The 31st OUSL General Convocation Address 2018

Torsten Henry Fransson, PhD. DSc.

Challenges and Changes towards a Sustainable Society: Climate, Energy and Education

Today I have the special privilege of receiving a Doctor of Science Honoris Causa from The Open University Sri Lanka. The OUSL has been a pioneer in the open education sector in Asia since its creation in 1978, becoming the 3rd Open University in the whole of Asia (only 9 years after the world-wide first Open University, the OU UK in 1969, and a few years after Korea 1972, Pakistan 1974 and Thailand 1978). The purpose at its creation in 1978 was to provide higher educational opportunities to working adults, providing them the road to success, surpassing age, vocation, gender, race, ethnicity and religion. This has been a success, and the university has now 8 regional centers and around 40’000 students enrolled. This progress is a great achievement and I express my sincere congratulations to the OUSL, its leadership and the entire staff!

I would heartfully like to thank the Chancellor, Vice-Chancellor Prof S. A. Ariadurai, the University Faculty and all the colleagues at the OUSL for the Honory Doctorate. The results we over the years have commonly achieved of educating students from Sri Lanka towards a Master graduation from EU universities has been a significant achievement that could not have happened without a true collaborative spirit, and an openness towards the importance of education in a world-wide perspective, from colleagues both at OUSL and universities in Europe, and of course the dedication from the students themselves who made significant sacrifices during the study years. The evolution of creating such on-line collaborations already back in 2005 when internet was still in its infancy has been a second foresight from the OUSL, this time to work together with EU universities for the benefit of the citizens of Sri Lanka. As such the present leadership of OUSL has followed the tradition of academic openness, futuristic views and expoting new ways towards higher

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education that was at the origin of the university. Again congratulations to the OUSL.

Dear graduates,

A graduation convocation is a very important milestone in the life of an institution, and it is a great honor for me to be part of this occasion. I would, as you as fresh graduates embark upon new, highly exciting and fruitful careers, like to frame my thoughts, and remarks, towards the earth’s and societies sustainability perspective, perhaps giving you some “food for thoughts” and perhaps even some inspiration towards your new careers.

You go out into a divided world, but a world of enormous potential and opportunities.

We have all the future destiny of the earth in our hands. As earth’s stewards, we must strive for sustainable development, aim to reduce global injustices, to erase poverty, and ensure a full mitigation of climate change. Clean water and energy services are essential to all of these goals. And for this knowledge is a key, knowledge accessible for all. Increased knowledge will empower us to manage the earth’s precious water and energy resources for the service of mankind.

Access to clean, affordable energy and water, and appropriate food, all put in a humanitarian, social and environmental context, are the three main pillars of sustainable development. To overcome social injustices in these three areas, education at all levels is a key element.

Today the world faces unprecedented challenges. The United Nations has put up 17 essential Sustainable Development goals for the future (Fig. 1) where I in this address would specifically like to highlight the goals 4 and 7 which relate to “Quality education” and “Affordable and clean energy”.

These two are, together with goal number 6 of “Clean water and sanitation”, essential preconditions for all the other goals as without education, water and energy services the world will come to a standstill, and the societal injustices we today find in the global world will not be reduced.
Figure 1. United Nations 17 Sustainable Development Goals (https://tonyloyd.com/category/sdgs/)

Figure 2. Global temperature variation 1860-2017, with the period 1969-1990 as baseline (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)
The recent warnings from the Intergovernmental Panel on Climate Change (IPCC) in October 2018\(^1\) give clear warnings to policy makers and worldwide citizens that keeping the goal, approved by most governments in the world, of less than 1.5 degrees Celsius global warming compared to the pre-industrial situation requires very fast actions (Fig. 2).

The consequences of not reaching this goal can be disastrous for the world resulting in rising sea levels, disappearing islands and whole nations, extreme droughts, more and more weather-related natural catastrophes, and subsequent unprecedented migration of people between regions. The report indicates that we already presently can see some consequences of global warming, and that keeping the temperature rise to 1.5\(^o\)C instead of the more realistic 2\(^o\)C should significantly reduce the effects. In this context every bit of warming matters and the more actions that can be taken on all levels will help in this regard. Already at 1.5\(^o\)C the consequences will in many cases be irreversible, at 2\(^o\)C it will be disastrous and the consequences of the higher scenarios cannot be foreseen. Immediate actions are needed to reduce the CO\(_2\) emissions for an acceptable climate by the end of the century. Scenarios indicate that zero net CO\(_2\) emission is a necessity by 2050 (Fig. 3).

\(^1\) Report title: Global Warming of 1.5\(^o\)C, an IPCC special report on the impacts of global warming of 1.5\(^o\)C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. http://www.ipcc.ch/pdf/session48/pr_181008_P48_spm_en.pdf
Figure 3. Maximum allowed CO2 emissions to keep the global temperature rise to x°C by the end of the present century. (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)

_All this does of course not sound good for the future of the planet Earth!_ However, the good news is that several actions that would be needed to limit global warming to 1.5°C are already underway around the world, although they will need to significantly accelerate. This requires rapid and far-reaching transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide (CO₂) would need to fall by about 45 percent from 2010 levels until 2030, reaching ‘net zero’ around 2050. But we will also need to, through various methods, continue on this path and also remove CO₂ from the air to be able to keep the 1.5°C until the end of the century. Highly efficient climate change mitigation technologies do exist already today, but they need to be more implemented and the cost must go down. As they do exist the main problem is the implementation. The challenge is the short-term cost towards the
long-term ones, and often also the fact that the most polluting nations are not the ones who will feel the burden first.

The IPCC report gives policymakers and practitioners the information they need to make decisions that tackle climate change while considering local context and people’s needs. The next few years are probably the most important in our history. Different sectors will need to make strong commitments. Energy, agriculture and transport have significant reductions to do (Fig. 4). But the climate change mitigation shall not only be put upon engineers and technicians.

*In this perspective all you fresh graduates have, independent upon academic discipline, a possibility to make impact.*

Citizens must be informed, local and national politicians need to be pressured towards actions, political ambitions must be pushed forward and accepted by the citizens. Corporates need to, and many do already now, come forward to step up to mitigate climate change.

There will of course in the future be many more, and significantly more efficient, methods than today, but already the implementation of the existing technologies can mitigate and largely solve the greenhouse gas problem we face today. One important example is that the transfer to renewable energy (solar, wind, hydro, ocean/tidal, biomass,..) sources is already now possible. In some countries it starts to become cheaper to install solar power than fossil-fired units.

The global average solar radiation, per m² and per year, can transform the same amount of energy as a barrel of oil, 200 kg of coal, or 140 m³ of natural gas. Still only about 1% of the electricity in the world is through solar power². This is a huge potential for renewable energy, especially as the prices for solar panels are on a significant decreasing slope. Similarly, biomass contributes already ~10% of the global energy mix³ and is also on a significant rise, mainly driven by the fact that biomass is CO₂ neutral over a period of a generation as long as there is new and continuous planting. Among other renewable energy sources with significant potential hydropower, waste-to-energy, geothermal, wind and marine can be mentioned. In short, there is no shortage of renewable energy resources in the world. So why do we

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² [https://www.worldenergy.org/data/resources/resource/solar/](https://www.worldenergy.org/data/resources/resource/solar/)
still use the fossil fuel? It is a matter of price per unit. But these calculations are very short-sighted and do not consider the environmental cost of burning the energy which the sun has given us during millions of years and releasing all this CO$_2$ in a matter of a few hundred years.

Although the United States has gone out of the Paris Climate agreement, everything is not completely “black” there either: California has among the toughest climate goals in the world, and they have just announced that the 2020 greenhouse gas emission target was already met 2016$^4$. And several other states go in the same direction, independent of the US federal government’s declined interest in climate change.

**So what can we commonly do?**

The technology exists, the awareness is present in a number of governments but the urgency seems to be missing. As solutions do exist it is a matter of implementing and using these technologies. For this *education*, at all levels, is needed. School children needs to become aware of how the earth’s resources can be saved, citizens have to become aware of what can be done on a day-to-day basis and exercise their power in the democratic processes to combat climate change, engineers have to be educated towards implementing the latest technologies into their constructions, and politicians must be educated towards the global financial impact of not acting on time, and take their responsibility towards future generations.

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$^4$ Mechanical Engineering, Sept 2018, p. 15
Figure 4. CO2 emissions from different sectors (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)

Quality education:
This brings me to the second, out of the UN Sustainability Goals for the future, important topic I want to raise, namely “Quality Education”. This is a topic very fitting for you as fresh graduates to reflect upon, starting with the question of how you think your education could have been even better than it was. Basic education should of course be a human right and is gradually becoming so in all countries. Such education should in the globalized world of today be broad, not only based upon achieved grades but ethics, integrity, personality as well as knowledge about the regions, global and local, and the societal factors influencing citizens choices. The higher education is, although global, not easy to handle, mainly as it is through national accreditation systems and as different cost models
exists in different countries. The main two cost models are “pay upfront for on-campus education” (that is, students pay the tuition fees for the studies) or “pay downstream for on-campus education” (which in most countries mean a long-term payback time through various taxes paid in the country one works in). These models have, together with the “open universities” in many countries, co-existed well for a number of years but the appearance of online education, the development of interactivity in education and Artificial Intelligence is presently drastically changing the educational landscape. The teacher of today is used to teach in the by now “classical ex-cathedra” way: The teacher has a significant monolog in front of a number of “physically present students” (Fig. 5), in a similar way as you now listen to me.

However, the appearance of “Massive Online Open Courses” distributed globally through special channels like Coursera, EdX, FutureLearn (Fig. 6), and more, has drastically changed the educational landscape. Although there is not an educational revolution going on, it is a very fast evolution. Earlier academic and professional education was clearly separated. This is not any more the case. Students nowadays can learn from different global sources at virtually no direct cost, apart from the dedicated time and intellectual efforts needed. These drastic educational changes make many highly reputed universities going into the online market, offering various courses (both academic and non-academic) as well as both Master and Bachelor degrees. Very recently universities like Penn State and others have come out with complete online programs offering also Bachelor degrees. The cost for such programs can at the present time land at 50%, or even 25%, of the cost for an on-campus program at these high-reputed universities. This opens significant possibilities for global students to receive high-quality education at a significant lower cost than the traditional on-campus programs, at the same time as it also challenges the traditional “open universities” around the world.

We have only seen the very beginning of such an evolution. One, often neglected, part of this will be the selection and admission process. The traditional way of “best academic grades” and then going directly from high-school to university will be challenged as people will continuously move back and forth between education and work, to

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5 https://www.coursera.org/
6 https://www.edx.org/
7 https://www.futurelearn.com/
8 https://www.worldcampus.psu.edu/degrees-and-certificates/directory/undergraduate/bachelor
continuously update the knowledge in the original trade, while also “changing gears” and start completely new specializations. New ways of accepting students to university courses will change as a result of academic accreditation of MOOCs as these become, as a function of the transparency, peer review and the large number of users, of increasing quality. The main important issue in this process will be to ensure the high quality of the Overarching Intended Learning Outcomes (= the officially, published educational goals) of individual courses as well as programs, and ensuring corresponding and academically appropriate assessments. As such MOOCs will soon be accepted also as giving academic credits, and will thus open up for receiving accredited university education from non-university educational providers.

A second very important trend, and one with significant potential, is the “Team-based Societal Challenge education”⁹. This is another step away from the “ex cathedra teaching” in the sense that the learners are presented with a societal challenge in the beginning of the studies, and learn the necessary topics to solve the challenge “just in time” when the knowledge will be needed. This gives the learner a much higher motivation as they immediately understand how they can apply the knowledge from the course, and it also corresponds to how the graduates will later engage in the working environment. Of course, the teacher must take care to ensure that the education remains broad towards also other applications. This also means that not all students shall have the same background. In fact, putting students from law, political science, technology, and for example philosophy, food and health, etc together to solve societal challenges sparks significant new ideas and innovations. In this perspective it is also easy to imagine, but of course difficult to realize and implement, that students will need to find their own learning pathways, away from the classical “one size fits all” education. This implies that it will be needed for teachers to work together in new ways, also sharing and together develop educational material, instead of individual teachers developing material (often in duplication) by their own. This can for example be done through the creation of repositories of sharable learning units, where both teachers and students can find re-usable learning units for individual path-ways and learners can receive “micro-degrees” in different areas to enhance their careers (Fig. 7).

⁹ See for example: https://www.kth.se/social/group/guide-to-challenge-d/
With this evolution what will then education be like in the world of the future?

The human brain is slow to adapt new technology, but the evolution with computers is going fast. Internet use, also for school purposes, is going down in the ages. Younger people will adapt the technology very much faster than the professors today occupying the teaching positions. In Sweden 79% of all children use today internet before they are 2 years old (49% on a daily basis), and when they are 10 years old they use regularly internet in the school-work\(^\text{10}\) (Fig. 8).

\[\text{Figure 5. Example of “traditional ex-cathedra” education}\]

\(^{10}\) https://2017.svenskarnaochinternet.se/barn-och-internet/
When these persons come to the university, they will be much more used to seek information “from anywhere” than the present university generations. University teachers of today are still in the old paradigm that they shall be the providers of the basic knowledge. But if this traditional knowledge is already available outside the universities, what will the purpose of the university be? And more specifically what will the role of the teacher become? The traditional teaching must definitely change. Exactly how is not known but the tendencies at the present time go towards much shorter courses, to attract the shorter attention span of the “computerized” generation, ensuring that there will be significant “rewards” on a daily basis in the direction of gamification of education and scenario buildings. The traditional teacher will have to change perspective and become more like a guide,
Figure 7a. Possibility for “the 2030 student” to organize their own learning paths

Figure 7b. An example of a repository that stores basic learning units, accessible to both teachers and learners in a global perspective
Coach and mentor who will not be “teaching” but rather setting up the educational framework about the Intended Learning Outcomes (ILO) and assessing that the learners have the requested knowledge, skills and competences corresponding to these ILOs upon graduation (Fig. 9). Adaptive courseware, sometimes called intelligent tutoring systems\textsuperscript{11} have grown increasingly popular as an alternative to large classes that emphasize lecture and memorization. They have also given rise to the specter of the robot teacher. With adaptive courseware, students first encounter material outside of class, often through short video lessons and readings. They take quizzes that assess their understanding of the material and, depending on the results, the courseware either advances them to the next lesson or provides supplemental instruction on concepts they don’t yet grasp. This lets students’ study at their own pace and frees up the instructor’s time in class to instead have in-depth intellectual discussions with the learners. Furthermore, an educator spends usually a tremendous amount of time grading homework and tests. The traditional assessment related to basic engineering calculations can already now be automatically corrected but this possibility is seldom used by teachers.

\textsuperscript{11} https://www.chronicle.com/article/How-Artificial-Intelligence-Is/244231
Figure 7c. Example of small, globally accessible “learning units”, to be used both for individual learning and for commonly creating better and more sophisticated courses.

Figure 7d. Example of a “stackable” concept in which the learner gradually builds up their knowledge, skills and competences by “stacking” a number of “micro-credentials” from many different sources toward a broader degree.
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**Figure 8.** Daily internet use by youth in Sweden (https://2017.svenskarnaochinternet.se/barn-och-internet/)

**Figure 9.** As learning material exists outside the traditional university the teacher’s role need to change towards a “tutor/mentor/coach” for enhances quality time

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**So: What is the teachers future role? Quality vs quantity time**

1. **Architect to design the**
   - Overarching Intended Learning Outcomes (program/course level)
   - Identify the detailed Intended Learning Outcomes (course/lesson level)
   - Identify the Achieved Learning Outcomes to be assessed
   - Moderate peer discussions, assure understanding of the OILO
2. **Assess if achieved competences and skills match the intended design**
3. **Recommend the Knowledge Material (recommend, not necessarily teach)**

- Assessment of competences and skills as requested from the OILOs
- Create Achieved Learning Outcomes: Part 1: Auto corrected; Part 2: Discussions
- Define detailed Intended Learning Outcomes
- Define Overarching Intended Learning Outcomes

**And what about AI as a teacher?**

**Peer discussion between teachers and learners**

**Peer discussion between learners**
This is however rapidly changing and “simple” exam questions will more and more be handled automatically. Furthermore, Artificial Intelligence (AI) will step in, take over manually corrections of exams and at the same time offering recommendations to learners for how to close the gaps of missing knowledge. Machines can already grade multiple-choice tests, and they are very close to being able to assess written responses as well. As AI steps in to automate admin tasks, it opens up more time for teachers to spend with each student, thus going from “quantity time” to “quality time” and “personalizing” the learning process (Fig. 9). There is also much potential for AI to create more efficient enrollment and admissions processes, offering great potential for persons who might have other qualifications than the absolute highest grades in the class to become enrolled. Although education might be a bit slower to the adoption of artificial intelligence and machine learning than other branches, the changes are beginning and will continue. It is expected that artificial intelligence in U.S. education will grow by more than 45% from 2017-2021\(^2\). Stanford University, one of the most prestigious universities in the world has had significant internal discussions over the last few years about the future of the university as a whole. They have explored different scenarios, each groundbreaking as towards a major shift from the traditional undergraduate education in “disciplines” towards “something new”, so far completely unknown\(^3\) (Fig. 10). This means that universities world-wide presently struggle with what their role will be in the future.

Even though most experts believe the critical presence of teachers is irreplaceable, there will be many changes to a teacher’s job and to educational best practices. Artificial Intelligence has already been applied to education primarily in some tools that help develop skills and testing systems. As AI educational solutions continue to mature, AI can help fill needs gaps in learning and teaching and allow schools and teachers to do more than ever before. AI can drive efficiency, personalization and streamline admin tasks to allow teachers the time and freedom to provide understanding and adaptability—uniquely human capabilities where machines would struggle. By leveraging the best attributes of machines and teachers, the vision for AI in


\(^{3}\) http://www.stanford2025.com/#intro
education is one where they work together for the best outcome for students. Since the students of today will need to work in a future where AI is the reality, it’s important that our educational institutions expose students to, and use, the technology. Adjusting learning based on an individual student’s particular needs has been a priority for educators for years, but AI will allow a level of differentiation that’s impossible for teachers who have to manage many students in each class. There are several companies currently developing intelligent instruction design and digital platforms that use AI to provide learning, testing and feedback to students from pre-Kindergarten to college level that gives them the challenges they are ready for, identifies gaps in knowledge and redirects to new topics when appropriate. As AI gets more sophisticated, it might even be possible for a machine to read the expression that passes on each individual student’s face that indicates they are struggling to grasp a subject and modify a lesson to respond to that. The idea of customizing curriculum for every student’s needs is not viable today, but it will be for AI-powered machines.

Figure 10. Scenarios about the future of university as discussed by Stanford Universities
Is this a vision of today or of tomorrow?

During the 40 years of information age, we told computers what to do. With advances in artificial intelligence, particularly machine learning, and faster processing chips we can feed computers giant data sets and they can (in narrow slivers) draw some inferences on their own. The first step will be fully automatic assessments, but guidance systems where the computer directs us towards missing information will not be far away\textsuperscript{14}. And once this has happened there will be a competency management in which learners can themselves, with the guidance of Artificial Intelligence select their own learning paths receiving scores, badges and micro-credentials, going into full degrees, even outside the university settings. \textit{Questions like what might be the right balance between teachers and technology will have to start to be seriously considered and discussed.} This shift of teachers from knowledge providers to coaches/mentors and discussion partners will also change the perspective of who will be “teaching” at the university. Already today non-academics are invited to university classes to talk to students about their work and experiences. This will become significantly more common and as such you, fresh graduates, should aim to keep the contact with the university. \textit{You can yourself become guides and mentors towards the next generation of students!}

We can of course not say what the future will look like, but based upon the technology progress and the speed of society today it is a safe bet that life-long learning with a person “going back to school” to take formal classes will increase. The majority of employees will not work in a “life-long employment” as previous generations in the field they graduated, and companies will more and more be looking for “fresh blood” to re-vitalize their environments. \textit{Come back to school, explore new courses, and work with the OUSL to share your future experiences into a modern educational setting for the benefit of future students.} On the other hand, the AI will also be prone to manipulations, and it is vital to ensure that it is used for the benefit of society and not as a manipulation tool from organizations and governments. Also, here your direct academic sincerity is needed.

In closing let me extend my warm congratulations and greetings to each one of you, my fellow graduates. The degree you have just received is one stepping stone on the learning pathway towards

\textsuperscript{14} http://www.gettingsmart.com/2018/08/32-ways-ai-is-improving-education/
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continuously increased knowledge, skills and competences. As you set out on the next steps of your journey and as you cross many more milestones that mark your achievements, I am sure that you will proudly recall the opportunities that the OUSL gave you and how it empowered you for success. Make sure that you add your personal qualifications while keeping the academic integrity and devotion at the very highest level. Keep the “moral compass” high and ensure ethical approaches in all lines of work and duties. Join forces in multi-disciplinary teams to address the important societal challenges expressed in the UN sustainability goals, and ensure that also the ones who might not have had the opportunity to receive a high-level education like yours can be on board for the journey towards the future. You, as fresh graduates, have a privilege to participate in the development and act as earth’s stewards towards a sustainable future for mankind.

Good luck, and thank you for your kind attention.

**Professor Torsten Henry Fransson**

*Email:* torsten.fransson@kic-innoenergy.com
*ID:* https://orcid.org/0000-0001-8532-3594