The impact of positive change in higher education

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ABSTRACT: In order to enhance the student experience and, ultimately, student success, there have been many calls for *positive change* in the quality of undergraduate education. These changes are being asked for at a time when universities are facing financial, and other, challenges. In this article, the authors examine how positive change can be achieved in undergraduate engineering programmes. Three stages are identified in the change process: initiating (Why is change important?); implementing (How to achieve change?); and sustaining (What are the elements of successful change?). High impact practices are identified as important components of quality undergraduate education (the How?). In examining elements for successful change, two approaches are discussed, the *change equation* and *appreciative inquiry*. The *change equation* starts with dissatisfaction as the Why? identifies what is wrong. *Appreciative inquiry* begins with discovery; it identifies processes that work well now. Through appreciative inquiry, there is an acknowledgement that new conditions exist that require change, but that any change must be consistent with the best of the old.

INTRODUCTION

Continuous change and the increasing complexity of challenges facing today's society, require universities to adapt and to enhance the quality of teaching and learning. As stated by different researchers, there is a need for *positive change* in the quality of undergraduate education [1-3].

The pressing issue for engineering undergraduate education is not whether the change is required, but how to support and manage the change in a continuously changing environment.

Universities and higher education institutions play the main role to shape, connect and educate students, so that graduates are ready to contribute to society. Meanwhile, they should be able to adapt their curricula depending on the circumstances and requirements of the society in order to create *a strong, vibrant and relevant higher education sector for the 21st Century* [4].

By analogy, one can look to today's manufacturing environment, where the development and implementation of changeable and reconfigurable manufacturing systems was essential in order to manage and capitalise on increasing market volatility and product variety [5].

In a similar manner, higher education should allow for a flexible and reconfigurable curriculum, with teaching and learning modules designed to better prepare the graduates for the *volatile nature of change in our world* [4]. In fact, we are all learners, and as noted by Hoffer:

> *In a time for drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists* [6].

The article examines how positive change can be achieved across the engineering curriculum. The proposed model identifies three stages that need to be considered concurrently in the process of positive change: initiating, implementing and sustaining change within engineering departments:

- The purpose: initiating change - *Why* is change important to engineering undergraduate education?
- The process: implementing change - *How* to achieve change in engineering undergraduate education?
- The result: sustaining change - *What* are the elements for successful change?

This approach follows the naturally occurring pattern that Sinek calls *the golden circle* [7], shown in Figure 1.

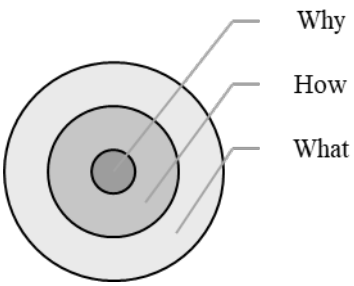

Figure 1: The golden circle.

WHY IS CHANGE IMPORTANT TO ENGINEERING EDUCATION

Change is not an easy process, but it is a necessary process, if the goal is to achieve exceptional undergraduate education that meets the need of a continuously changing environment. This idea is reflected in a quote that is often attributed to Winston Churchill, but was, in fact, originally put forward by Newman:

> *To live is to change; and to change often is to become more perfect* [8].

As a result, institutions involved in engineering education are engaged and collaborate in order to make changes in teaching and learning that enhance the quality of undergraduate education. The reasons for change are different for each institution [9]. The ones that are more common are:

- Better student performance;
- Recruiting more/better students;
- More cooperation with industry;
- Better learning environment;
- Economic considerations.

Graff and Kolmos also reported that across the globe, the shift to project and problem-based learning was caused by motivation to stimulate learning and decrease drop-out rates [10].

All universities want to ensure their engineering programmes are relevant to the 21st Century, and to establish or maintain an international reputation for high quality undergraduate education. As noted by Riddell in a recent article:

> *…we have the curiosity, creativity and capacities for collaboration that can help us build the next generation's capacity to impact positive change* [1].

HOW TO ACHIEVE CHANGE IN ENGINEERING UNDERGRADUATE EDUCATION

It is important to examine both how this change can be successfully implemented, and how one knows that there has been a successful overall implementation. To make the change effort successful, Kotter has proposed an enhanced 8-step process for leading change, known as 8 accelerators [11]. The steps of the process are shown in Figure 2.

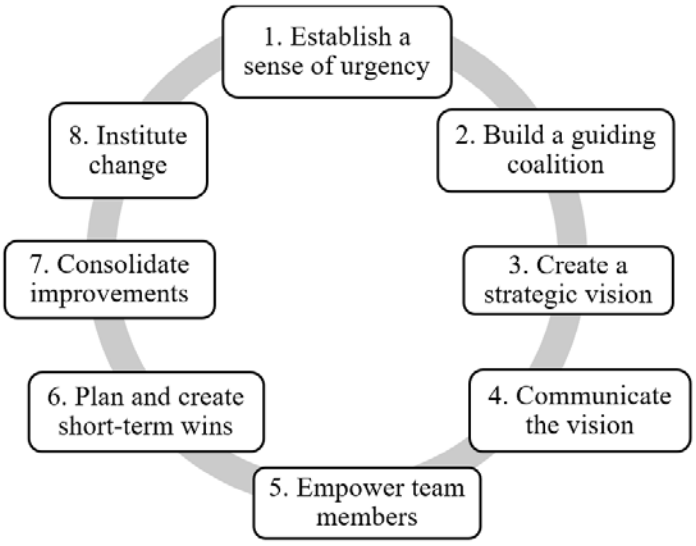

Figure 2: The 8-step process to accelerate change.

Several authors argue that change cannot be managed, but a change and improvement process can be led through ongoing learning, continuous growth and development [11][12]. For example, Clemmer states that:

> *Change can't be managed. Change can be ignored, resisted, responded to, capitalized upon, and created. But it can't be managed and made to march to some orderly step-by-step process* [12].

Factors that Influence the Quality of Undergraduate Education

How to make change happen in the environment of deeper financial cuts in the context of student-centred education? How to ensure a better quality of higher education?

Formulating a clear vision will help everyone involved in the process of change to understand what the organisation is trying to achieve. Linking the adopted vision to strategies will help both instructors and students to achieve their goals.

When designing the strategies that need to be implemented, staff across the university will have to consider many factors that may influence the quality of undergraduate education, as summarised in Table 1.

Table 1: Factors affecting the quality of undergraduate education.

Physical	Functional	Environmental	Economic	Legal
• Room design/ learning environment • Class size	• Curriculum design • Contact hours	• Diversity of student population • Diversity in delivery methods	• Limits on budget allocation • Cooperation with industry • Graduates' employability	• Governmental requirements/ strategic mandate agreement • Institutional quality assurance process requirements

What Does Quality Undergraduate Education Look Like?

A culture of continuous innovation and quality improvement is needed to ensure both the academic success in university and expected post-graduation outcomes in engineering practice. According to Kuh, high impact practices are techniques and designs for teaching and learning that have proven to be beneficial for student engagement, successful learning and retention among students from many backgrounds [13]. Riddel also mentioned that *high-impact practices are widely accepted features of quality undergraduate education* [1].

These high-impact practices include [1][13][14]:

- First year seminars and experiences.
- Undergraduate research.
- Building common intellectual experiences.
- Writing-intensive courses.
- Collaborative assignments and projects.
- Undergraduate research: working with a faculty member.
- Diversity/global learning.
- Service learning/community-based learning: activities designed as experiential learning opportunities to involve students in solving real world open-ended problems.
- Internship, co-operation.
- Capstone experience.
- ePortfolios - normally considered as a culminating senior experience, but it can also be implemented at the first year level to enable students to reflect upon their personal and academic growth.

It has been indicated that high impact practices are, for the most part, *resource-intensive initiatives* [1]. Here are a few examples:

- Writing-intensive courses - require small classes.
- Common intellectual experiences: working with a faculty member on a research project requires supervision and training.
- Service learning - involves logistical support and interaction between students, faculty and community members.

As a result, it may be possible that not all high impact practices are implemented in undergraduate programmes at every institution across the country, because of the limits in budgetary allocations. As part of the institutional approach to innovation in teaching and learning excellence, and in an effort to improve students' teaching and learning experience, high impact curricular practices have been implemented in undergraduate programmes at the University of Windsor, Windsor, Canada [14]. Design thinking was used as a human-centred, open-ended problem-based approach to solve the challenges associated with the implementation of high-impact practices in the context of outcome-based curriculum.

Instructors, when reflecting on what and how they teach, must encourage curiosity and creativity [15][16], and enhance intellectual dexterity. There are different opinions regarding the relationship between the class size and the instructor's capability to engage students and stimulate teaching and learning.

Riddell is a firm believer that …*one can model curiosity, courage and generosity of spirit in a class of 600 students just as you can in class of 20* [1].

The authors of this article argue that …*large class sizes have a direct relationship on how the instructor's objective to create an engaging and stimulating teaching and learning environment are served*, since there is less direct communication between the students and instructor [14].

Several initiatives have been implemented to address student engagement through active learning and as a result to support creativity and the creative process in large engineering design classes at the University of Windsor, including:

- Classroom design: user-centred classroom design that facilitates student engagement, collaboration, and active learning through problem-based and project-based assignments;
- Group work: students work in groups and are encouraged to develop personal, teamwork, leadership and task completion skills;
- Flipped teaching: the instructor frees up more of class time to engage students in active learning, and the students are using class time to deepen their understanding and improve their skills [15].

WHAT ARE THE ELEMENTS FOR SUCCESSFUL CHANGE?

Each university has its own identity, attracting students from different backgrounds. In addition, each university and engineering department has designed an outcome-based curriculum, to produce graduates with a specific set of attributes and knowledge to suit the job market. Any changes can have an effect on all participants including instructors, students and industry. Robertson et al indicated that:

> *To effect systematic change in higher education requires a sophisticated blend of management, collegiality and simple hard work over a prolonged period of time* [17].

To implement the strategies for change, departments across the university need to become fully engaged, and to commit to the significant amount of work involved in the process. Instructors are directly responsible for the implementation of high impact practices, and as a result, for the design of their outcome-based curriculum accordingly. They are responsible for initiating, implementing and sustaining change within engineering departments. Sir Ken Robinson emphasised that *good teachers know that their role is to engage and inspire their students* [18].

The change equation was first developed by Beckhard and Harris [19], attributed by them to Gleicher, and subsequently modified by Dannemiller and Jacobs [20]. This simple equation indicates how to engage individuals at all stages of the change process in order to achieve successful organisational change. The change equation states that in order for change to occur, the product of dissatisfaction with the *status quo* (D), a clear vision (V) and first steps towards the vision (F) must be greater than the resistance to change (R):

$$D \times V \times F > R \quad (1)$$

In other words, if any of dissatisfaction (D), vision (V) and first steps (F) is low or absent, the product result will be low and will indicate that resistance to change will dominate. As a result, the product of the left three variables must be convincing and powerful enough to exceed the resistance to change and make change possible: dissatisfaction (D) with the present situation, a vision (V) of what is possible in the future and the achievable first steps (F) for implementation.

- D - Dissatisfaction is the *Why* or the motivational factor in the formula.
- V - Vision is the *How* factor of the formula.
- F - First steps is the *What*.

A new paradigm in organisational change is the *appreciative inquiry* (AI) [3][21]. Instead of assessing and evaluating a situation, and then proposing solutions based on a deficiency model, predominantly asking questions, such as *What are the problems?* or *What is wrong?*, the AI method shifts attention on what works, the positive core and on what people really care about. This model suggests a 4-D cycle iterative process for approaching change, as shown in Figure 3.

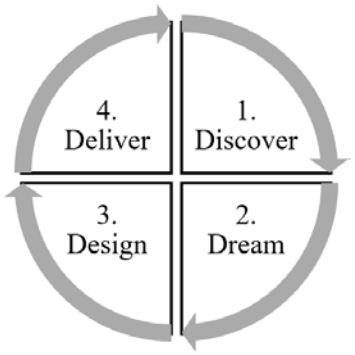

Figure 3: Appreciative inquiry model.

In Table 2, one can notice the comparison between the *change equation* and *appreciative inquiry* models. The change equation builds on d*issatisfaction*, whereas appreciative inquiry (AI) develops the best of what already exists.

Table 2: Comparison between two models to achieve change.

	The change equation	Appreciative inquiry
Why	Dissatisfaction: Identify what is wrong	Discover: Identify processes that work well now
How	Vision: Envision what is possible in the future	Dream: Envision processes that would work well in the future
What	First steps: Planning achievable first steps towards reaching the vision	Design: Planning and prioritising processes that would work well
	Deliver	

How Do We Know that There has been a Successful Overall Implementation?

The high impact learning associated with the implementation of high impact practices can be viewed from a lens of effectivity; namely, effective learning. From the students' perspective, effective can be described by the following question:

> *What does the student use, creatively develop and apply in practice and, then, at the end, use in a successful profession?* [22]

In a quest to make higher education *a more creative place* [23], Jackson suggests an answer to the above question:

> *We live in a complicated and messy world in which work for most of our graduates is a continuous stream of* problems *that have no simple or unique solutions. Being able to work creatively will help your students survive and thrive in this world and help them lead more satisfying and meaningful lives* [24].

It is the authors' opinion that both teaching and learning should be done creatively [15]. As a result, student experience is improved, and the teaching moments become more enjoyable and trigger the instructor's enthusiasm in the process.

CONCLUSIONS

In this article, the authors emphasise that change cannot be managed, but the improvement process can be led and the key is ongoing learning. It is shown *Why* positive change is important to engineering undergraduate education; *How* to achieve change in engineering undergraduate education; and *What* are the elements for successful change.

In looking at how to achieve change, the *appreciative inquiry* approach, which identifies and builds on processes that work well now, seems to have much to recommend it. As eloquently put by Rosenzweig:

> *It seems to me, however, that the most sensible way to confront the changes I have described is to view them simply as a new condition for which we must account, even as we try to shape the new circumstances in ways that are consistent with the best of the old. It does no good to rail against the flood, but it may help a lot to be sure that the riverbank is reinforced with sandbags* [25].

The associated problems and proposed actions to improve students experience in the context of a continuously changing world by implementing high-impact practices are addressed and discussed in this article.

REFERENCES

1. Riddell, J., We need to have a candid conversation about quality undergraduate education. *University Affairs*, 60, **7**, 45 (2019).
2. Brown, S., Bringing about positive change in the higher education student experience: a case study. *Quality Assurance in Educ.*, 19, **3**, 195-207 (2011).
3. He, Y. and Oxendine, S.D., Leading positive change in higher education through appreciative enquiry: a phenomenological exploration of the strategic planning process. *J. of Higher Educ. Policy and Manage.*, 41, **3**, 219-232 (2019)
4. The Permeable University: the Purpose Of Universities in the 21st Century: a Manifesto (25 November, 2019), 15 February 2020, https://cpb-euw2.wpmucdn.com/blogs.lincoln.ac.uk/dist/9/8300/files/2019/11/J22424_UNIL_21st-Century-Lab_Publication_Web-Version.pdf
5. Anderson, A.L., Brunoe, T.D. and Nielsen, K., Engineering education in changeable and reconfigurable manufacturing: using problem-based learning in a learning factory environment. *Proc. CIRP Conf. on Manufacturing Systems*, 81, 7-12 (2019).
6. Eric Hoffer Quotes, 29 February 2020, https://www.quotes.net/quote/42914
7. Sinek, S., *Start with why: How Great Leaders Inspire Everyone to take Action*. New York: Portfolio (2009).
8. Newman, J.H.C., *An Essay on the Development of Christian Doctrine*. London, UK: Longmans, Green and Co. (1909).
9. Moesby, E., The process towards implementing PBL (edited version). *Reflections on PBL Newsletter*, **1**, A Republic Polytechnic Publication (2002).
10. de Graaff, E. and Kolmos, A., *Management of Change: Implementation of Problem-based and Project-based Learning in Engineering*. Rotterdam: Sense Publishers (2007).
11. Kotter, J.P., *Accelerate: Building Strategic Agility for a Faster-moving World*. Brighton, Massachusetts, USA: Harvard Business Review Press (2014).
12. Clemmer, J., Change management deciphering the oxymoron. *HR Professional*, 24, **3**, 70 (2007).
13. Kuh, G.D., High-impact Educational Practices: what they are, who has Access to them, and why they Matter. Association of American Colleges and Universities (AAC&U), Washington, D.C. (2008).
14. Pusca, D. and Northwood, D.O., Implementation of high-impact practices in engineering education. *World Trans. on Engng. and Technol. Educ.*, 16, **2**, 108-114 (2018).
15. Pusca, D. and Northwood, D.O., Curiosity, creativity and engineering education. *Global J. of Engng. Educ.*, 20, **3**, 152-158 (2018).
16. Avsec, S., Investigation into design thinking in mechanical engineering students. *World Trans. on Engng. and Technol. Educ.*, 18, **2**, 91-96 (2020).
17. Robertson, C., Robins, A. and Cox, R., Co-constructing an academic community ethos - challenging culture and managing change in higher education: a case study undertaken over two years. *Manage. in Educ.*, 23, **1**, 32-40 (2009).
18. Robinson, K., *Out of Our Minds - the Power of being Creative.* (3rd Edn), Chichester, UK: Capstone Publishing (2017).
19. Beckhard, R. and Harris, R.T., *Organizational Transitions: Managing Complex Change*. (2nd Edn), Reading, MA., USA: Addison-Wesley Publishing (1987).
20. Dannemiller, K.D. and Jacobs, R.W., Changing the way organizations change: a revolution of common sense. *The J. of Applied Behavioral Science*, 28, **4**, 480-498 (1992).
21. Cooperrider, D.L. and Whitney, D., *A Positive Revolution in Change*. In: Cooperrider, D.L., Sorenson, P., Whitney, D. and Yeager, T. (Eds), Appreciative Inquiry: an Emerging Direction for Organization Development. Champaign, IL: Stipes, 9-29 (2001)
22. Fox, M.F., Publication productivity among scientists: a critical review. *Social Studies of Science*, 13, 285-305 (1983).
23. Jackson, N.J., Making higher education a more creative place. *J. for the Enhancement of Learning and Teaching*, 2, **1**, 14-25 (2005).
24. Jackson, N.J., Designing for Creativity: a Curriculum Guide (2002), 14 February 2020, http://complexworld.pbwiki.com/Creativity
25. Rosenzweig, R.M., The permeable university: academic life in the age of special interests. *Interchange*, 25, **1**, 11-17 (1994).