

Intrinsic Case Study of Co-Curricular Leadership Development Program for Undergraduate STEM Students



SOUTH DAKOTA MINES
An engineering, science and technology university



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Introduction

At South Dakota Mines (a midwestern science, technology, and engineering university), the [Mines Advantage](#) program seeks to provide quality opportunities for students to improve upon the leadership skills needed for graduates to be successful in an increasingly diverse and global industry. The program focuses on developing skills in six core competency areas: career preparation, cultural and global inclusion, community involvement, personal development and ethics, leadership and teamwork, and communication.

This purpose of this intrinsic case study was to evaluate the effectiveness of the Mines Advantage leadership development program for undergraduate STEM students at South Dakota Mines. This study explored the experiences of students who participated in the program and sought to understand if they perceived the program as effectively aiding in their professional development.

The results of this study will help the university ensure it is providing quality professional development opportunities to students and may also provide insight into how the university could enhance the program.

Literature Review

Companies that recruit today's engineering graduates are more frequently seeking to hire individuals who not only have a solid foundation of technical knowledge, but also have strong leadership and communication skills (Almalki et al., 2016).

Historically, engineering universities have been ineffective in developing the leadership skills of their students (Cox et al., 2010). Leadership skills are vital to advancing the engineering field and provide a solid foundation for students to learn how to work in an increasingly diverse global market (Almalki et al., 2016). Universities that provide undergraduates with courses that combine business and engineering principles along with diverse cultural learning have been effective in enhancing students' leadership skills (Crumpton-Young et al., 2010).

Additionally, co-curricular programs that focus on developing students' initiative, systems-thinking, networking, relationship-building, communication, and problem-solving skills ensure the coexistence of the technical and leadership skills that are necessary for students to become well-rounded leaders in STEM fields (Almalki et al., 2016).

Participants

The ten students included in this study represented a variety of the university's 20 undergraduate degree programs, which allowed more comprehensive generalizations to be developed. Male and female students were evenly represented, even though the university's male-to-female ratio is 3:1. Two students also self-reported as minorities. The student participants must have also completed at least one internship within their respective disciplines, so they could reflect on how their experiences in the Mines Advantage program affected their experiences in industry. All students in this study completed more than one internship or co-op with companies ranging from small manufacturing plants and regional energy companies to global companies like Kimberly-Clark, Emerson, Tesla, and Boeing.

Methodology

This study was designed as an intrinsic case study (Stake, 1995). Since this study included data primarily centered on the experiences of students participating in the Mines Advantage program, elements of transcendental phenomenology were incorporated to form an objective description of the participants' experiences (Moustakas, 1994; Creswell & Poth, 2018). Further, utilizing a pragmatic framework for this research allowed for the collection of various forms of data and focused on the practical implications of the findings (Creswell & Poth, 2018). Quantitative data was also included to provide additional contextual information.

Data Collection & Analysis

Interviews with students served as primary source of data. Interviews with faculty, staff, and board members were also conducted to collect historical knowledge about the program, so a thorough understanding of its evolution and outcomes could be developed.

Atlas.ti was utilized to analyze transcripts in an open coding process; analytic memoing process and axial coding were also utilized to further refine the data collected (Saldana, 2016).

A chi-square test was also performed to compare the 84% graduation rate of the 504 students who participated in the program (405 graduated) with the 47% graduation rate of the 2,963 students who did not participate in the program (1,403 graduated). Employing a .05 significance level for the test, a significant relationship was found between the variables, $\chi^2(1, N = 3,467) = 188.05, p < .00001$.

Results

The results indicated students generally exhibited a positive perception of the Mines Advantage program. They believed the program's curriculum aided in their professional development skills—primarily in the areas of communication, exposure to cultural diversity, community service, and leadership development. Additional strengths of the program are centered on how the program prepares students to meet industry needs, develops students' emotional intelligence, and supports the university's strategic goals. Further, the quantitative data indicated program highlighted a significant relationship between participation in the Mines Advantage program and student success (graduation rates).

Many of the challenges the program faces are related to the management of program logistics including marketing, reflection requirements, lack of support from faculty and staff, unappealing milestone recognition, inefficient reporting software, a lack of diversity in the student participants, and the need to enhance curriculum for diversity and global inclusion. To address these challenges, there are four recommendations the university should consider:

1. Review the program's curriculum and requirements and make necessary adjustments;
2. Evaluate the staff needs and management of program logistics;
3. Develop a comprehensive marketing plan that targets students, faculty/staff, and employers; and
4. Create an annual review cycle with specific checkpoints throughout the year for ongoing evaluations of the program.

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