Some Insights on Social Inclusion in Engineering Education

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Abstract

A revolutionary transformation in engineering education is well known since past some years. The fourth industrial revolution is mainly responsible for that. But somewhere it is also important to keep some fundamental aspects such as social inclusion and knowledge decolonisation etc. in practice. These are basic building blocks that strengthen the foundation of university education. More importantly, they prompt a better work culture; students engagement, participation, and involvement; and social security as well. This paper provides some insights on social inclusion practices with an aim to facilitate Professors of engineering education and prompt further dialogue and work to create a better work culture in universities for engineering education. It is worth mentioning that dialogues, trainings, facilitation methods, and policies play a major role as far as enabling social inclusion in engineering education is concerned. The paper hopes to encourage the Professors of engineering education institutes or universities in order to bridge the gap between diversity and inclusion and for maintaining a better relationship between them and students.

Keywords: Social inclusion, Education, Engineering, Knowledge, Learning

1. Introduction

This is an era of transformation in higher education, as the whole world is under the impact of the fourth industrial revolution. Engineering education 4.0 interventions have changed the scenario where traditional classrooms have been replaced by ultramodern digital classrooms and backpack based education has been replaced by tablet based digital teaching and learning. But, on the other hand, social inclusion is also an extremely essential aspect that plays a major role for the development and success of the students. In the race of technological revolutions, this concept of social inclusion is ignored that is not good for the students, especially those who are from vulnerable groups and difficult backgrounds. Social inclusion can be defined as a process of facilitating the individuals and groups for their better participation and involvement in the society (Adams et al, 2007; Hlalele and Alexander, 2012). In context of education, it implies to improve ability of the students and provide them access, respect and equal opportunity (Akoojee and Nkomo, 2007; Boiler, 2005). It needs engagements and encouragements to troubling dialogues etc. to enable social inclusion in engineering education (Juvonen et al., 2019; Zembylas, 2015). We human beings are different or diversified in many aspects that affect the thinking, behaviour, and abilities; however it is extremely essential for learning and to adapt ourselves and to bring uniqueness, creativity, innovation and sense of understanding of inclusion (Goldfarb and Grinberg, 2002). In other words, we are human beings with a huge diversity in religion, language, culture, life-style, beliefs, skills and abilities, personal traits, values, occupation, economic status, education, perception, and in many other aspects. But in common, we all are living for a cause, playing important roles in the society and world, and bearing some sort of responsibilities. Our diversity makes for learning and exploring more creative solutions. The need is to realize that we are becoming more and more diverse, innovative, capable, and responsible. Moreover, we are learning from each other and becoming a more rounded individual.

This paper provides some insights and recommendations with an aim to facilitate Professors of engineering education, for dissemination of social inclusion concept and further student empowerment. Student facilitation methods, social justice, feedback techniques, decolonization of knowledge, and consultations etc. are major areas and provide much scope for social inclusion implementation (Fig. 1).
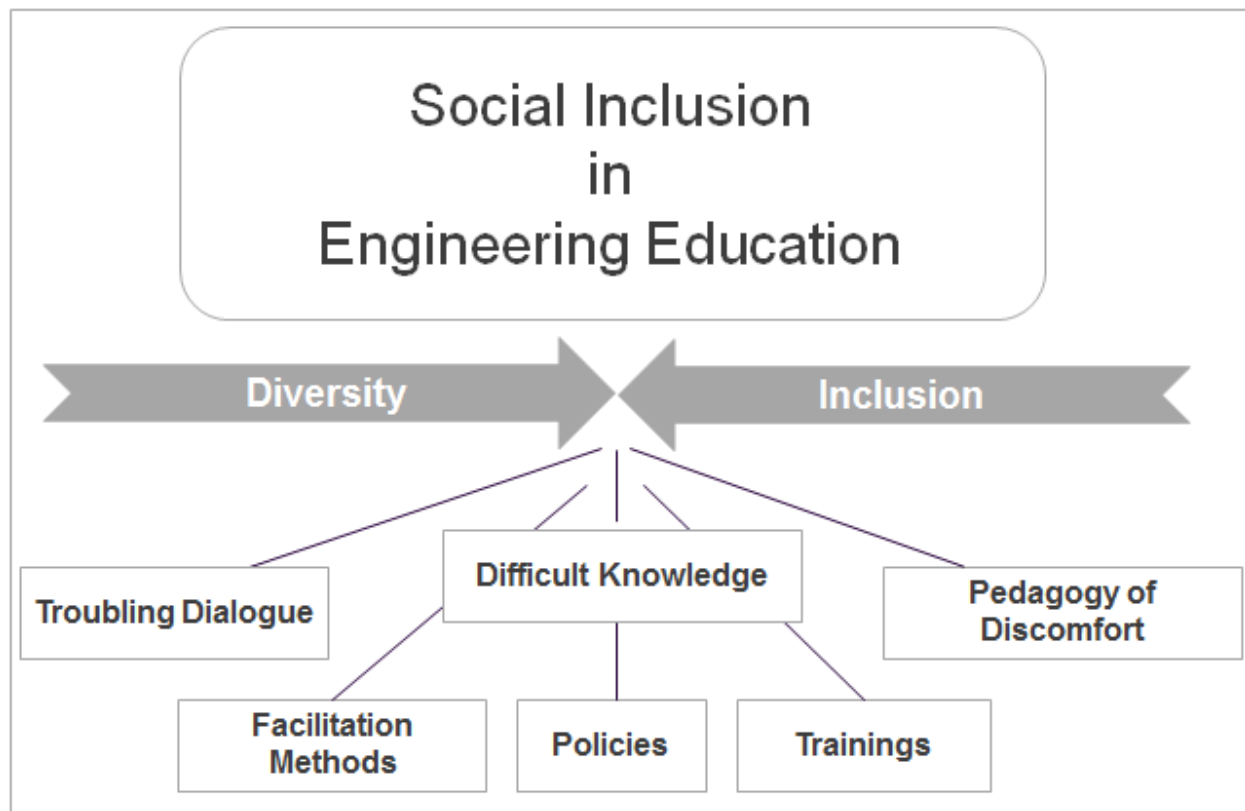
Figure 1. Some enablers for social inclusion in engineering education

2. Social Inclusion Strategy and Statement

Some of the advisable social inclusion strategies are as follows (Landis, 2008; Sue et al., 2009):

Professor or Educator must act as a Facilitator
It is important that the Professor must understand the limitations and psychology of the students where ample opportunities are given to the students to explore, come out of fear, and learn. Professors have to go out of the traditional tendency of being an authority figure and having power to control the class or atmosphere of the class system, rather play a role of facilitator to provide enough opportunities to the students to engage, explore, and understand. It is mandatory for both educators and learners to step-out of their comfort-zone.

Defining objectives and establishing ground rules in advance or in the beginning
The very basic strategy is to identify and define the objectives of engagement with students. Doing so will help to develop a better understanding and keep the learners inform all the times. Establishing ground rules for all learners to feel included, respected, and engaged is also very important for difficult knowledge. Individual engagement and consultation with the learners, allowing them for the conservation that are troubling.

Adopting service learning strategy
It is essential to facilitate for transformative learning and co-operative learning for developing leadership attributes and social justice respectively. The learners should be exposed to the service-learning sites, to break their comfort zone, and have real-life learning experience. It will help them to analyse the gap between theory and practice and they will be trained enough to bridge this gap. Involvement, noting service experience, and engagement for reflection, encourage students/learners to explore, to question their own assumptions, and to get out of the comfort zone.

Decolonizing the knowledge

It is also one of the best strategies, as high discomfort level somewhere also prompts learners to follow this strategy and Professors can also adopt it for difficult knowledge. In this, help from the industry people, engineers and experts working in this field is required to be ensured. Learner's difficulty level and knowledge transformation become quite easy when follow this approach. Learners understand and gain knowledge interestingly when engaged with the experts from their native place, town, religion, and area.

The decolonization of knowledge implies knowledge transformation from western thought to local (African and global south in context of African continent) in order to enable the sustainable development. It is believed that Rethinking and Reinventing are the two pillars that govern this transformation to affirm African knowledge and cultural traditions in universities. As decolonization of knowledge involves more than changing curriculum and reading lists, significant efforts in terms of sustained discussion and experimentations are required in the university as a social institution for reflection of values and assumptions that underpin the knowledge transformation. It is essential to prepare students locally relevant and internationally competitive. We can make contribution to decolonize knowledge, such as, by participating in the knowledge decolonization based seminars and workshops, initiating discussion on decolonization among students and faculty members, including examples and cases studies in the local contexts for students in subject teaching.

A case scenario can be discussed in the context of engineering education in African continent where students are studying manufacturing engineering subjects. To pass the subject, it is essential for them to understand the principles, mechanism, and salient features of various manufacturing processes; and answers the related questions in the examination. All students who come to the class have different mind-set, background, and interest level in this subject. In general, it's difficult to make all the students understand the aforementioned as regards to various manufacturing processes only via lecture slides. During lecture, going deeper into the course content makes them uncomfortable and further progression makes them extremely discomfort. Following the four aforementioned key strategies for their engagement, provide the learners an opportunity to going beyond the acceptance of the contents delivered by the Professor, and increase their awareness of the contents and willingness to learn. They find their own ways to explore the manufacturing processes at local industries, watching animations, videos, and interacting with the experts, and engaging with one another as a group activity. Coming out of the comfort zone, they learn by exploring, engaging, thinking, doing, and rethinking in case of difficult knowledge.

Further, a social inclusion statement can be proposed. Considering a scenario of South African university where under the faculty of engineering, Bachelors qualification programmes are run in various streams or branches of engineering. In this, competency building and skill developments are the major aspects for students to become accredited and qualified engineering graduates. The proposed social inclusion statement can be distributed to the students in the beginning when they commence their professional studies or start of first semester every year, and also it can be displayed at various locations in the engineering faculty or departments. It will cover the following points-

Participation
- To include the student representative in all regular departmental meetings and special meetings to be held to discuss matters of labs, industrial trainings, and employment etc.
- Before finalizing any policy or regulation, the attempts will be to consult with the students or get feedback from them.
- To advise and recommend faculties to take care of the requirements of students and consult with them if possible before finalizing the assessment criteria, submission deadlines etc. for the sake of their progress and development.

Accountability
- To understand the responsibility and focus more on the weak or underperforming students.
- To make provisions for extra classes and extended consultation hours for the underperforming students.
- To promote discussion and brain storming in practice for the issue such as knowledge decolonization and treating disabled students etc.

Non-Discrimination

- To acknowledge and celebrate diversity, and teach and treat all students equitably.

Empowerment
- To make sure to communicate the students well in advances or in the beginning of their studies about the grievance procedure, access rights, support, feedback, and ethical aspects.
- To timeously inform the students about any change, amendment or development in the aforementioned.
- To follow a reform strategy to support and welcome all students.

3. Proposal for a Social Inclusion Workshop

To facilitate the Professors to understand social inclusion concept and implement such practices, some workshops can be proposed and conducted. This section provides some insights for such a possible workshop. The overall plan on what participants will be engaged in during a social inclusion workshop is discussed here as under.

First of all, it is necessary to understand why such a workshop is necessary. The following may be the reasons:
- The international universities appoint diversified faculty members who came internationally from different countries, religion, and culture. Thus, it is very important to collect, inform, and engage them for the best possible social inclusion habits in their working and dealing with other colleagues and students.
- Some issues such as promoting disadvantaged students and focusing underperformed students always remains in picture.
- For the growth and progress, there is always a requirement to promote troubling dialogues among the faculty and staff members.
- As the faculty and staff members are from different countries so are the students; therefore, interacting in such a workshop will explore hybrid ways of thinking, behaviour, and abilities to be more socially inclusive.
- To learn from one another, and to explore the ways to be more innovative and socially inclusive.
- To improve the levels of relationships among faculties, staff members and students.
- To initiate and promote troubling dialogues as a common practice.
- To make aware of the concepts like social justice, decolonization of knowledge, pedagogy of discomfort and universal learning design.
- For better teaching and learning practices and overall development of the students.

The anticipated outcomes of the workshop could be as follows:
- Participants will have clear understanding of social inclusion in teaching, learning, and academics.
- Participants will be able to discuss on social inclusion in the department with an interest to initiate troubling dialogues.
- Participants will know how to decolonize the curriculum/module/lecture/class room to cater the need of a wide range of students.
- Participants will get aware of universal learning design principle and be motivated enough to use in their teaching practice.
- Participants will be motivated enough to encourage other colleagues/staff members to adopt social inclusion practices.
- Participants will leave with an instinct to explore or to become more accountable and responsible.
- After having this workshop, the department will have improved and innovative strategies for the betterment of underperformed students, and physically challenged students and faculty members.
- It will give rise to further workshops, seminars, and troubling dialogues in the department on the matter of social inclusion.

The aim of the workshop is to initiate dialogue within staff in the department around issues of social (in) justice and inclusion, with a specific focus on teaching and learning and/or improving the relationships between staff and students. Three key themes that can be considered in this workshop are: familiarity with the policy framework around social inclusion, issues of decolonization and cognitive justice, and universal learning design (Burgstahler, 2008; Jansen, 2019). The participants can be briefed about decolonization of knowledge. The decolonization of

knowledge implies knowledge transformation from western thought to African and global south in order to enable the sustainable development. It is believed that Rethinking and Reinventing are the two pillars that govern this transformation to affirm African knowledge and cultural traditions in universities. As decolonization of knowledge involves more than changing curriculum and reading lists, significant efforts in terms of sustained discussion and experimentations are required in the university as a social institution for reflection of values and assumptions that underpin the knowledge transformation. It is essential to prepare students locally relevant and internationally competitive.

The following ways can be adopted to make contribution to decolonize knowledge:

- By participating in the seminars and workshops in the department and university.
- By initiating discussion on decolonization among students and faculty members on decolonization of knowledge.
- By including examples and cases studies in local contexts to students in subject teaching.

Consider the case of a lecturer who is teaching material science subject, then for decolonization of knowledge, an extra chapter on "Processing of Titanium and its alloys" can be added, as South Africa is very rich in this material. Furthermore, industry experts can be invited during the semester to share the local engineering and processing of these materials for the students to understand it in local perspective. Pictures, case studies, and videos on materials from local research labs, industries, and institutions can be arranged for decolonization of knowledge. It will be an add-on to the literature and information, students get from their books which provide them an international level understanding.

Participants may be given opportunity to speak out the policy they know which must relate to the social inclusion. The policies can be of the government and/or university based on education and social inclusion.

As regards to the universal learning design (ULD), the following objectives can be briefed to the participants:

- To address diversity and make environments welcoming and user friendly.
- To create responsive and flexible programmes for students

As per ULD, there is no intelligent, average, or weak student (Chuck et al, 2002). It provides enhanced opportunities for engagement, expression, and academic performance. ULD would provide an environment which is welcoming and usable for everybody. ULD teaching is learner-centred and interactive. It refers the necessity of providing choices for students in relation to their learning needs and more inclusive classrooms. ULD recognizes the importance of changing institutional or environmental arrangements to address the learning needs of all students.

ULD curriculum should be aimed to maximize learning and should support all students. It must be a flexible curriculum to take care the needs of all students. Universally designed curriculums include a range of options for accessing, using, and engaging with learning materials recognizing that no single option will work for all students. Digitalization of the material helps extensively to achieve the goal's of ULD based curriculum. In this context, a diverse classroom needs multiple pathways to be taken by the instructor or Professor for presenting concepts and delivering knowledge. Overall, a flexible pedagogy approach is required to be taken".

To determine (after the workshop) the efficacy or value of the workshop and potential follow-up sessions, a quantitative and qualitative Feedback from the participants can be requested via following questionnaire.

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Questionnaire for Feedback from the participants

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Instructions

- Participation in this survey is voluntary.
- The benefit of participating in this survey is that you will supply us with information that will help us to see where we can better your experience further.
- All data collected in this survey will be held anonymously and securely, and results will only be presented in an aggregated and anonymized form.
- By completing this questionnaire, you give consent that your supplied answers may be used in the further analyses.
- Please answer the following questions as objectively as possible.

Social Inclusion Workshop

Facilitator: ………………………

The response scales for all questions are:

5. Strongly Agree 4. Agree 3. Disagree 2. Strongly Disagree 1. Not Applicable

Questions	Response
1. I was communicated beforehand the objectives and a detailed program of this workshop	
2. Before this workshop, I was quite familiar with some policies around social inclusion	
3. Attending this workshop added in my knowledge on policies around social inclusion.	
4. I am more intend to include student's participation in my and department's academic activities	
5. I plan to be more responsible and accountable towards disadvantaged, underperformed, and disabled students	
6. I plan to initiate troubling dialogues among my colleagues for social inclusion	
7. I'll make efforts toward decolonizing the knowledge to facilitate learners/students	
8. I'll offer students choices in the learning material, assignment, and assessment based on universal learning design	
9. The workshop helped me to understand and realize social inclusion in education	
10. After this workshop, I'll explore new ways to be more socially inclusive	
11. I intend to attend such workshops in future too	
12. I intend to conduct such workshops in my institute/university	

Comments………………………………………………………………………………………………………

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4. Summary

Social inclusion should be seen as a reform strategy which supports and welcomes all students. Student facilitation methods, knowledge decolonization, universal learning design, and non-discrimination etc. should be focused. Teaching all students equitably, proposing a universal curriculum to cater the need of all students, avoiding notions and assumptions such as poor students are deficient, involving students in policy and decision making etc. are some important aspects that should be ensured to enable social inclusion. Debates on the existence of a link between social justice, academic achievement, critical consciousness and inclusive practices also need further interrogation.

Acknowledgement

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Biography

Kapil Gupta is working as Associate Professor in the Dept. of Mechanical and Industrial Engineering Technology at the University of Johannesburg. He obtained Ph.D. in mechanical engineering with specialization in Advanced Manufacturing from Indian Institute of Technology Indore, India in 2014. Advanced machining processes, sustainable manufacturing, green machining, precision engineering and gear technology are the areas of his interest. He has authored several SCI/ISI Journal and International Conference articles. He also authored and edited 15 international books on hybrid machining, advanced gear manufacturing, micro and precision manufacturing, and sustainable manufacturing with the renowned international publishers. He has also successfully guest edited special issues of a Scopus indexed journals and he is currently editing a series of handbooks on Advanced Manufacturing as a series editor. He is a recognized reviewer of many international journals and in the advisor/technical committees of international conferences. He has also delivered invited speeches in international conferences and symposiums, and seminar talks at international universities. Kapil Gupta is a NRF [National Research Foundation] rated Researcher in South Africa. Currently, he is supervising some postdoctoral fellows and postgraduate students who are busy conducting research in advanced manufacturing and industrial engineering fields. He has obtained PG Diploma in higher education and conducting research in engineering education. He is working on implementation of innovative teaching techniques for the enhanced learning of engineering students. Recently, he also developed a manufacturing engineering virtual lab.