PROBLEM-BASED LEARNING FOR CULTIVATING SOCIAL RESPONSIBILITY IN A COMMUNICATION IN SCIENCE ENGLISH CLASSROOM

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ABSTRACT

The aim of this paper is to examine the teaching and learning context of an English language classroom as one way to assist in-service teachers in grasping the best practices to help students develop a sense of character and values as professionals and socially responsible citizens. Acknowledging the educational significance of new directions in socio-scientific issues research and science-in-context investigations, this study explores the role of the place-based context of a Communication in Science English course offered at Sultan Qaboos University in Oman in cultivating student social responsibility through a problem-based course component. Course related socio-scientific issues, teaching materials, procedures and activities are examined in relation to four key dimensions of social responsibility including multicultural, ethical, civic and environmental competences. Views and perceptions of forty-six student participants shared through reflections are also explored. To analyze the data from the instruments content analysis is applied. The results of the study indicate that the problem-based learning component that addresses sociocultural perspectives advocated in the socio-scientific issues framework contributes to students' development as socially responsible citizens. It supports the learning process toward becoming socially responsible scientists and assists in shaping student awareness as professionals. Moreover, the problem-based learning component provides a chance for future professionals to be more connected to community and global issues. Thus, curriculum designers and course developers and teachers need to support such problem-based components in Communication in Science English courses by giving relevant tasks and assignments, which in turn will contribute to student development as global socially responsible citizens.

Keywords: social responsibility, problem-based learning, English course, Sultan Qaboos University, Oman

INTRODUCTION

The development of human resources has always received attention from the government of the Sultanate of Oman. According to the late HM Sultan Qaboos bin Said, much has been done, "during the past period, various systems of education and curricula were implemented and different training programs were executed, but the matter calls for greater attention to be accorded to linking the educational output to the requirements of the labor market. Hence one of the priorities of the current stage of development and the next stage, which we prepare for is to revise the educational policies, its plans and its programs, which need to be developed to keep pace with the changes that the country is going through" (From the speech of His Majesty Sultan Qaboos bin Said at the Council of Oman in 2012 as cited in The National Strategy for Education 2040, 2018, p.3). His Majesty further added in his speeches that, "more attention should be accorded to the requirements imposed by scientific and cultural development towards the evolution of a generation armed with awareness, knowledge and the

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abilities required for worthwhile work" (ibid.). Consequently, to enable Omani nationals to contribute to the development of the society and humanity at large, great efforts have been employed in education and training. Special attention has been given to upgrading programs and their continuous development (The National Strategy for Education 2040, 2018).

Integrating a problem-based component in English for Specific Purposes courses at Sultan Qaboos University, specifically a Communication in Science English course, is one of the examples. According to the course outline, this is a content-based course intended to develop reading, writing and speaking skills in academic English of first year undergraduate students in the College of Science and College of Education (LANC 2058 course outline, 2021). Aimed at developing confidence among students in using academic English for Science, the course introduces general science texts for content value and activities designed to enhance students' reading, understanding, comprehension and text interpretation skills, as well as writing and speaking activities that encourage the students to research academic articles related to a topic of choice in general science, take selective notes, paraphrase and produce a report and synthesized summaries using several sources, and express themselves coherently and accurately sharing information on a topic of scientific nature. This integrated language and research course also involves a problem-based learning (PBL) component in which students are expected to solve an ill-structured scientific problem, give a presentation, produce a poster, and write reflections. This component is designed using an inquiry-based approach where learning is team-centered, and students follow a process to find possible solutions to socio-scientific issues. While addressing sociocultural perspectives advocated in a socio-scientific issues (SSIs) framework, the PBL component design and delivery aims to match the university's graduate attributes, according to which Sultan Qaboos University graduates "should relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs and be mindful of contemporary issues" (LANC 2058 course outline, 2021, p.2).

Examining the teaching and learning context is one way to grasp the best practices in helping students develop a sense of character and values as professionals and socially responsible citizens. Acknowledging the educational significance of new directions in socio-scientific issues research and science-in-context investigations, what is the role of the problem-based learning component of the English for Science course in the developmental trajectory of Omani students as socially responsible citizens and professionals?

LITERATURE REVIEW

Socio-scientific issues framework

Socio-scientific issues (SSIs) are societal issues which have conceptual or technological connections with science (Sadler, 2004). They are frequently the focus of media reports and create opportunities for all citizens, regardless of background and profession, to interact with science. Common examples of SSIs include climate change, genetic technologies, medical controversies like vaccination, and questions related to energy sources and consumption patterns. The science education community has long embraced the notion of using SSIs as contexts for science learning experiences because of the important role they can play in the development of a responsible citizenry who are able to apply scientific knowledge in keeping with "habits of the mind" (Sadler, 2004, p.514). Negotiating SSIs in the classroom has led to increased ethical sensitivity, argumentation and reflective judgement, with benefits to the capacities of socio-scientific reasoning in students, including dimensions such as complexity, inquiry, perspective taking, skepticism, and the affordances and limitations of science (Zeidler et al., 2019).

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The use of a socio-scientific issues (SSI) framework, paying attention to research and practice, in science education has been an important educational practice tool over the last twenty years contextualizing students' learning and connecting this learning to personal, local and global community concerns (Zeidler et al., 2019). It has been argued by many science educators that socio-scientific issues should be included in science classrooms because of their "central role in the development of a responsible citizenry capable of applying scientific knowledge and habits of mind" (Sadler, 2004). Recent contributions to research in socio-scientific issues consider a different conceptualization within the socio-scientific reasoning of SSIs, including the primacy of socio-scientific perspective taking and the importance of informal and place-based contexts (Zeidler et al., 2019). To illustrate, according to Zeidler, Herman and Sadler (2019), "thinking ethically, so it seems, allows for bridges to be built between science and non-science areas of study, and subsequently between and among students and the social, material, organic and physical world in which they dwell" (p.3). Michel et al. (2002) emphasize that socio-scientific issues when addressed in the context of a problem-based learning educational approach can also enhance student interest and enthusiasm for learning. Linking an SSI framework and context-based problem-based learning course component to inform English for Specific Purposes (ESP) language practice in the context of the culture of Oman can provide "bridges" in the learning of English, as students need to have knowledge of the ESP content areas. In this way their English class becomes much more than practicing the structures of the target language.

Problem-based learning

Problem-based learning (PBL) "is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" (Savery, 2006, p.1). This educational approach, which dates back to the1960s, has its origins in the McMaster University Medical School, Canada. Over the past sixty years, the approach has been applied in learning programs at educational institutions across the globe and several different models have emerged (Noordegraaf-Eelens, Kloeg, & Noordzij, 2019).

The problem-based learning approach is viewed as a serious instructional approach with strong philosophical and epistemological foundations (Savery, 2006). As stated by Savery (2006), "critical to the success of the approach is the selection of ill-structured problems (often interdisciplinary) and a tutor who guides the learning process and conducts a thorough debriefing at the conclusion of the learning experience" (p. 1). There is a lot of evidence that suggests the effectiveness of PBL. Many educators consider that increased student interest and motivation can be enhanced through a PBL approach (Michel et al., 2002). Other researchers and educators consider PBL to be instrumental in developing cooperative working skills, communication skills, critical thinking and problem-solving skills (Al Busaidi, Yusuf & Reinders, 2021).

Though relatively recent in English language teaching, PBL, according to Al Busaidi et al. (2021), "has a particularly great potential to aid language acquisition and to emphasize the meaningful use of the language as a tool for communication and problem solving" (p.2). PBL is also considered to be an effective approach to 21st century skills teaching and learning, such as, for example, social responsibility. As stated in O'Neill, this approach is active and collaborative, resulting in the integration of ideas, information, and experience (O'Neill, 2012), and, according to Yarbro and Ventura (2019), at the same time engages students in real-world situations.

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Social responsibility

Social responsibility is "broadly defined as taking responsibility to behave ethically and with sensitivity toward social, cultural, civic, and environmental issues" (Yarbro, & Ventura, 2019, p.4). The concept of social responsibility is being given increased emphasis in all aspects of society, where individuals are expected to do the right thing (Tuzlukova et al., 2020; Venugopala, 2015). This overriding accountability towards the world in which the human-being resides has been explored in many areas. In the corporate world, social responsibility "indicates that business, in addition to maximizing stakeholder value, must act in a manner that benefits the society" (Social responsibility, 2019, n.p.). In the world of science, Frazer and Kornhauser (1986) and Andrzejewski and Alessio, (1998) have argued that teaching social responsibility in science education is important so that there is increased awareness of ethical and social problems and more understanding of the impact on society as a whole when scientific research decisions are made (Andrzejewski & Alessio, 1998; Frazer & Kornhauser, 1986). In a National Research Collaborative report, O'Neill (2012), considers personal and social responsibility outcomes of education to be as follows: "striving for excellence", "contributing to a larger community", and "taking the perspectives of others seriously" (p.46). Such outcomes are rooted in O'Neill's study that indicated that "nearly one-half of students overall strongly agreed that they came to college aware of the importance of contributing to the greater good, but only one-third strongly agreed that the campus had helped them to expand their awareness, to learn the skills necessary to change society for the better, or to deepen their commitment to change society for the better" (p.20). O'Neill (2012) believes that these outcomes require engaged learning experiences, and O'Neill focuses on three areas described as follows: "diversity and perspective-taking experiences; service learning and volunteering; and other engaged learning experiences, such as discussing course content with students outside of class, active and collaborative learning, and integration of ideas, information, and experience" (O'Neill, 2012, p.46).

Yarbro and Ventura (2019), in the context of their teaching, learning and educational research, use their own framework for social responsibility, in their book "Skills for today: What we know about teaching and assessing social responsibility". They have identified four key dimensions of social responsibility competence: multicultural, ethical, civic, and environmental. Multicultural competence is having knowledge and sensitivity towards cultural differences, while ethical competence is about being knowledgeable and aware of ethical standards and issues and applying ethical reasoning while making decisions when situations are ethically ambiguous. Yarbro and Ventura (2019) relate civic competence to being an active citizen who shows understanding and demonstrates action at all levels of society from local to global. Finally, environmental competence is having knowledge about, and concern for environmental issues while engaging in sustainable behaviors. Developing competence in these dimensions of social responsibility will lead not only to successful students, but also to the development of ethical, just and well-functioning societies (Yarbro, & Ventura, 2019). Such development, as supported by research, can be achieved by several strategies "including problem-based learning, case-based instruction, interacting with diverse groups of people, and providing structured opportunities to practice and engage with real-world situations relevant to social responsibility" (Yarbro, & Ventura, 2019, p. 4).

STUDY

Recognizing the educational significance of new directions in socio-scientific issues research and science-in-context investigations, this study explored social responsibility teaching and learning grounded in the context of a Communication in Science English course offered at Sultan Qaboos University in Oman. The specific focus of the study was on how a problem-

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based course component of the course is used to cultivate student social responsibility in the English language classroom that supports the socio-scientific issues (SSI) framework and four key dimensions of social responsibility competence.

Context

The Communication in Science content-based course is integrated with a problem-based learning (PBL) component which follows an enquiry-based approach where learning is team-centered, and students go through a process to find possible solutions to socio-scientific issues (SSIs) relevant to the local context of Oman. The semester-long project is student self-directed; and the facilitator guides, provides teaching and learning materials, for example, topic prompts, interview research logs, reflection questions and a reflection rubric, and sets timelines for assessed assignments. All documents are worked on by the team collaboratively in a Google Document and the facilitator is able to see which students need guidance and advice and which ones are progressing independently.

The process includes planning, researching and reflecting with activities and stages set out for the students in their PBL project guide. These stages are as follows: Stage 1 is preplanning, Stage 2 is understanding the problem, Stage 3 is writing a group research proposal, Stage 4 involves conducting the research into solutions, Stage 5 is the presentation of the findings and Stage 6 is reflection. The details of the activities and assignments involved at each stage are as follows: Stage 1 involves the students doing activities involving initial group activities, and students think, discuss and write about their initial thoughts on positive and negative aspects of teamwork and collaboration. They then choose their team members for the project and select a problem they would like to research from a list. Stage 2 is where students share what they already know about their selected problem and do background research into the causes and effects of the problem. At this stage they are expected to do the first assignment where they deliver a mini presentation introducing the problem to the class. All their work is submitted to a Google Drive folder, their research folder for the whole semester. The second assignment is the survey where students create a Google Form with five to eight preliminary questions sent out to a random sample of the Omani population to give students some information of the awareness of this sample population about the problem. The responses are collected and submitted to their research folder. Stage 3, still within the planning stage, is where students write their research proposal. Students review what they have learned from their previous assignments and discuss their plans for researching into ways to mitigate their chosen SSI. The research proposal report has a given structure and students are expected to follow this in their written submission and proposal presentation slide show. The facilitator and the classmates give feedback on the proposal and the presenting team is expected to be knowledgeable about the background of their SSI at this stage. The individuals in the research team write a first reflection based on the Gibbs' (1988) reflective cycle about the preparation and delivery of their research proposal presentation work and how they consider their teamwork is going. This reflection asks the reflector to describe what has happened, to examine their feelings/attitudes related to the work, to give an evaluation and an analysis of the success or any issues encountered, and to come up with an action plan for how a similar situation can be improved on. Once the proposal is approved, students start to conduct their research into finding solutions or ways to mitigate the SSI. This is Stage 4. Students' research for reliable sources is guided by the PBL guide booklet, which gives students information on search engines, websites and online libraries where they can search for relevant information. The students, for the most part, have benefitted from study skills classes in their previous year in the university foundation program, so they already have experience of small research projects. Some students are given further guidance in online research methods as needed or requested. Students annotate and make notes from their sources. They are asked to write

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questions about possible solutions to the problem, contact an expert and conduct an interview. All their information and answers is recorded and added to their research folder. The next assignment is for each individual team member to use their notes from the team's collected sources, including the interview, in order to write a summary paragraph about a possible feasible solution to, or way to mitigate, the SSI in the local context of Oman. In Stage 5 students collate all their findings into a scientific poster and present the poster with their findings in a public exhibition either in person or online. Finally, Stage 6 is the second reflection where students reflect individually about the last two stages of the poster preparation and the final poster presentation.

METHODOLOGY

To examine the curriculum design, practice and experiences of social responsibility teaching and learning in the place-based context of a Communication in Science English course through a problem-based course component and provide detailed descriptions, a qualitative research paradigm was used (Coyle, 2007) in this study. Particular attention was given to course related socio-scientific issues, teaching materials, procedures and activities. These were examined in relation to four key dimensions of social responsibility including multicultural, ethical, civic and environmental competences (Yarbro, & Ventura, 2019). In addition, to study practices that are currently in place, excerpts from forty-six participants' reflections who shared their individual experiences through their responses and personal stories were explored. Content analysis was applied to examine trends and patterns in the data from the instruments, in relation to the four key dimensions of social responsibility. The goal of this content analysis is "to provide knowledge and understanding of the phenomenon under study" (Downe-Wamboldt, 1992, p. 314).

RESULTS AND DISCUSSION

The first and the most important finding is that the PBL component of the Communication in Science course is shown to be "striving for excellence", "contributing to a larger community", and "taking the perspectives of others seriously" (O'Neill, 2012, p.46). This course component, as revealed in the study through students' reflections and positive responses towards the integration of the PBL, is engaging and learning experience centered. Such engaged learning experiences, similar to O'Neill's (2021) study results, involve discussing course content with students outside of class, active and collaborative learning, and integration of ideas, information, and experience.

Furthermore, the study revealed the focus of the course's PBL component on all four key dimensions of social responsibility competences and behaviors outlined in Yarbro & Ventura's, 2019 publication. In more detail, the examination of the course related socio-scientific issues, teaching materials, procedures and activities clearly indicates a PBL component focus on multicultural competence where one behavior, as described in Yarbro and Ventura (2019), is "seeking out opportunities to work with people who have different backgrounds and perspectives" (p.9). This competence is encouraged in the PBL course component where there is extensive use of research papers and articles, written by authors, from different regions and cultures about global, regional and local issues. Student participant 6, for example, noted that, team members '*find the information easy and in trusted sites because robots have become the focus of importance in this century, there are many articles about them on the Internet*.' Students in a different research team, as reported in participant 12 reflections, when researching the problem of the increase in ocean-microplastics, accessed articles which focused on the expeditions of a French not- for- profit organization researching the problem and different ways of mitigating the issue. Such research activities into what is

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happening globally can be seen as an indicator of the development of multicultural competence in our students. It can also be noted that there is another trend which has been revealed as influential for this competence in this teaching and learning context. That is that the majority of facilitators of the PBL project are from different ethnic backgrounds bringing multicultural perspectives to the students' learning. These facilitators help students validate different approaches in researching socio-scientific issues and understand them. Also, when researching for ways to mitigate their chosen socio-scientific issues in Oman, students spend time examining and discussing with the facilitators various possibilities used in different cultures and countries, and the feasibility of applying these in the local context.

The results of the study indicate that the second competence integrated in the PBL course component involves being "knowledgeable about relevant ethical standards within one's field" as well as being able to "recognize the ethical aspects of a situation" (Yarbro and Ventura, 2019, p.9) and being able to apply that ethical reasoning. In the Communication in Science class context, students are required to carry out responsible research conduct, for example, acquiring knowledge ethically by using correct citation styles, applying appropriate interview techniques and organizing the research according to international standards. This can be illustrated by the commentary of study participant 3 who referred to the importance of appropriate research organization, when s/he noted that s/he '*learned from the last time to stick to time and not waste it on something that is not so important. It is also important to use time in an organized manner for each part of the project, by making a schedule that includes all the work*'. Participant 7 also realized the importance of accuracy in research noting that, s/he '*felt that choosing the information that we will focus on was difficult because we must choose accurate information, so we stopped on each website and checked its accuracy.'*

The third identified competence is civic with one of the behaviors being "participation in community organizations" (Yarbro and Ventura, 2019, p.9). According to the course outline, in the context of the Communication in Science course, students are working collaboratively in PBL teams and also together with experts in the field, whom they interview, to discover ways to mitigate a particular socio-scientific issue which is affecting Oman. Throughout the project students are thinking, discussing, researching, writing and presenting collaboratively. As described by student participant 1, '*working with a team allows us to benefit from the opinions of team members, which contributes to increasing the quality of the final work*'. Participant 2 noted the '*unrestricted exchange of ideas, and mutual assistance" and "practicing how to work together with others made this project extremely worthwhile*'. While participant 4 commented in the first reflection that s/he '*was both surprised and happy because the group did well because of overcoming the problems faced with cooperation and assistance*'. However, the same participant also noted in reflection 2 that s/he '*wasted a lot of time because the group was not disciplined in time to deliver. In coming times, I will make sure to alert group members about time and cooperation*'.

The fourth competence that attends to student development as socially responsible citizens and professionals includes being able to identify how "current environmental issues are relevant to one's field" (Yarbro and Ventura, 2019, p.10). The results of the study clearly indicate that this key component of social responsibility is also in the focus of Communication in Science course. In the course, for example, the topics, tasks and assignments are based on finding ways to mitigate a socio-scientific issue in the local context. All students are studying a variety of science majors in the College of Science and the SSI topics reflect these diverse majors, but all topics are connected with ethical, civic and environmental social responsibility competences, for example, pesticides and fertilizers, ghost fishing, Oman energy after petroleum, vehicle emissions, ocean micro plastic pollution, robots and people and a recent addition, rapid vaccine development in an emergency public

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health situation. This connection with the development of social responsibility competences can be exemplified by an excerpt from the reflections of participant 2 who noted that s/he '*tried to give convincing and suitable solutions which may help to stop this problem'.* S/he further explained that also, s/he '*searched for some ideas and plans could scientists use to reduce the dangers of this problem'* and s/he *'really wishes that this problem disappears in the future do not kill more marine organisms*'. Participant 7 also showed raised awareness of the importance of the same SSI stating that, s/he *'enjoyed the part of reading about the problem because of learning new things'.* Participant 4 pointed out personal importance of the problem s/he researched and noted that s/he *'will research and read as much as s/he can to obtain information that will help me in the research.*' Participant 1, in reflection 2, stated that if s/he *'could go back in time, s/he will choose this problem again because s/he was happy to search and work on a big problem and telling the student and society about this problem, and sadly most of them didn't hear about it at all'*. S/he also talked about challenges: '*Among the challenges we faced, some of the students asked questions out of our topic maybe because they didn't hear about the problem before, and they didn't understand the problem well. But we were happy to explain the problem to the student and telling them about its effects and causes, I was very gladdened because we told them about a new problem, and this will contribute to solving it'.* In this way, as emphasized in Al-Busaidi et al. (2021), "students are engaged in exchange of meaning, discussion of possible causes and solutions, and reaching agreements" (p.3), and develop as socially responsible individuals.

CONCLUSIONS

The results of the study indicate that the problem-based learning component that addresses sociocultural perspectives advocated in the socio-scientific issues (SSIs) framework contributes to students' development as socially responsible citizens. It supports the learning process toward becoming socially responsible scientists and assists in shaping student awareness as professionals. Moreover, the problem-based learning component that incorporates four key competences of social responsibility provides a chance for future professionals to be more connected to community and global issues.

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