



A Sustainable Extractive Industry Requires Educated Responsible Geoscientists

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Most geoscience undergraduate courses are technical with little regard to social responsibility and sustainable development implications. Workshop outcomes have suggested that the introduction of this content into their studies is necessary so that they can apply their technical knowledge in a responsible way. In regard to the extractive industry where most geoscientists in resource rich countries are employed, the industry's record of social and environmental impact with non-sustainable outcomes, particularly in developing countries are evident. Important extractive industry issues such as sustainable development, corporate social responsibility, social license to operate and free, prior and informed consent for Indigenous People have attracted great attention and scrutiny in the development of industry and government policy and rightful concerns from all stakeholders. There are very few examples of these responsibility and sustainability subjects being introduced in undergraduate geoscience education except in some environmental courses in universities in North America, Europe and Australia/New Zealand, but not so well established in developing countries where there is a greater need for this content.

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INTRODUCTION

There is a general lack of social responsibility or ethical content in university undergraduate programs (Sharma and Sharma 2019) and this is the case in science and engineering courses as well where there is a need for this subject to be developed (Børsen et al., 2021). In the geosciences most undergraduate courses and fieldwork projects are technical with little regard to social implications and engagement with local communities. However the introduction of socially responsible courses should be considered as an important content in the syllabus as workshop discussions have suggested (Katz 2021). Social awareness input would make the ideal, but often lacking, race and gender diversified students (Stokes et al., 2015) more balanced in their skills, especially in developing countries, which are often dependent on and socially negatively impacted by the development of their extractive resources. This knowledge should be best practiced in their fieldwork where there are opportunities for community engagement. Ideally as the student progresses to their final year, the field project report would include a community engagement component, an important attribute that can be applied in their career.

Most students in resource rich countries will be employed by the extractive industry where social awareness is especially very important in mineral exploration (Mackenzie et al., 2020) as these geoscientists, who may include other team specialists, are often the first point of

contact with remote communities. This also is the case in the fieldwork of government geological surveys, environmental organizations and NGO's. Students should be aware that social issues related to sustainable extractive industry development are becoming more and more important with all stakeholders as discussed in Vanclay and Hanna (2019). These issues include social license (SL) where communities accept a project to operate with legal, social and economic legitimacy, corporate social responsibility (CSR) where companies adopt policies and practices to reflect their commitment to local communities and free, prior and informed consent (FPIC) that must be obtained from Indigenous People before project operation (Katz 2020). Even the extractive industry investment shareholders are now concerned with these environmental, social and governance (ESG) issues (Heenetigala et al., 2015).

These pressing socially related issues are currently lacking in the undergraduate geosciences study curriculum and a literature review shows virtually no examples, nevertheless there is a recommendation for a proposed departmental and student questionnaire survey to assess and evaluate this need (Katz 2021). However in many universities and colleges in North America, Australia and Europe, it may be introduced in an environmental course. In Latin America (Lencina 2017), Asia and Africa these educational programs are lacking where they are most needed. Recent initiatives on how the geosciences can contribute to the UN Sustainable Development Goals has recognized the importance of new approaches to geoscience education by the incorporation of social and economic sustainability concepts into the curriculum (Metzger et al., 2021).

RESULTS OF WORKSHOPS

The conference workshops on social responsibility in geoscience education (Katz 2021) from 2014–2018 in India, South Africa and Morocco have resulted in the following unrevised rapporteur conclusions that are presented as an indication of the many views on this subject.

University and Departmental Support

- There is a general lack of university, faculty and department practical support for these courses, but this could be developed in the future by making the universities aware that the earth sciences can help to avoid social problems
- There is virtually no staff interest and experience now, but this could be developed in the future by including a social topic in their research.
- In regard to the need for this topic to be introduced students should be afforded space in the curriculum to introduce this awareness, possibly in the environmental courses, which are usually offered.
- Collaboration with social science departments and faculties would enhance the available resources to aid in the development of the course.

Courses and Fieldwork

- Although there is little provision for these courses, ideally the curriculum should have a course for accreditation.
- In all discussions there was a consensus for university students to have social responsibility skills and that it should also be introduced at more basic school/college levels. Society and geoscience development links are important for everyday life.
- Fieldwork, which should be essential component of the study program, is not always offered but in most cases gives the student opportunities to engage the community.
- Fieldwork should also be organized to inform the community of the social and environmental risks and the benefits of the extractive industry.
- Other comments included the ideal need for students' visits to small-scale mines especially in countries where this sector is important to the local economy
- Even if the students are not made aware of their social responsibility in their undergraduate studies, which is the best option, when employed, they may or may not become aware on the job as a poor second option.

Stakeholder Support

- The department and staff should encourage socially responsible content in the syllabus and industry, government and all stakeholders should support this.
- Collaboration with government and especially industry is important, in order to get practical advice and resources
- Government decision makers should be aware that, socially responsible geoscientists are very much needed when there are mining and natural disasters
- Community involvement would be best served by, presenting lectures and seminars in towns and villages and listening to their views and opinions with their consent
- Social and print media can also be used to raise awareness

DISCUSSION

This perspective stresses the need to develop and to introduce social responsibility content into the undergraduate geoscience syllabus. These social issues are an important requirement in the extractive industries of resource rich countries where most of these students will be employed now and in the future. These socially aware geoscientists will be in a better position to overcome the new challenges in the mineral intensive green energy transition of the economy, which demands the discovery of high tech critical minerals (Simmons et al., 2020) many of them found in socially and environmentally impacted developing countries (Sheldon 2020). This is especially important in mineral exploration that often occurs without prior community consultation (Buxton 2022). Responsibly educated and trained professional geoscientists will be best able to serve their communities and country well into the future in a beneficial

and socio-economic, community friendly fashion for sustainable outcomes (Stewart and Gill 2017).

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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CONFLICT OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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