacher in the classroom has a more directive attitude, which refers to the first style (S1). The dynamic of the model is that the leader (in this case, the teacher or supervisor) develops the person's professional skills by a combination of directive and supportive behavior to a high competence level and a high commitment level.

This leads us to conclude that training the teacher and supervisor to use coaching tools (a questioning style) on professional topics will stimulate the students' feeling of motivation, mastery, and positive emotions about their competencies. Whereas coaching in personal and interpersonal issues has to be reserved for a neutral person, for instance an older student or an external coach.

To sum up, we train the trainers as change agents on several levels:

Onboarding team	New colleagues – training program.
Exchange forum	Discussion forum for the staff about professional (and interpersonal) topics.
Insights Discovery preference profile	All staff is tested, some are educated in using the test tool. A common supportive language for the mechanical engineering studies.
Supervision of older students	Junior colleagues – training in personal, interpersonal, and professional issues.

Table 3: Train the trainer activities at the mechanical engineering studies. Trainers as cultural change agents in the mechanical engineering environment.

CONCLUDING REMARKS – ARE WE ENCOUNTERING A NEW CULTURE?

As we have demonstrated above and in our former papers (Flarup & Wivel, 2013; Flarup et al., 2017), the psychometric work profile test tool, the team coaching sessions, including tools and models, and the process report indicate that the level of self-reflection on part of the student teams as to their personal and interpersonal development is very high. This corresponds to the self-efficacy theory, which defines well-being as a feeling of mastering the situation professionally and personally. The theory shows that the guidance of a trustworthy role model aiming to strengthen efficacy is necessary for students to improve their positive view on their skills and motivate them for the work. Albert Bandura, the father of the theory of self-efficacy, points out that strengthening learning environments in order to train the students' ability to feel mastery and personal emotions is of crucial importance for the students in enduring challenges in the study environment and in their future careers as mechanical engineers. For the teams, the feeling of synergetic and collective efficacy is key to deliver high-quality project reports of importance for the society.

This is exactly the purpose of widespread activities at the mechanical engineering studies, beginning with the team coaching sessions headed by an engineer on the 1st semester, an HRM coach on the 2nd semester, student tutorial supervisors assigned to all courses, and finally, the teachers functioning as supervisors of the project work and in the classroom teaching. All are role models for the students, and by their common language as engineers and in respect of the issues of personal and interpersonal skills (e.g., by using the Insights Discovery preference tool), the new students are included in the modern engineering culture as "whole, mature, and thoughtful individuals" (Crawley, op. cit.; Flarup & Wivel, 2013, p. 7). The HRM four-phase framework outlines a general understanding of the path into the culture for every single student as well as the milestones for the staff and teachers. By that, we have noticed a dramatically reduced dropout rate on the first two semesters, and we hope that the coming activities will reduce the dropout rate for the later semesters as well.

The Head of the Mechanical Engineering Study program observes a new engineering culture at ASE, which has developed since the introduction of the CDIO rationale. This emerging culture includes both the students and the faculty competencies as change agents, which the CDIO framework aims at. She summarizes:

"Slowly, a new culture has emerged. It is different than six years ago. The students are met at eye level; we see them, we listen to them, and we try to understand them. They have become much more open – it is ok for them to say that something isn't working and that their feelings matter. They are better equipped at handling social anxiety, and they have great

empathy for each other. Their behavior seems more personally and professionally competent."

REFERENCES

Armstrong, M. (2008). *Strategic Human Resource Management: A guide to action.* Kogan Page.

Arthur, D. (1995) *Human Resource Management in Small and Mid-Sized Companies.* New York: Amacom.

Bandura, A. (1987). *Self-Efficacy. The Exercise of Control.* NY: W.H. Freeman and Company.

Bandura, A. (1994/1998). Self-Efficacy. In V.S. Ramachandran (Ed.), *Encyclopedia of Human Behavior.* Vol. 4 (pp. 71-81). NY: Academic Press.

Baumeister, R.F., Bratslavsky, E., Finkenauer, C. & Vohs, K.D. (2001). Bad Is Stronger Than Good. *Review of General Psychology.* Vol. 5(4).

Cooperrider, D., Fry, R., Stavros & Whitney, D. (2008). Berrett-Koehler.

Csickszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience.* NY: Harper & Row.

Crawley, E. M. (2001). *The CDIO Syllabus. A Statement of Goals for Undergraduate Engineering Education*. http://www.cdio.org.

Crawley, E. M., J., Ôstlund, S., Brodeur, D. (2007). *Rethinking Engineering Education. The CDIO Approach.* New York, NY 10013, USA: Springer Science+Business media, LLC.

Deci, R.M. & Ryan, E.L. (2000). The 'what' and 'why' of goal pursuits: Human needs for understanding motivation in the workplace. In M. Gagne (Ed.). *The Oxford Handbook of Work Engagement, Motivation, and Self-Determination Theory.* Oxford University Press.

Flarup, J. and Wivel, H. (2013). Designing Process Enablers to Strengthen Engineering Reasoning and Problem Solving. *Conference Paper. CDIO 9th International Conference.* MIT/Harvard. Boston, June.

Flarup, Munk, C. & Wivel, H. (2017). Designing Process Enablers to Strengthen Personal Skills in Project Work 2.0. *Conference paper. CDIO 13th International Conference*. Calgary University, June.

Hattie, J. & Yates, C.G.R. (2014). *Visible Learning and the Science of How We Learn.* Routledge.

Hersey, P. & Blanchard, K.H. (1982). *Situational Leadership. In Management of Organizational Behavior.* Prentice Hall.

Hofstede, G. (1993). Cultural Constraints in Management Theories. *The Executive.* Vol. 7.

Kauffman, C. (2006). Positive Psychology: The Science of the Heart of Coaching. In D.R. Stober & A.M. Grant (Ed.). *Evidence Based Coaching Handbook: Putting Best Practices to Work for Your Clients.* Hoboken, NJ: Wiley.

Knoop, H. H. (2016). The Eudemonics of Education. Vittersø, J. (Ed.) (2016). *Handbook of Eudaimonic Wellbeing*. Dordrecht: Springer.

Loew, O. (2009). *Pædagogisk vejledning. Facilitering af læring I pædagogiske kontekster*. Akademisk Forlag.

BIOGRAPHICAL INFORMATION

Jane Flarup, MA, GDBA (jfl@btech.au.dk). She is an Associate Professor and the Head of the Business Engineering Studies at Aarhus University, Denmark. She holds a Master of Arts and Communication, a Master of Positive Psychology (MoPP, exp. June 2018), and a GDBA. She is a member of the MBIT research group at the Department of Business Development and Technology, Aarhus University. Together with Helle Wivel, she is the author of a CDIO conference paper (2013), and together with Helle Wivel and Christina Munk, she is the author of a CDIO conference paper (2017). She continues to conduct research on this topic together with Helle Wivel. She is team coach and coordinator of the personal and interpersonal activities at the Aarhus School of Engineering.

Helle Wivel is an Associate Professor, M.Sc.Mech.Eng (hwi@ase.au.dk). She holds a Master of Mechanical Engineering and an e-MBA, and is the Head of the Mechanical Engineering Studies at Aarhus University, Denmark. Together with Jane Flarup, she is the author of a CDIO conference paper (2013), and together with Jane Flarup and Christina Munk, she is the author of a CDIO conference paper (2017). She continues to conduct research on this topic together with Jane Flarup.

Corresponding authors
Associate Professor, Head of Business Engineering Studies
Jane Flarup
Aarhus School of Engineering, ASE
10, Inge Lehmannsgade
8000 Aarhus C
Denmark
jfl@btech.au.dk

Associate Professor, Head of the Mechanical Engineering Studies
Helle Wivel
Aarhus School of Engineering, ASE
10, Inge Lehmanns gade
8000 Aarhus C
Denmark
hwi@ase.au.dk