

Title: Co-Creating for Resilience – Development of Transdisciplinary Skills and Competencies in higher education.

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This paper presents the co-creation of a University-wide Open Educational Resource (OER) on Transdisciplinary Skills and Competencies for enhancing graduate employment with the necessary knowledge, values, and attitudes for building a more resilient workforce in an increasingly uncertain future. The four Key Pillars underlying education and life from the highly influential, and increasingly relevant, Delor's report (1996) underpinned the development of future-thinking stances for the first-year students as they engaged with learning activities that enabled them to:

1. Learn to know: Investigate their own learning and courses with more agency and depth through metacognitive strategies.
2. Learn to do: Relate theoretical knowledge to more relevant, practical, transdisciplinary applications through collaboration on working towards solution-oriented and challenge-based learning.
3. Learn to live together: This entails the cross-fertilization and respect of each-others' ideas to bring about innovation through a learning environment that is conducive for thriving together.
4. Learning to be: Developing the human potential to its fullest, especially the skills, competencies and attitudes required to work in an increasingly connected world with greater responsibility for the attainment of common goals.

The objective of the action research was to co-create the OER with the input of both academics and students from different faculties. The collaboratively designed learning activities were adapted to different disciplines and educational contexts to enable learners to be assessed for four main value-laden skills and competencies:

- a) **Collaborative Networking** (comprising Cultural awareness, Acknowledging differences, Personal branding, Team playing and trust building, Virtuous circles)
- b) **Communication Networking** (comprising Social and Emotional Intelligence, Technology-enhanced Communications, verbal and non-verbal communication, conflict management)
- c) **Growth Mindsets** (comprising Solution Orientedness, Grit and determination, Opportunity seeking, creative and critical thinking, design thinking)
- d) **Professional and Ethical Practices** (comprising case studies and role plays to demonstrate Social responsibility, Sustainable development, Managing ethical dilemmas and transformational leadership)

9 faculty members and their respective students formed part of the action research and while co-creation is perhaps too innovative and disruptive for certain academics, the students were appreciative of the opportunity of having a voice and participating in the co-creation of the learning activities that would develop their full potential. This study demonstrates the need for engaging with learners so that they are aware of the active role they play in the learning environment and to build resilience and self-efficacy from within.

Introduction

Resilience is a key concept of our times, especially in a small island developing state context where environmental hazards and climate change, remoteness and vulnerability to health, energy and economic shocks require that we develop a more competent, resourceful, future-oriented and highly adaptable workforce. In the current volatile world we are living in, universities should be equipping graduates to flexibly adjust their own choices and lifelong learning paths and develop skills and competencies for a productive future workforce. However, it has been noted that the skills gap is widening - Tandranyen (2020, p95) reports that the main cause of skills mismatch put forward by stakeholders in Mauritius is "a misalignment between university/educational institution curricula and industry requirements that is a disconnect between the education system of the country and the needs of the economy". How do we then ensure more coherence, relevance and consistency in our university programme offerings? Freeman and Hawkins (2016) suggest that students need to believe that they are part of creating the solutions for tackling grand challenges, creating employment for themselves, and this is how we come to the next key concept: Co-creation. Co-creation is a rapidly expanding and powerful notion: that of empowering stakeholders in a conceptual or problem-solving process as co-designers. In the higher education domain, this implicates students, potential employers, industry, public and private sector, research centres, etc.. along with university academics to work together to design more meaningful teaching and learning experiences. This strategy to bring the students to play a central role in their education can not only

empower them towards taking ownership of the knowledge creation process, but also enhance their skills and creativity and provide greater agency for understanding the challenges ahead, act more responsibly and innovatively, with value-laden principles, and thus build more resilient futures. While it is beyond the scope of this paper to consider all disciplines at the University of Mauritius, we have attempted to bring students and academics from different faculties together to provide their understanding, contributions, and constructive criticisms on a module on Transdisciplinary Skills and Competencies. The aim of this paper is to present the pedagogical design for the activities of this module and their relevance for SIDS university students to exercise agency and build resilience for their future within contexts of health pandemics and world unrest. We expect that this study can provide academics with a useful and transformative open educational resource for developing 21st century skills that they can adapt to their own contexts, but also a methodology for co-creation with their students.

Philosophical Stance: The 4 pillars of learning

The design of the Transdisciplinary Skills and Competencies was inspired by the Delors Report which was prepared for UNESCO in 1996 – “Learning: The treasure within”. The report provided an insight into the still relevant societal challenges of globalization, knowledge societies, inclusion, social cohesion, and democratic participation (Tawil & Cougoureux, 2013). The four pillars of learning (Learning to be, Learning to do, Learning to know, and Learning to live together) underpinned the development of learning activities for the module on Transdisciplinary Skills and Competencies. From these four pillars, we also embedded concepts of sustainability and “greening” of skills, and how to translate this utopian vision into practice.

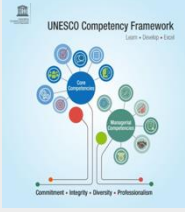




1. Learn to be: Becoming a better version of oneself and developing the human potential to its fullest, this construct was interpreted as looking inwards to acquire and cultivate skills and attitudes required to work in an increasingly connected world with greater responsibility for the attainment of social justice and common goals. This also requires an awareness of inherent biases that cause us to take hasty decisions which could be detrimental and contrary to our values.
2. Learn to know: Investigating all types of learning opportunities with more agency and depth through metacognitive strategies (reflection, self-questioning, self-awareness, regulation, design thinking).
3. Learn to do: Relating theoretical knowledge to more relevant, practical, transdisciplinary applications through collaboration on working towards solution-oriented, and challenge-based learning.
4. Learn to live together: This entailed the respect, engagement, cross-fertilization and thriving of each-others’ ideas to bring about innovation and sustainability within diverse and complex learning environments.

Also McGregor (2017) proposes transdisciplinary higher education pedagogies that can enable graduates to become more skilled at reflecting on and connecting data, concepts and real-world items, the activities of the problem-solving system/community, and their modes of participation and inquiry. As the future cannot be tackled from a mono-discipline point of view, having a transdisciplinary perspective is of utmost importance for sustainable and inclusive development (Di Giulo & Defila, 2017). It makes much more sense, as Galafassi et al. (2018) have found, to have an “open and engaging transdisciplinary processes with large and diverse populations aimed at sharing experiences, co-creating knowledge and reimagining public goals” (p. 73).

Mapping Future Skills and Competencies: Overlaps, Synergies and Outliers

Considering that there are as many frameworks that have been developed for key competencies and future skills (Young and Chapman 2010; Davies et al 2011; UNESCO 2016; WEF 2016; OECD 2018, 2019; Ehlers 2021) as disciplines, there are obvious areas of commonality, overlaps and variations of similar competencies that we would like our graduates to develop, and it would be impossible to come to a final definite list. We contemplated transdisciplinary skills and competencies that would provide the students a strong basis to then explore further with better awareness and honing of their personal strengths, choices, and affinities. This made even more sense in the spirit of co-creation that we had adopted for developing this module while at the same time avoiding the one-size-fits-all approach. The matrix below maps the 4 Pillars of Learning with the fundamental future skill sets, values, and competencies as compiled and reported by the most influential institutions in education and future skills.

Organisation

	Learning to be (Self focus)	Learning to know (Cognition focus)	Learning to do (Practice focus)	Learning to live together (Social focus)
 <p>UNESCO (2016)</p>	<ul style="list-style-type: none"> - Integrity - Accountability - Leading and empowering others - Professionalism 	<ul style="list-style-type: none"> - Strategic Thinking 	<ul style="list-style-type: none"> - Driving and Managing Change - Making quality decisions - Managing performance - Results focus 	<ul style="list-style-type: none"> - Commitment to the Organisation - Respect for Diversity - Team work - Knowledge sharing and Continuous improvement
 <p>Institute for the Future (2016)</p>	<ul style="list-style-type: none"> - Resilience 	<ul style="list-style-type: none"> - Sense Making and adaptive thinking - New Media Literacy - Computational Thinking - Cognitive Load Management - Design Mindset 	<ul style="list-style-type: none"> - Virtual Collaboration 	<ul style="list-style-type: none"> - Social Intelligence - Transdisciplinarity - Cross cultural competency
 <p>World Economic Forum (2016)</p>	<ul style="list-style-type: none"> - Physical Abilities - Emotional Intelligence 	<ul style="list-style-type: none"> - Cognitive Abilities - Content Skills - Complex problem-solving Skills - Judgement and Decision making 	<ul style="list-style-type: none"> - Physical Abilities - Technical Skills - Creativity 	<ul style="list-style-type: none"> - Social Skills - System Skills - Resource Management Skills - People Management - Negotiation
 <p>Microsoft Finland (2017)</p>	<ul style="list-style-type: none"> - Cultural competence - Interaction and Self-Expression - Self Care and managing everyday life 	<ul style="list-style-type: none"> - Thinking and Learning to learn - Multiliteracy - Critical thinking - Responsibility over your own learning 	<ul style="list-style-type: none"> - Work-life Skills and Entrepreneurship - ICT competence - Managing an enquiry-based learning style 	<ul style="list-style-type: none"> - Participating, Influencing and Building a Sustainable Future
 <p>OECD (2018)</p>		<ul style="list-style-type: none"> - Critical thinking - Inductive reasoning - Mathematical reasoning 	<ul style="list-style-type: none"> - quality-control analysis - oral expression - complex problem solving 	<ul style="list-style-type: none"> - Active listening - Persuasion - Social perceptiveness

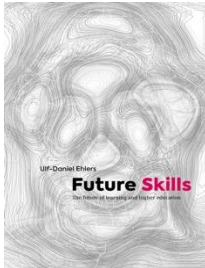
Organisation	Learning to be (Self focus)	Learning to know (Cognition focus)	Learning to do (Practice focus)	Learning to live together (Social focus)
 <p>Next Skills.org (2020)</p>	<ul style="list-style-type: none"> - Self-Competence - Self-Determination - Self-Efficacy - Ethical Competence 	<ul style="list-style-type: none"> - Decision competence - Reflective competence - Learning literacy - Design thinking competence - Sensemaking - Ambiguity competence 	<ul style="list-style-type: none"> - Decision competence - Initiative performance - Innovation competence 	<ul style="list-style-type: none"> - Communication competence - Cooperation competence - Systems competence

Figure 1: Mapping the 4 Pillars of Learning to Skill sets, Values and Competencies

Each of these organizations had devised their own methodology to reach to these sets of skills, values and competencies, but most commonly applied a Delphi survey technique with a panel of experts in higher education, human resources and future-focused think tanks. It was also noted the green competencies (resource conservation, eco-consciousness, sustainable and frugal innovation approaches) were not yet explicitly proposed in the whole listing of competencies, values and affective domains proposed. Although the aim was to be as generic as possible, it was impractical to consider all the constructs, and through discussions and developing a consensus we agreed upon the following broad competencies regrouped under the main themes of Collaborative networking, Communication Skills, Growth Mindsets and Professional and Ethical Practices.

- **Collaborative Networking** (comprising Self and Cultural awareness and sensitivity, Acknowledging and Appreciating Differences, Personal branding, Team playing and trust building, Opportunity seeking)
- **Communication Skills** (comprising Social and Emotional Intelligence, Technology-enhanced Communications, Active Listening, Conflict Management, Visual and Digital Literacies)
- **Growth Mindsets** (comprising Grit and determination, Creative and critical thinking, Design Thinking, Innovation Competence)
- **Professional and Ethical Practices** (comprising Social responsibility, Sustainable development, Managing ethical dilemmas and transformational leadership)

Assessing for Transdisciplinary Skills and Competencies

Redman, Wiek and Barth (2021), pronouncing on the assessment of sustainability competencies, claim that creating individual case studies, or scenario-setting and role plays, while being resource and time intensive would be most effective to create learning opportunities for students. Rosenberg et al (2018) suggest that the creation of supportive networks can provide learning through hybrid models including Challenge labs with learners from different disciplines working with tutors and professors to resolve real-life sustainability issues (Larson and Holmberg, 2018) or assessing students based on student-led consortia (Watkins, Higgenson and Clarke, 2018). Having a design thinking approach and getting students to self or peer assess skills has been proposed by Tan et al (2018) whereby empathy maps about videos depicting real-life problems are drawn by students in teams and then discuss these situations with instructors and engineers involved in the community. Fiala et al (2018) also explored didactic methods for applying transdisciplinary research approaches in agro-ecology and organic farming through a System Analysis and Scenario technique. This entailed a collaborative case study technique which required teams to read, discuss and apply techniques for creating systems maps, influence diagrams and multiple cause diagrams, reading around the theoretical aspects and eventually meeting with the case owners to discuss about plausible solutions and their implementation. Clearly, socio-constructivist approaches were to be favoured since they allowed for truly integrative curriculum designs but at the same time, it had to be noted that students found these approaches time-consuming and stressful. The co-creation approach was then discussed at departmental and faculty level allowing for multiple courses to combine their module assessments as synergetic case studies.

Planning for delivery

The module on Transdisciplinary Skills and Competencies was presented to both academics and students from various departments at the University. The module rationale and learning outcomes were discussed as well as the assessment criteria used to appraise the student learning are also given hereunder:

	By the end of the course, students should be able to	And will be assessed through the	Transdisciplinary skills and competencies
Learning to be	<ul style="list-style-type: none"> ▪ Identify their own personal competencies and strengths in a digital world ▪ Display Self-efficacy, resourcefulness, and Leadership qualities 	<ul style="list-style-type: none"> ▪ Creation of an IKIGAI model for self-assessment of personal strengths and development areas. 	Self and Cultural Awareness, Personal branding, Acknowledging, and appreciating differences
		<ul style="list-style-type: none"> ▪ Role Play in class/ online on Future job preparation – Jobs can be in any field. ▪ Story Boarding and Video recording of discussions around Emotional Intelligence, Cultural Sensitivity and Ethical practices during the role play 	Technology-enhanced Communications, Transformative leadership
Learning to know	<ul style="list-style-type: none"> ▪ Discuss about deep learning and authentic learning events ▪ Reflect upon cognitive processes and how these can be optimised for assessment. ▪ Develop alternative solutions through deep and complex thinking 	<ul style="list-style-type: none"> ▪ Annotating the Curriculum ▪ Design and development of a Digital portfolio using digital tools and techniques for note taking, screen casting, and Social Reading and share its contents with peers ▪ Create an influence diagram related to what should be displayed on a Social Network Site and what influences these decisions 	Creative and critical thinking, Design Thinking, Social and Emotional Intelligence, Personal Branding Cognitive Bias Analysis
Learning to do	<ul style="list-style-type: none"> ▪ Build an online collaborative empathy map using Design thinking ▪ Resolve an issue pertaining to problems from a different faculty 	<ul style="list-style-type: none"> ▪ Drawing a Future Spokes and Wheels diagram related to the first, second and third order consequences pertaining to a given Signal or trend (For example Design Future Thinking approaches for Small Island State Workforce) ▪ Infographic pertaining to the faculty problem and its resolution (With statistical references and concept analysis) 	Social responsibility, Sustainable development, Managing ethical dilemmas Problem solving.
Learning to Live together	<ul style="list-style-type: none"> ▪ Planning, Organising and Presenting a University Wide Workshop 	<ul style="list-style-type: none"> ▪ Compile a Who's Who for a particular Field ▪ Developing Digital Poster –SDG Theme-based ▪ Designing Promotional and registration packaging ▪ Compiling Sponsorship list and costing sheets ▪ Delegating team responsibilities and task 	Collaborative Networking Innovation Competence Design thinking Conflict management and resolution Negotiation Skills Creativity and Visual literacies

Co-creation Methodology

A focus group discussion was organised with 9 academics and 6 students to present the Transdisciplinary Skills and Competencies Module. Participation was purely voluntary and followed research ethics protocol and the respondents gave their informed consent.

- Faculty of Social Sciences and Humanities: F – Lecturer in Psychology 8 years' experience
- Faculty of Law and Management: M- Senior Lecturer in HRM – 25 years' experience
- Faculty of Agriculture: M- Assoc Prof Biometry – 28 years' experience
- Faculty of Agriculture: M – Senior Lecturer in Agricultural Sciences – 26 years' experience
- Faculty of Engineering: F- Senior Lecturer in Town and Country Planning – 20 years' Experience
- Faculty of Medicine and Health Sciences: F – Assoc Prof in Medicine – 26 years' experience
- Faculty of Information Communication and Digital Technologies: F- Senior Lecturer Software and Information Systems – 15 years' experience
- Faculty of Science: Assoc Prof in Mathematical Modelling – M 20 years' Experience
- Centre for Innovative and Lifelong Learning: F -Senior Lecturer Graphic Design – 22 years experience

The 6 students who participated in the group discussion were mostly from the first year of web and Multimedia development and had followed the module during the confinement period. The majority of them were female and only one male student had responded positively to the call for participation.

Their views were recorded, transcribed, and analysed using thematic analysis. Most of the lecturers (7) had over 20 years' experience in higher education, while the remaining 2 academics had between 10 and 20 years' experience. In our judgement, the length of experience is a good indicator of their opinion and experience with skills development in students and how best to undertake this in future.

The main aim of the discussions were to gain consensus around the module outcomes and activities set and whether there should be any modifications or improvements that needed to be made.

Findings and discussions

Reality Check, Learning from others' experiences and need for Scaffolding.

While some students felt that they could do with more instructions and guidance, the students found that the module had helped them to build confidence and had discovered sides of their personality that they had not thought of. They appreciated the opportunity to be able to present what they had learnt in the module but required more feedback sessions.

There were some concepts which were a bit difficult. For example, I had difficulties understanding the future wheel but I also got some feedback from my friends who said the content was not related to web multimedia. I think that they did not understand the concept of the module, it was more about preparing us for the world of work. For me, it was okay.

I'm much more confident because once we looked up T- graduates and that really helped me get into the mind of an employer and what he's looking for, that really helped me. And then with the Viva Sessions, we were given some prompts as to what we have to talk about.

I think after the Ikigai one, it really got me thinking and re-evaluating all of my dreams because there are some aspects that we miss that we forget, like how it will contribute to the world and everything. And when you put all that together, that's when you realise that we did not think about it thoroughly. So we really need a reality check, maybe a one to one session to make us realise sometimes we don't even realise what we need and what we lack until we get the opportunity to. So that would be good.

One student requested that the module should feature a guest speaker in the field of study to celebrate a "day in the life" of their work. "The guest can be an ex-student of the same course or those who have been on internship". In general, the students were very much in favour of participating in the co-creation process, but would need more time and experience to be able to fully contribute to the module.

Academics, for their part were visibly reluctant to work with the students. They expected student to be more self-reliant and have “*the will and motivation to learn ahead of what is expected from them, ability to keep abreast of latest developments via use of proper tools. Be able to adopt lifelong learning and master language properly*”. They also mentioned communication skills to enable the students to be more participative in classes, however admit that owing to lack of time and lack of appropriate training, were not able to incorporate 21st century skills in their classes and these were barely assessed for during the semester. One academic, referring to the American higher education system in a book by Hacker and Dreifus (2010) and mentioned the need to implement science and "humanities" topics in all programmes for students to get a broader view of today's world and for them to learn to think. This showed that the transdisciplinary approach was appreciated and needed more discussion. In terms of challenges that they had with organizing work placement, academics mentioned “the time it takes to establish contacts; finding appropriate employers, development of appropriate learning outcomes and follow-up of the students progression”. Also another concern was that with the Covid-19 situation, many employers were not interested in providing work placements. The module on Transdisciplinary skills and competencies module could then provide the students with interesting perspectives through video-recordings of work-placement scenarios and student experiences (both good and challenging) which could be taken up as points of discussion during classes.

Conclusion

The current education system in Mauritius, like in many developing countries, is based on traditional teacher-centred approaches where students are not provided with adequate opportunities to develop transdisciplinary skills and competencies. The discussions from both the students and academics suggest that self-efficacy and self-directed learning are not being promoted sufficiently. Students expect that their lecturers will determine “the knowledge that needs to be transferred, design and conduct training and monitor and evaluate the outcomes”. For self-directed learning (Knowles, 1975) learners should take control – make decisions, and take responsibility for their learning process. The co-creation process can be viewed as an innovative approach to higher education learning design training as adapted from Bovill (2020) : (1) to plan about which kind of co-creation would be most appropriate for a given topic; (2) a reflective tool to help students and staff articulate rationales for particular modules and why they are chosen to co-create and (3) as a mapping tool to see the module from a “bigger picture” perspective and how the university vision fits in relation to the Delors’ 4 pillars of learning. Clearly, the first-year students were still requiring the scaffolding that they were used to, and given this module was asking them to co-construct their own knowledge not only individually, but also collaboratively with more knowledgeable others (Vygotsky, 1978), it was important to enhance the module to clearly enunciate the more self-reliant competence that was required from the students. To conclude, the co-creation of a module on Future skills and competencies is one that students are very keen to participate in and would provide academics with greater variety of learning experiences and cases for their students to learn from but requires some organization to bring the academics and students together to work towards breaking down the silos. Having a consortium or special interest group approach, as in this case could provide the necessary structure and is worth investigating further for a formalization within the university cadre.

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