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EDUCATIONAL PLANNING

A JOURNAL DEDICATED TO PLANNING, CHANGE, REFORM, AND THE IMPROVEMENT OF EDUCATION

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FROM THE EDITORS

This issue of Educational Planning includes interesting planning topics such as scenario planning in higher education, transformational leadership and staff satisfaction, seeking external resources for higher education, problem-posing and mathematics achievement, and differentiated instruction at the post-Covid period.

In the first article, Coates, Foucar-szocki and Snow shared their learning experiences on the organizational design barriers they perceived to have encountered with scenario planning in higher education for program development.

In the second article, Degef and Kidane investigated the relationship between the transformational leadership of academic leaders and the job satisfaction of academic staff in polytechnic colleges of Ethiopia. They found a weak correlation between transformational leadership and job satisfaction.

In the third article, Johnson and Chan explored the strategies higher education institutes used to seek external resources to help develop the education programs. A prestigious Chinese higher education institute was selected for the case study.

In the fourth article, Sangpom and Sangpom examined the effect of using online problem-posing to enhance students' mathematics achievement during the outbreak of the COVID-19 pandemic in Thailand. The result indicated a statistically significant difference in the mathematics post-test mean scores between the experimental and control groups.

The fifth article by Aranha, Marwaha and Polka investigated teachers' desired and actual use of differentiated instruction within the Greater Toronto Area. The study was conducted to gain a perspective on the areas of particular growth for differentiated instruction in the post-COVID educational environment.

The editors would like to thank all the authors of this issue in sharing their unique planning ideas to broaden our academic view. We educational planners can learn from the success stories of a global perspective for adaptation in similar situations in our country.

Editor: Tak Cheung Chan Associate Editors: Walt Polka and Holly Catalfamo Assistant Editor: Selahattin Turan

July, 2024.

ABOUT THE AUTHORS

Roselle Aranha is a Ph. D. student in the Leadership and Policy doctoral program at Niagara University, New York. Previously, she earned a Ph.D. in Education from the University of Mumbai in 2016. Her research interests include Educational Psychology, Action Research, Curriculum and Evaluation Leadership and Design, Quality Processes for Institutional Development, Teacher and Student Well-being, Diversity and Inclusion. Roselle worked as assistant professor in the teacher education program at the University of Mumbai for ten years. She has also taught in various PreK-12 schools in Mumbai, Canada. She is an author, a researcher and an educational consultant.

Tak Cheung Chan, Professor Emeritus of Educational Leadership, Kennesaw State University, U.S.A. is a graduate of the Ed.D. program of the University of Georgia. He was a secondary school teacher, assistant school principal, school principal, and district office administrator. His previous experience in higher education includes serving as a faculty member of educational leadership at Valdosta State University, Georgia Southern University and Kennesaw State University. His research interests include educational planning, facility planning, school business administration, school finance, and international education.

Tabitha Coates is an Assistant Professor at James Madison University. She teaches in the areas of human resource development, organization development and change management. Dr. Coates has worked in banking, human resources, and various positions in higher education. Her research interests are in the meaning of work, phenomenology, and organizational development.

Milion Bekele Degef is a Ph.D. candidate in Educational Policy and Leadership at Addis Ababa University, College of Behavioral Studies and Department of Educational Planning and Management, Ethiopia. He is also a lecturer at Wollo University, Department of Educational Planning and Management, Dessie, Ethiopia. He has published an article on perceived leadership style and organizational commitment in polytechnic colleges as co-author. His research interests are in educational administration, leadership, policy and management.

Diane Foucar-Szocki is Professor Emerita at James Madison University where she taught in the Adult Education/Human Resource Development at James Madison program, served as Academic Unit Head of the Learning, Technology and Leadership Education Department; Interim Academic Unit Head of Middle, Secondary and Math Education, Coordinator of Grants, Contracts and Special Programs and was Assistant to the Dean.

Arvin D. Johnson is the Interim Director of the School of Instructional Technology and Innovation and an Associate Professor of Educational Leadership at the Bagwell College of Education at Kennesaw State University. He has held various leadership positions in higher education and K-12. His K-12 experiences range from elementary to high school, including serving as a special education teacher, assistant principal, and principal. In higher education, his experiences include professor, executive director, director, coordinator, and interim school director. Dr. Johnson's research interests include principal professional learning and preparation, instructional technology, finance, and curriculum and instruction.

Befekadu Zeleke Kidane is an Associate Professor of Educational Policy and Leadership at Addis Ababa University, College of Behavioral Studies and Department of Educational Planning and Management. He has published a number of articles in local and international reputable journals at different levels of educational institutions. He also offers courses for several doctoral programs at Addis Ababa University and other regional universities in Ethiopia. His research interests include educational administration, management, policy and leadership.

Sushma Marwaha is a retired Ontario school administrator, and K-12 educator with over 35 years of experience. She acquired her Bachelors and Master of Sciences degrees from Rajasthan University in India. She has taught students at various levels of the educational spectrum in India, Canada and the USA. She is an alumnus of Niagara University, having completed her Masters in Educational Administration in 1995 and her Ph.D. in 2014 from the same university. Her dissertation was titled Examining the Skill Set of Culturally Proficient School Leadership from an International Perspective: A Mixed Methods Approach Using Critical Race Theory and Multidimensional Analysis. She is presently an Adjunct Professor at Niagara University, teaching in the Bachelor of Professional Studies Program in Ontario and Ph.D. Program in Leadership and Policy.

Walter S. Polka retired in 2003 after serving over 35 years as a public-school teacher, curriculum coordinator, school district administrator, and superintendent of schools in New York. He began his higher education career in 2003 as associate professor of educational administration at Georgia Southern University and is currently a tenured full professor in the Department of Leadership and Coordinator of the PhD program in Leadership and Policy at Niagara University, New York. He has chaired over seventy-five doctoral dissertations and has authored over 75 peer reviewed journal articles and book chapters. Eight of his books about educational leadership issues have been published. He has presented his research in 47 states of the United States and in over 25 countries world-wide.

Narongsak Sangpom is currently serving as the Vice President of Rajamangala University of Technology Suvarnabhumi's Suphanburi campus. He was born on May 9, 1973, in Nakhon Si Thammarat Province, Thailand. He earned his Ph.D. Degree in Information and Communication Technology for Education, Faculty of Industrial Education, King Mongkut's University of Technology North Bangkok, 2017. In addition to his administrative role, he works as an instructor at the undergraduate level in the field of computer engineering, which involves applying computer science to education. His expertise lies in developing learning models using associative learning theory to foster creativity under professional standards for higher education teachers.

Wasukree Sangpom is a lecturer in the Computational Science Department at the Faculty of Science and Technology, Rajamangala University of Technology Suvarnabhumi Suphanburi Campus. She was born on October 30, 1975, in Nan Province, Thailand. She earned her Ph.D. Degree in mathematics education from Khon Kaen University, Thailand. Her research expertise and interests include classroom learning management, mathematical thinking, mathematics process skills, innovation related to education, and applying various sciences in learning and teaching.

Randell Snow is a licensed K-12 teacher and administrator. Mr. Snow is a former K-12 educator in high-risk dropout prevention. He has worked in pharmaceutical manufacturing and clinical pharmaceutical research as a Human Resource Analyst. Mr. Snow has spent the past 17.5 years as a Lecturer in Human Resource Development at James Madison University. Mr. Snow has taught in both the HRD minor and AHRD Master's programs bringing a practitioner approach to both programs bridging theory into practice.

ORGANIZATIONAL DESIGN BARRIERS OF USING SCENARIO PLANNING FOR PROGRAM DEVELOPMENT IN HIGHER EDUCATION

TABITHA COATES DIANE FOUCAR-SZOCKI RANDELL SNOW James Madison University, U.S.A.

ABSTRACT

In this article we share our learning experiences on the organizational design barriers we perceived to have encountered with scenario planning in higher education for program development. Our perceived barriers discussed include misalignment of culture and change intervention; constructing organizational reality and meaning making; knowledge creation and transfer of knowledge; and short term versus long term outcomes. Our retrospective analysis contributes to the understanding of the complexity of change in higher education and adds to the knowledge base on using scenario planning in a bureaucratic, hierarchical context. Our experiences are incongruent with implicit assumptions that scenario planning can be used in any context (Balarezo et al., 2017), and illustrate some important constraints to consider before using this type of forward-thinking intervention. We provide recommendations for using scenario planning and for transformational change in higher education. These changes have implications for more creative, future-oriented educational planning processes for improving higher education teaching and learning experiences.

INTRODUCTION

Universities increasingly need to be adaptable and able to evolve to meet the demands of society (Petersen & Bartel, 2020; Spanier, 2010). Current challenges facing universities include expanding expectations for productivity, technological advances, lack of public funding, reliance on external financial support, and serving multiple functions and missions (Greer & Shuck, 2020; Petersen & Bartel, 2020). Higher education increasingly functions in an unpredictable and uncertain landscape, suggesting that large-scale transformational change may be needed. However, change in higher education is difficult (Petersen & Bartel, 2020), requiring the old guard to embrace paradigmatic shifts (Greer & Shuck, 2020) and implement forward-thinking change interventions that expose, critique, and even change, if necessary, underlying assumptions, beliefs, and values about the function and purpose of higher education (Greer & Shuck, 2020; Petersen & Bartel, 2020). Research is lacking on how universities are responding to disruptive changes in our society (Hall & Lulich, 2021). Over twenty years ago, Rieley (1997) recommended that higher education institutions use interventions such as scenario planning to better understand multiple, plausible futures, as strategic decisions can often be based on bias and overconfidence that keeps university structures and systems from evolving. In a follow-up response twenty-one years later, Rieley (2018) posited that not much progress in planning for higher education's future has been made.

In this time of increasing demands on higher education the need for questioning our assumptions, values, and belief systems at the department and program levels of universities matters. Researchers recommend supporting and promoting high quality, innovative graduate programs because students are entering a dramatically different job market than in prior years (Hakkola & King, 2016; Spanier, 2010). In alignment with these recommendations, our graduate program responded to the findings of an external review team to position our program to better reflect the field and be a competitor in the marketplace. The external review findings suggested the

main obstacle to the program's potential growth and impact was an ambiguous program identity that impacted other foundational factors including core competencies and capabilities. We needed an intervention that forced us to question our biases and assumptions as a program situated within a mid-size university. We also sought a process that incorporated and supported strategic planning flexibility and adaptability. We selected scenario planning to help us consider several plausible and desired futures for our program. This approach could help inform our decision-making by creating a shared mental model of our identity and a more comprehensive and effective plan for addressing the recommendations from the external review team.

The purpose of this article is to share our experiences with scenario planning for program development and highlight our perceived barriers to implementation. Our retrospective analysis contributes to the understanding of the complexity of change in higher education and adds to the knowledge base on using scenario planning in a bureaucratic, hierarchical context. Our experiences are incongruent with implicit assumptions that scenario planning can be used in any context (Balarezo et al., 2017), and illustrate some important constraints to consider before using this type of forward-thinking intervention.

This article is structured into six sections. First, the context of our program is presented. Second, the scenario planning process is described. Third, we present relevant literature specific to organizational design and understanding the underlying assumptions of a functional structure that create the barriers we experienced. Fourth, we describe the perceived barriers encountered as misalignment of culture and change intervention; constructing organizational reality and meaning making; knowledge creation and transfer of knowledge, and short term versus long term outcomes. Fifth, we provide recommendations for using the scenario planning process at a program level in higher education. Finally, we discuss implications for educational planning initiatives.

OUR CONTEXT

In accordance with other universities, our graduate program is located within a bureaucratic and hierarchical operating system (Manduk, 2023; Petersen & Bartel, 2020). It is our observation that the overall university is pursuing a more centralized approach to how work gets done including, as examples, but not inclusive of all efforts, centralization of academic advising, career planning, and research and development. Our graduate program is an applied field situated within a College of Education heavily focused on public education and teacher preparation. Most programs in our field are situated in colleges/schools of education based on the focus of learning through adulthood (Li & Nimon, 2009). In our program, students learn the skills and knowledge to secure positions focused on developing both people in the workplace and organizations themselves. This is accomplished through understanding the areas of adult education/learning, training and development, organization development, and career development.

Academic program reviews are conducted for the purpose of providing evidence of program effectiveness, to inform decisions about resources, and for continuous improvement initiatives that advance the mission of the University ("Academic Program Review," 2022). The review begins with faculty submitting an internal self-study report (ISSR) that provides data on the current state of the program, followed by an external review team visit. In our case, the external review team conducted a virtual visit. The external team is led by a campus faculty member and is composed of members from other programs across campus, faculty from other institutions, and industry experts. During our visit, the team reviewed the ISSR, supporting documentation, and conducted virtual interviews. The team provided a report with findings and recommendations for program improvement. Review of the findings led to faculty prioritizing the program's ambiguous

identity. Over time, the program had been influenced by the expertise, background, and interests of faculty in charge. The program had become less grounded in the field. Resolving our identity would inform the program's core competencies and capabilities, contributing to a sustainable, competitive program that provides value to students in the workplace. The outcome of the process would align the foundational and critical program components including mission, vision, values, curriculum— and related facets of marketing, recruiting, evaluation, networking relationships with alumni, and other external and internal partnerships.

SCENARIO PLANNING

Scenario planning is an organizational level change intervention grounded in system's theory (Anderson, 2012; Balazero et al., 2017; Chermack, 2011; Chermack & Walton, 2006). Traditional strategic planning tools are often rooted in the notion of stability and single focused forecasting (Chermack, 2011). In contrast, scenario planning develops multiple futures, making it appropriate for use in the uncertain, complex, unpredictable, and continuously changing landscape (Balarezo et al., 2017; Chermack, 2011) of higher education today. Developing multiple scenarios yielded several plausible outcomes, different driving forces, and impact levels to better inform decision options. Scenario planning allowed us to think deeply about plans; assess a wider array of threats; opportunities, strengths; and better contextualize our complex problems. As a highly participative, collaborative effort that requires dialogue and transfer of knowledge within the organization (Balarezo et al., 2017; Chermack, 2011; Chermack & Payne, 2006), scenario planning seemed to suit our situation at the time. We engaged in the step-by-step phases of the performancebased scenario system intervention (Chermack, 2011) of project preparation, scenario exploration, scenario development, and scenario implementation. For project preparation, we received support from college and department leadership. We engaged in the scenario planning process from fall 2020 to spring 2022. The scenario team consisted of program faculty intent on making sense of our program identity and learning how the program could become more strategic and competitive. For the scenario exploration phase, data were gathered in spring and summer 2021. Data collection methods included existing data, focus groups with students, individual interviews with faculty, an interview with the leadership team, a survey to prospective students, benchmarking data on programs in the field, and peer-reviewed research. A report of the findings was shared with program faculty and college leadership in September 2021.

In fall 2021, the scenario development phase began with the faculty team meeting weekly to brainstorm major forces informing the program, and then ranking these forces by impact and uncertainty levels. The two critical uncertainties selected were audience and delivery. Using the critical uncertainties we created a research agenda, defined our plots and titles, wrote four scenario stories and shared them with one another, anticipating the next phase of scenario implementation.

We were able to conduct some steps within the scenario implementation phase. We wind tunneled the four scenario stories by returning to the original purpose of intervention: asking questions, exploring ideas and insights, and brainstorming potential issues. We immersed ourselves in the scenario stories. We identified threats and opportunities that informed the development of effective strategies within each scenario. We developed plausible and actionable strategies in each scenario for working towards our desired future for the program. These sessions lead to our team creating a business idea, analyzing the current goals of our college/university through the lens of each scenario, and developing program indicators of successful scenario fruition. We were unable to progress from our team strategic conversations to implementing our strategic plans or the final phases of overall project assessment and outputs. Our experiences with scenario planning provide insight on many aspects of the use of the scenario planning process in the higher education organizational context. Organizational barriers we encountered seem to stem from organizational design and structure that clashed at the implementation stage of the scenario planning process with the outcomes the scenario planning process is designed to yield.

ORGANIZATIONAL DESIGN AND UNDERLYING ASSUMPTIONS OF STRUCTURE

Organizational design is the interconnected systems that create the conditions in the workplace for employee success (Kates, 2010). To fully support the work, all the system components need to be aligned to reinforce the desired actions and behaviors. These components include strategy, structure, processes, rewards, people practices, culture, performance management systems, technology, and feedback loops (Anderson, 2012; Kates, 2010). Structure is often perceived as the way the boxes are visually organized on a chart (Petersen & Bartel, 2020), which has underlying assumptions about the functioning of an organization and its responses to change.

Bureaucratic structure is defined by control, high centralization, unequal power distribution, standardization, and high uncertainty avoidance (Petersen & Bartel, 2020). Centralization organizes organizational initiatives under the assumption that they are more likely to be successful if developed from the top-down (Petersen & Bartel, 2020). In alignment with these characteristics the functional structure is a hierarchy (Anderson, 2012). A hierarchical functional structure has chains of command where information sharing is slow, providing obstacles in communication and coordination among employees (Anderson, 2012; Cummings & Feyerherm, 2010). There is often a short-term focus of the organization around routine and standardization of work (Cummings & Feyerherm, 2010). These focuses reinforce the sense of stability and certainty that these structures are built upon (Alvesson & Spicer, 2012; Roubelat, 2006). Coordination and decision-making happen at the top levels of the organization resulting in narrow perspectives and the possibility of groupthink (Alvesson & Spicer, 2012; Anderson, 2012). In this type of system, employees are passive. The standardization of work and emphasis on efficiency provides a lack of space and openness for deep thinking, reflectiveness, and asking difficult questions (Alvesson & Spicer, 2012). Consequently, employees do not disrupt this system because challenging it creates conflict, which is unwelcome (Alvesson & Spicer, 2012).

PERCEIVED BARRIERS DURING THE SCENARIO PLANNING PROCESS

Misalignment of Culture and Change Intervention

Culture is an organization's assumptions of the world and how to succeed in it (Schein & Schein, 2019). It is how an organization gets work done in the day-to-day activities (Howard-Grenville, 2020). Culture stems from, and is informed by, the historical context of the organization (Schein & Schein, 2019). Schein and Schein (2019) identify three levels of culture. The first level is the outer layer known as artifacts, which are what is seen in terms of the visible structures, processes, and behaviors. The middle layer is the espoused values and encompasses what the organization wants you to see and experience, such as its value claims, goals, and ideals. The inner layer is the underlying assumptions and beliefs that drive the behavior, actions, and organizational practices. The inner layer is reflective of the organization's collective assumption on how to be successful in the world. Core elements of culture can be described in terms of understanding how organizations address challenges, solve problems and respond to change (Cummings & Worley, 2009; Howard-Grenville et al., 2020); the norms, standards, rules of conduct, values, basic assumptions, and mindsets that drive behavior among organizational members (Burke, 1994; Cummings and Worley,

2009; Katz & Miller, 2010); authority structure, distribution of power, reward allocation systems, communication patterns (Burke, 1994), and decision-making processes (Howard-Grenville, 2020). There are many different types of organizational cultures described in the literature. Commensurate with the functional organizational structure, or hierarchy, higher education culture can be understood as one that values unequal power distribution, formality, tradition, stability, rules, and efficiency (Cameron & Quinn, 2011).

Organizational culture plays a significant role in the sustainably of change efforts (Burke, 1994). In fact, researchers and practitioners warn us that a change initiative will not succeed in the workplace if it does not align with the culture of the organization (Katz & Miller, 2010; Kezar & Eckel, 2002; Merton et al., 2019). Through their case studies, Kezar and Eckel (2002) found that change initiatives that violated organizational cultural norms experienced challenges. By using scenario planning as our change intervention, in hindsight, we recognize that we violated several norms of our organization cultural that is steeped in a historical context of being a hierarchy. We did not expect that our organization was not designed for program level transformational change that would help us better respond to the unpredictable, uncertain environment. Yet, our program is in an applied field that must change with the nature of work. In our program we provide preparation for highly uncertain environments, so we must take into consideration work itself, the needs and skills of the job market, perceptions of graduate degree utility and the purpose of higher education in general. We selected the scenario planning process to increase our program's capacity to function in this type of environment because the process itself requires imagining multiple futures that account for complexity, unpredictability, and continuous change (Chermack, 2011). While scenario planning increased our ability to make decisions to adapt, remain competitive, and survive (Korte & Chermack, 2007), its results infringed on organizational elements of the functional structure of a hierarchy such as stability, control, power, and limited use of cognitive capacities (Alvesson & Spicer, 2012).

Systemic interventions, such as scenario planning implementation, involve a paradigmatic shift in thinking about how things are done in organizations, working best in flexible, adaptable, decentralized environments that value participative decision-making (Cummings & Feyerherm, 2010). Our assumptions about the functional structure of our organization anticipated sufficient adaptability, decentralization and valuing of participative decision-making for scenario implementation. However, the process challenged existing paradigms and aspects of the status quo (Roubelat, 2006) becoming disruptive to, and challenging, the system's assumptions. A culture based on control inherently limits creativity, innovation, and flexibility by design (Eversole et al., 2012). This is in alignment with Burke's (1994) perspective on the relationship of change and culture in that the two are so intertwined that "some significant aspect of an organization's culture will never be the same" (p. 9). When assumptions of how the system is supposed to work are disturbed, stakeholders take action to reduce conflict and tension for equilibrium of the status quo (Burke, 1994). In this context, implementation of the strategic plan developed at the program level did not align with a more imposing and less participatory organizational culture. This outcome informs our next barrier which we identify as construction of organizational reality and meaning making.

Constructing Organizational Reality and Meaning-Making

In a functional structure, decision-making happens at the upper levels of the organization. There is a lack of autonomy provided to employees for reflectiveness and deeper thinking (Alvesson & Spicer, 2012; Anderson, 2012). Such structures can be experienced as oppressive by not allowing employee's experiences for the constructed meaning of their work to matter (Alvesson & Johnsson, 2022). Work is routine and standardized where "actors dutifully follow a script they have been handed, which tells them what to do" (Alvesson & Spicer, 2012, p. 729). This level of control can be argued to be dehumanizing because "the activity of being a person is the activity of meaningmaking" (Kegan, 1982, p. 11). In a functionally-oriented structure, people in the upper levels of an organization are practicing sense-giving in that they are giving employees the organizational reality (Gioia & Chittipeddi, 1991) with the assumption of not being challenged. Organizational reality is not meant to be a shared construction between employees and leaders, which further reinforces control and unequal distribution of power. Imposed sense-making for our program has historically been influenced by a focus on education as elementary and secondary schooling, with less attention on learning and development in adulthood. This organizational reality is in alignment with research showing that there is an overall a lack of understanding of our field's focus on "organizational life" and a divergence of values, purpose, and outcomes with other departments that mostly focus on K-12 education in the United States (Cho & Zachmeier, 2015, p. 150). We conjecture that over time the foundations and bounds of our program identity started becoming more malleable to better fit the organizational reality created by those in leadership positions to reduce conflict and tension for the college's identity.

Using scenario planning and imagining plausible, challenging futures required us to think deeply, be reflective, and ask difficult questions. We were making meaning of our experiences and our work while creating a shared mental model and vision of the identity of our program. As this process unfolded, our *fit* within the constructed organizational reality was becoming more uncontrollable. The more grounded and vocal we became about our shared mental model, program possibilities, and needed resources to flourish, more tension and conflict occurred, creating "organizational dissynchronization" (Alvesson & Jonsson, 2022, p. 725). Dis-synchronization occurs when the levels of sense-making and shared meaning of the organizational reality are no longer in equilibrium (Alvesson & Jonsson, 2022). In the given organizational reality, meaning-making is restricted, so individuals are supposed to follow orders "without complaining, being a responsible, law-abiding employee" (Alvesson & Spicer, 2012, p. 740). Our disruption of sense-giving further illuminated the misalignment between the espoused values of a higher education system, such as innovation and collaborative decision-making, and the underlying assumptions of what it means to be successful in a centralized, hierarchical functional structure.

Knowledge Creation and Transfer of Knowledge

The transfer of knowledge of the constructed mental models from those doing the scenario planning to the wider organization can be problematic and is not well understood in the literature (Balarezo et al., 2017; Chermack & Payne, 2006). Gaining wide-spread support and buy-in for the scenario planning generated changes within the system requires the newly created knowledge and meaning to be communicated through all organizational levels. Doing this requires trust of interactions, relationships, and lots of vertical and lateral dialogue (Chermack, 2011; Chermack & Payne, 2006; Nonaka, 1994). Management style and organizational design factors are critical for successfully transferring knowledge, especially when employees are not able to interact on equal terms (Nonaka, 1994). Additionally, differentiation of power and top-down information sharing can be difficult for coordination and communication among employees (Anderson, 2012; Cummings & Feyerherm, 2010). There is an underlying assumption that knowledge creation only happens at the upper levels of the organization, so lower-level employees serve only minor relevance because they should be focused on implementing the objectives and goals dictated by leadership (Nonaka, 1994). Participating in the scenario planning process enhanced both our learning and imagination

(Chermack, 2011). However, because new knowledge was generated at our program level that disrupted the *given* organizational reality and threatened control and power, the possibility of gaining buy-in and support from the wider organization for future actions became more challenging than anticipated. Scenario planning needs space for the mental models to be put into practice, requiring experimentation and refinement (Nonaka, 1994) in an organizational context that is adaptable, flexible, takes risks, and learns from failure to make continuous improvements. These conditions are incongruent with the functional, hierarchical structure assumptions of environmental stability and predictability.

Short Term Versus Long Term Outcomes

Organizations are weakened by a high dependency on management for decision-making, (Nonaka, 1994) resulting in the possibility of narrow perspectives and groupthink as employee's cognitive capacities are limited by power, control, and coercion (Alvesson & Spicer, 2012). Dependence on management decision-making provides only short-term rewards that maximize profit versus long-term gains (Dal Borgo & Sasia, 2022). Since the functional structure of an organization can dehumanize people by stripping away autonomy, decision-making and the ability to make deeper meaning of their work, it can inevitably erode overall purpose. Routine behavior requires only mindlessness (Alvesson & Jonsson, 2022). Finkielsztein and Wagner (2023) propose that the bureaucratization of universities leads to meaningless work, highlighting that research is inherently innovative, leading to new knowledge and discoveries. In contrast, bureaucratic work becomes predictable and boring. Alvesson and Jonsson (2022) suggest that part of an academic identity is autonomy.

In alignment with the scenario planning literature, we were motivated and energized about our program's future possibilities when we imagined we could build and sustain it to proactively respond to the external environment (Chermack, 2011; Haeffner et al., 2012). Through the scenario planning process, we learned that much of our purpose at work stems from the autonomy and ability to make and implement programmatic strategic decisions, some of which may have disrupted the status quo. The scenario planning process revealed paradigmatic shifts in the how and why of our program. However, implementing these paradigmatic shifts became challenging. Our organizational design ultimately did not allow the space and support to develop meaningful long-term, sustainable gains for the program, department, college, and university. The time and resources necessary for the long-term approach did not materialize.

RECOMMENDATIONS

In this article we present our learning experiences about perceived barriers encountered in using the scenario planning process in an organizational structure strongly rooted in stability. Based on our experiences, we provide recommendations for using scenario planning in a functional structure and conducting transformational change in higher education institutions.

Assess Organizational Readiness

Scenario planning is a powerful tool, thought to be useful in any context (Balazero et al., 2017). Our experience underscores the importance of assessing the organizational readiness for change before initiating a strategic planning process with possibilities for transformational change. Clarifying the deeper, underlying assumptions of an organizational structure and culture would better assist in determining the fit of a strategic planning method to the environment. Many change interventions fail because of a lack of organizational readiness for change (Anderson, 2012). Lack

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of readiness may take the form of resistance due to underlying concerns of upper levels for losing control, power, and showing vulnerability (Block, 2000) in a functional hierarchical structure. Assessing readiness will aid in the fit for and use of the scenario planning process.

Assess Espoused Values and Underlying Assumptions

Beer and Eisentat (2000) suggest that top-down management styles and poor vertical communication and coordination are the "silent killers of strategic implementation" (as cited by Anderson, 2012, p. 277). Success in bureaucratic hierarchies is often based on valuing and protecting unequal power distribution, control, and coerciveness. Scenario planning is incongruent with these styles, values, and assumptions. The capacity and motivation to share and use the knowledge from scenario planning to create a more robust vision of the organization and its future must be understood beyond the scenario planning team. This requires assessing assumptions and beliefs about where knowledge is created and by whom. Scenario planning is a highly participative intervention with outcomes of changed thinking, informed decision-making about the future, increased learning, and the use of imagination for people and the organization (Chermack, 2011). These outcomes challenge the status quo of an organization and could be perceived as a threat to the given organizational reality rather than an opportunity for growth and development. The level of shared meaning of the organizational reality needs to be assessed. Also, the deeper beliefs of how organizational reality is constructed and by whom need to be considered. Is organizational reality primarily constructed by upper-level positions, or is it a shared construction among employees at all levels of the organization? Is knowledge creation restricted to the upper-level positions or is it a dynamic process valued at all levels of the organization? Asking these questions can help determine if scenario planning is right for the organization. At the time, we did not know the importance of exploring the responses to these questions to adequately determine the required levels of support from leadership, and the corresponding structures and systems necessary to use and implement the results. Had we been more proactive in understanding these underlying assumptions, we would not have implemented scenario planning at the program level, recognizing that the organizational conditions were not yet present to support the transformational change we sought. As with our experience, there is the risk that while the process itself is supported, the ability to put the shared mental models into practice is not possible. Additionally, sharing new knowledge to the wider organization in a functional structure is challenging. Thus, we undertook this reflective analysis as a means of continuing our learning and offering the knowledge gained as a resource for others in higher education settings considering a strategic planning process like scenario planning.

Embrace Flexible, Adaptable Organizational Designs

Our experiences illustrate the importance of embracing organizational designs that support programs in universities to proactively respond to continuously changing external environments. If upper levels of the organization can embrace flexible, adaptable structures that relinquish central control, and "encourage emergent thinking, experimentation, and expansion of information flows in their social networks" (Mandzuk, 2023, p. 4), meaningful change is possible. By moving away from centralization (McGrath, 2019) toward decentralization, faculty are more involved in collaborative decision-making and shared governance, which are often espoused values of higher education institutions. Initiatives are more likely to succeed when created from the ground-up instead of topdown (Janicijevic, 2017; Petersen & Bartel, 2020). Higher education institutions are complex and serve multiple missions and functions (Greer & Shuck, 2020; Peterson & Bartel, 2020). Faster paced information-sharing is critical to creating more lateral and horizontal systems and capabilities (Anderson, 2012). To disrupt and challenge existing paradigms and the status quo (Alvesson & Spicer, 2012; Roubelat, 2006) with low centralization, high employee involvement in decisionmaking, high autonomy, and equal distribution of power among all levels and positions within the organization (Janicijevic, 2017) requires trust and resources. Decentralizing administrative responsibilities to colleges and programs has been linked to higher quality student experiences (Hakkola & King, 2015) when provided with the appropriate resources.

Align Structure and Organizational Components for Autonomy

Redesigning structures requires change that reinforces desired behaviors and actions including strategy, processes, rewards, culture, people practices and organizational feedback systems (Anderson, 2012; Cummings & Feyerherm, 2010; Kates, 2010). Changing a culture from being focused on power and hierarchy to one that reinforces innovation and inclusiveness requires learning and an inclusive culture (Anderson, 2012; Katz & Miller, 2010). An adhocracy is focused on innovation, where employees, in this case faculty, have autonomy to create cutting-edge outcomes (Anderson, 2012). A learning culture in a learning organization is designed to respond to uncertainty by valuing learning as the key to continuous change (Ahmad et al., 2023; Haeffner et al., 2012). Miller and Katz (2002) define an inclusive culture as one that enables ideas, perspectives, and experiences to be fully leveraged, creating a bandwidth for problem solving and innovation (as cited in Katz & Miller, 2010). They define inclusion as "a sense of belonging: feeling respected, valued, and seen for who we are as individuals; and a level of supportive energy and commitment from leaders, colleagues, and others so that we-individually and collectively-can do our best work" (Katz & Miller, 2010, p. 437). An inclusive structure and culture positively influence academic programs for continuous change and innovation instead of bureaucratic outcomes such as accountability and compliance (Hakkola & King, 2015). For innovation to happen at the group and organizational level, autonomy and encouragement is required from all levels of the organization (McLean, 2005).

Use Dialogic Organization Development for Transformational Change

The approach to conducting transformational change must not be coercive, as it is in functional structures (Petersen & Bartel, 2010). Instead, the change effort should follow the practices of dialogic organization development that prioritizes changing the conversations among employees, in this case faculty, and exploring common underlying assumptions and aspirations of what it means to be successful in the organization (Bushe, 2010). Scenario planning does this. However, embarking on the process, without engaging in dialog outside of the program needs to occur. Questions need to be asked such as, what are we rewarding and how do we build the organizational structures and systems to pursue those things we should be rewarding? For example, in a functional structure conformity is rewarded, whereas in a more flexible structure autonomy, collaboration, participation and innovation are rewarded.

Shift the Role of Leadership in Higher Education

To implement scenario planning requires a paradigmatic shift in the perception of what leadership is and how it functions in higher education. Innovation requires trust of leadership, not control and authority over decision-making (Supriyanto, et al, 2023). Often 'good' or 'effective' leadership is described in terms of specific leadership styles with corresponding characteristics and attributes, singularly focused outcomes such as profit, and identifiable followers (Lynham, 2010; Shier, 2019). These approaches are leader-centered perspectives that focus less on the interactions with others in the organization and their influence on desired outcomes (Shier, 2019; Younas et al., 2021). Instead, it is important to focus on leadership skills that are more integrated and multi-faceted, and that recognize results are obtained collectively through people (Katz & Miller, 2010). Leaders must be able to understand the whole system (i.e., organizational context/culture, structures, processes, external environment) to strategically think and act in navigating the unknowns and uncertainties within the external environment (Schoemaker et al., 2013). They must empower others in the organization to engage in continuous strategic thinking and planning. Often, interventions such as scenario planning become a one-time initiative, but to remain competitive there needs to be a continuous planning cycle and strategic adjustments (Cummings & Feyerherm, 2010; Haeffner et al., 2012). Leaders must recognize that they are responsible for both their context-specific outcomes, and the people within the system (Lynham & Chermack, 2006) including internal and external stakeholders. In doing so, leadership must be perceived as an equitable, collective process where all individuals are perceived as equal and ideas can reside at all levels of the organization (Katz & Miller, 2010; Ryan, 2007).

IMPLICATIONS FOR EDUCATIONAL PLANNING

The barriers identified from this retrospective analysis have implications for educational planning in higher education. With higher education facing unprecedented challenges and everchanging demands (Greer & Shuck, 2020; Petersen & Bartel, 2020) there is a need for forwardthinking planning processes that are innovative and can respond to the uncertain and continuously changing environment. Traditional strategic planning processes often result in decisions that only perpetuate the current status quo of an organization (Chermack, 2011). To truly improve education and offer high quality graduate programs, program reviews should be used as an opportunity for planning in a variety of possible futures that improve teaching and learning experiences. Program reviews can serve as an ongoing process for continuous, systemic approaches to strategic thinking and planning instead of singular events or check-the-box tasks. On an organizational level this approach requires leaders to work to identify and remove barriers that hinder faculty and staff from engaging in creative planning for programs and corresponding activities. Change in higher education is difficult (Petersen & Bartel, 2020) and demands a paradigmatic shift (Greer & Shuck, 2020) in assumptions on how organizations function and how work gets done. These changes necessitate using effective change processes for planning to create flexible and adaptable organizational structures and systems that encompass participative decision-making, collaboration, and inclusiveness.

CONCLUSION

In conclusion, Anderson (2012) reminds us that "what counts as a failed intervention is a matter of perspective" (p. 181). While we are disappointed with the outcomes of our scenario planning process, it is our hope that our retrospective analysis can serve as a catalyst for change for higher educational institutions and academic programs to reach their full potential. As a result of our scenario planning experience and with this retrospective analysis, our sensemaking of the organizational context we were functioning in eroded. We became more cognizant of the tensions in the system between our purpose as a program and faculty members, and the institutional purpose and given organizational reality. The process changed our perspectives, provided clarity, and made our program needs more explicit. Clarity has only exacerbated our differences with our organizational context and exposed the need for more inclusive structures, systems, and practices.

These are important understandings as we continue to navigate our program identity, our fit, and our individual roles as faculty seeking purpose within a hierarchical system. We have come

to value even more deeply the idea that to thrive, we need to "face the unknown with equanimity and to be curious, receptive, and humble. It is the work of asking questions that focus our attention toward deeply felt, collective aspirations" (Axelrod et al. 2010, p. 367). To be able to address and solve the wicked problems we need to mobilize, energize, and empower the cognitive and meaningmaking capabilities of all employees at all levels of an organization.

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THE LINK BETWEEN ACADEMIC LEADERS' TRANSFORMATIONAL LEADERSHIP AND STAFF JOB SATISFACTION IN POLYTECHNIC COLLEGES OF ETHIOPIA

MILION BEKELE DEGEF BEFEKADU ZELEKE KIDANE Addis Ababa University, Ethiopia

ABSTRACT

This study investigates the relationship between the transformational leadership of academic leaders and the job satisfaction of academic staff in polytechnic colleges located in the North Shewa Zone of Ethiopia. This study used a correlational research design and simple random sampling techniques to select 264 academic staff members. Respondents completed a rating version of the multifactor leadership questionnaire and a job satisfaction survey. Data analysis uses descriptive and inferential statistics like Pearson correlation and linear regression. The study found that transformational leadership was found to positively correlate with and predict academic staff job satisfaction, though it was weak. The findings also revealed that academic staff was dissatisfied with their jobs, despite perceiving their leaders as having a moderate degree of attributes of transformational leadership style. Educational planners can use the findings to transform administrative and academic leaders' leadership programs. Leadership training boosts academic staff morale and job satisfaction. Job satisfaction also improves staff retention and minimizes turnover. Thus, academic leaders should grow themselves and seek opportunities to improve their transformational leadership skills. To better understand the leadership style elements that have the greatest impact on job satisfaction, further research is necessary due to the limited variability or unexplained variance in the ability of transformational leadership styles to predict job satisfaction. Further investigation is also needed to explore the mediating factors that impact the link between two variables in an Ethiopian context.

INTRODUCTION

Background Information

The purpose of the research study is to examine the relationship between transformational leadership style and academic staff job satisfaction in polytechnic colleges. Leaders are essential to helping their followers overcome obstacles to raise their self-confidence and job satisfaction (Northouse, 2016). An organization can gain a competitive edge by improving its operations. Organizational effectiveness depends on leadership's ability to manage and influence all members with clear and concise orders. A leader's impact determines how much employee job satisfaction improves organizational performance (Holbert et al., 2021). As stated by Baluyos et al. (2019), the work performance of academic staff is contingent upon their level of job satisfaction. Brand & Walker (2021) also indicated that job satisfaction is a complex and diverse term that is vital to retaining high-performing employees. Leadership qualities affect employee job satisfaction and their decision to stay or leave the organization.

Organizational functions depend on employees' job satisfaction. Job satisfaction is an intrinsic construct based on workplace conditions. Educational organizations needed to be aware of proper leadership styles that enhance employees' job satisfaction (Al-Maaitah et al., 2021). Khan et al. (2021) discussed that employee jobs are satisfying when people are satisfied with them. When people are satisfied with their jobs, they feel confident and enthusiastic. Unsurprisingly, job satisfaction is a frequent topic of debate. However, as Al-Maaitah et al. (2021) noted, insufficient emphasis on

this particular aspect of organizational behavior has resulted in the emergence of atypical responses among employees. For instance, Brand and Walker (2021) argue that staff turnover disrupts and costs organizations. It can benefit from understanding employee turnover sources and implementing solutions. Therefore, educational leaders need to prioritize job satisfaction in their organization.

Transformational leadership is considered a fundamental element within the framework of the full-range leadership model (FRLM) and important for job satisfaction (Bass & Riggio, 2006). The transformational leadership style (TFLS) is composed of four elements, commonly referred to as the 4Is. These characteristics include idealized influence, inspiring motivation, intellectual stimulation, and individual consideration (Northouse, 2016). Despite the various influencing factors at play, Yukl (2013) emphasized that many scholars have broadly interpreted the term "transformational" to encompass any type of leadership that is successful in either reforming an entire organization or a particular group of employees. The primary focus of the analysis lies in the examination of the anticipated transformations inside the organization.

Transformational leaders play a crucial role in shaping the future of educational organizations in the contemporary era. They exhibit democratic behavior, assume responsibilities, and exercise leadership, addressing diverse challenges and assisting educators and learners in adapting to globalism, diversity, and the information age (Bass, 2000). As Brand and Walker (2021) argued, leaders must grasp the importance of showing the impact of behaviors that can be taught and changed. By understanding employees' views of their leaders and involving them in behavioral change, organizations can boost employee job satisfaction.

In addition to that, the Zeleke and Obang (2021) study indicated that leaders who promote a transformational and adaptive leadership style rather than transactional connections with their followers are crucial. Leaders must motivate subordinates, set lofty goals, and perform well. In such a setting, leaders who pay attention to their employees' needs and personal growth and promote an environment that supports creativity and innovation are more likely to succeed. On the other hand, Al-Maaitah et al. (2021) argued that leaders in organizations lack the knowledge and skills to create a great workplace and lead well. Thus, educational institutions must improve leaders' understanding and train them to improve and manage the organization's operations. This emphasizes the importance of managerial training to discover and apply leadership styles that boost job satisfaction and performance.

Skopak and Hadzaihmetovic (2022) also found that factors of transformational leadership, such as idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, boost job satisfaction. In the Ethiopian setting, the factors that were shown to predict teacher job satisfaction were inspirational motivation within the framework of transformational leadership (Yohannes & Wasonga, 2021). Contrary to expectations, Haleem et al. (2018) found that there is no statistically significant effect, specifically individualized consideration and inspirational motivation, on job satisfaction in Pakistani public sector colleges. This observation suggests that there is a lack of consistency in the research findings about the relationship between transformational leadership style and job satisfaction, to some extent. Thus, the research study intended to see the relationship between transformational leadership and job satisfaction.

Statement of the Problem

The level of job satisfaction plays a crucial role in determining the overall organizational accomplishment and effectiveness of a Technical and Vocational Education and Training (TVET) school. The diminished level of job satisfaction among personnel in TVET has a detrimental impact on the overall productivity of TVET institutions (Rimal, 2021). Besides, the current Ethiopian

education and training policy places due emphasis on technical vocational education levels and improves the levels from the previous five levels of technical and vocational education and training MOE (2008) to eight levels MOE (2023). It is argued that a motivated and satisfied academic staff is more likely to improve student learning and growth. Thus, investigating the issue is significant in developing countries, particularly in the Ethiopian context.

Transformational leadership style and job satisfaction have been studied in many contexts. Most education research relies on secondary (Cansoy, 2019; Mirsultan and Marimuthu, 2021; Baluyos et al., 2019) and higher education (Zeleke & Obang, 2021; Kebede & Demeke, 2017). Few studies have examined polytechnic colleges. Polytechnic colleges have short-term academic staff and have trouble hiring qualified academics. There was a shortage of qualified academic staff (trainers) in technical vocational education and training institutes or colleges (Hunde & Tacconi, 2017). Besides, Kebede and Asgedom (2021) attribute the lack of understanding of the nature of technical vocational education and training to leadership failure. Tamrat (2022) also found that it was difficult to find and retain qualified academic staff for TVET colleges in an Ethiopian context. Thus, polytechnic colleges provide little focus on academic leaders' leadership styles and academic staff job satisfaction. Thus, the study will provide information about leadership style and job satisfaction for policymakers and educational planners in general, and polytechnic college leaders in particular.

Moreover, Holbert et al. (2021) posited that forthcoming investigations are likely to yield varying outcomes across diverse organizations, regions, cultures, and other contextual factors. Pratama et al. (2022) also suggested the necessity for additional research to explore potential other elements that may influence job satisfaction. Brand and Walker (2021) proposed further investigation into specific elements of job satisfaction, such as pay, work assignment, work-life balance, fringe benefits, and other characteristics, as well as the defined leadership styles.

OBJECTIVE OF THE STUDY AND RESEARCH QUESTIONS

The general objective of the study is to examine the link between transformational leadership style and academic staff job satisfaction. Based on the general objective, the following basic questions are formulated:

- 1. What is the extent of academic staff's job satisfaction in polytechnic colleges?
- 2. How is transformational leadership in operations perceived by academic staff?
- 3. To what extent are the transformational leadership styles of academic leaders related to academic staff's job satisfaction in polytechnic colleges?

SIGNIFICANCES OF THE STUDY

This study elucidates the correlation between transformational leadership style and academic staff job satisfaction. This study offers useful insights into the effects of transformational leadership styles on the well-being and contentment of personnel in the specific setting of polytechnic colleges. Through an examination of the provided connection, researchers and colleges can discern particular transformational leadership characteristics that yield a favorable influence on job satisfaction. This understanding can inform the creation of leadership programs and initiatives that specifically aim to cultivate certain characteristics in order to improve staff satisfaction.

Examining the correlation between transformational leadership and job satisfaction fosters a culture of ongoing enhancement inside polytechnic colleges. It encourages educational institutions to routinely evaluate leadership practices and make appropriate modifications to establish a supportive work environment that improves job satisfaction among academic staff. The findings also provide valuable insights for educational planners for the formulation of policies, guidelines, and best practices with the objective of enhancing leadership efficacy and fostering employee contentment. Educational institutions can utilize the insights acquired from the study to build their policies about human resource management, initiatives for leadership development, and the overall culture of polytechnic colleges.

REVIEW RELATED OF LITERATURE

This component of the research study focuses on conducting a comprehensive evaluation of relevant literature based on the general objective of the study, explores the correlation between leadership style and job satisfaction in various organizations across global, African, and local settings.

The Link between Leadership Style and Job Satisfaction

Several studies have been conducted on the link between transformational leadership style and job satisfaction in different sectors around the world. For instance, Brand and Walker (2021) on professional services firms; Khoso et al. (2021) on Joint Venture Limited; Abd Rahman (2021) on private organizations; Al-Maaitah et al. (2021) on public universities; Kishen et al. (2020) on various companies; Makhdoom and Daas (2022) on the banking sector; Holbert et al. (2021) on the public sector; Skopak and Hadzaihmetovic (2022) in food industry companies; Yohannes and Wasonga (2021) in primary schools; (Rimal, 2021) and Bin Reduan (2023) in technical vocational education and training (TVET). The majority of research studies conducted in non-educational sectors have indicated that leadership style has a significant influence on job satisfaction. For instance, Kishen et al. (2020), Khoso et al. (2021), and Abd Rahman (2021) conducted studies that demonstrated a positive relationship between the existence of a transformational leadership style and employees' job satisfaction. Leaders use transformational leadership to inspire, intellectually excite, and meet the needs of their subordinates (Choi et al., 2016).

In the context of African countries, specifically the county government of Kakamega in Kenya, Barasa and Kariuki (2020) and Mgaiwa (2023) in Tanzania university research studies revealed that employees had a positive inclination towards the concepts of transformational leadership and its impact on employee job satisfaction. Contrary to the above study, the Idiegbeyan-Ose (2018) study found that leadership style played a significant role in the observed low levels of job satisfaction in private universities. The Mefi and Asoba (2021) study also found a non-linear relationship between leadership styles and employee job satisfaction in an Eastern Cape Province higher education institution. In other words, leadership styles were not correlated with job satisfaction. This indicates that there were inconsistencies in the research's findings and that a variety of factors, besides leadership styles, affect job satisfaction.

The link between transformational leadership and job satisfaction is also carried out across various educational levels in various contexts, including Mirsultan and Marimuthu (2021) in secondary schools; Zeleke and Obang (2021) in teachers' education and health science colleges; Elmazi (2018) on high school teachers; Yohannes and Wasonga (2021) in the public first circle; and Nazim (2016) in secondary schools and teachers' colleges. For instance, a study on public universities by Al-Maaitah et al. (2021) found that transformational leadership improved job satisfaction. This study suggested that leaders should choose a leadership style based on their circumstances and relationships and use it in public institutions. As indicated in Mehrad's (2020) study, Herzberg's motivation-hygiene theory matters in universities. The study stresses the importance of motivators for job satisfaction rather than job dissatisfaction. To obtain optimal results, workers and leaders research must recognize this reality and identify the main internal and external elements that affect job satisfaction.

Secondary school-level studies show that transformational leadership boosts teachers' job satisfaction. The association between job satisfaction and school effectiveness emphasizes principals' conscientiousness and the use of effective methods to boost teachers' job satisfaction (Elmazi, 2018). Similarly, school administrators' transformational leadership styles were more significantly linked to teachers' job satisfaction (Cansoy, 2019; Mirsultan and Marimuthu, 2021; Baluyos et al., 2019). In addition, Nazim (2016) indicated that there is a substantial positive correlation between the subscales of transformational leadership style and the subscales of job satisfaction.

A study conducted in Technical and Vocational Education and Training (TVET) schools in Kathmandu, Nepal, by Rimal (2021) found a moderate level of job satisfaction among staff. This finding demonstrates a positive correlation between job satisfaction and job performance among employees. Additionally, Bin Reduan's (2023) investigation in Mukah, Malaysia, in TVET had modest job satisfaction. Job satisfaction is crucial to performance and quality. High job satisfaction leads to greater contributions and commitment to the organization, particularly the educational one. Thus, it is important to achieve organizational goals effectively.

In the context of Ethiopia, Kebede and Demeke (2017) found that faculty job satisfaction was positively correlated with transformational leadership styles in Ethiopian public universities. Zeleke and Obang (2021) at Gambella Teachers' Education and Health Science College showed that all nine work satisfaction measures were significantly correlated with transformational leadership styles. Another study by Zeleke and Kifle (2020) indicated that transformational leadership positively and significantly affected intrinsic and extrinsic job satisfaction. The study suggested that leaders change their leadership style to boost employee job satisfaction in the organization.

On the contrary, the Yohannes and Wasonga (2021) study indicated teachers have low job satisfaction, with transformational leadership having moderate to low associations in secondary schools. Additionally, Metaferia's qualitative research in another setting highlights the detrimental impact of a lack of transformational leadership on teachers' job satisfaction, emphasizing the need for improved leadership practices and delegation of authority to teachers and staff members (Metaferia et al., 2023). This implies that transformational leadership styles are essential in developing countries to enhance the job satisfaction of academic staff. However, there is a variation in the level of job satisfaction and inconsistencies among results across different levels of educational institutions and organizations. Thus, it is essential to examine the role of transformational leadership style for job satisfaction among academic staff members in polytechnic colleges in an Ethiopian context.

Research Design

METHODOLOGY

The goal of the study is to examine the link between academic leaders' leadership style and academic staff job satisfaction in polytechnic colleges in the North Shoa Zone, Amhara region, Ethiopia. The goal will be attained through a quantitative method (Gay et al., 2012). Earlier studies used it, such as those by Jameel and Ahmad (2019) in another context and Zeleke and Obang (2021) with a national focus. A correlational research design is also used and is crucial for determining the strength and direction of the association between the two variables. The design was used in a previous investigation by Zeleke and Kifle (2020) in an Ethiopian setting.

Population, Sample and Sampling Techniques

The research was carried out at the Polytechnic Colleges located in the North Shoa Zone of the Amhara region, situated around 130 kilometers away from Addis Ababa. The data for this study was mostly sourced from the academic staff (trainers) of three polytechnic colleges throughout the academic year 2022–23. A sample of 264 individuals was selected using a simple random sampling technique. This sampling method was employed to ensure the representativeness of the sample, with a confidence level of 95%. The study employed the sample size determination table outlined in Cohen et al. (2007). Out of the total of 264 questionnaires that were distributed, a total of 221 academic staff members correctly completed and returned them, resulting in a return rate of 83.71%. After obtaining authorization from higher officials of polytechnic colleges, a questionnaire was delivered to the respondents. The analysis of correlation and regression was deemed adequate for addressing the basic questions posed initially (Gay et al., 2012).

Data Collection Instruments

The researchers used part of a multifactor leadership questionnaire (MLQ) developed by Avolio and Bass (2004) to assess leadership style. To gauge academic staff's job satisfaction, the Spector (1997) Job Satisfaction Survey (JSS) was used. Researchers worldwide have conducted numerous studies to examine and verify the validity and reliability of the questionnaires. Datagathering tools have also been utilized in national and international investigations.

The study used a 20-item questionnaire employing a five-point Likert scale to assess the transformational leadership style of leaders. The questionnaire was specifically designed to measure aspects of transformational leadership style, and it was derived from a larger set of 36 closed-ended multifactor leadership questionnaires. This assessment targeted academic staff with a rater version of the questionnaire. The five-point Likert scale measures behavior or attitude frequency. A score of 0 means "not at all," 1 means "once in a while," 2 means "sometimes", 3 "fairly often," and 4 means "frequently, if not always." According to respondents, a higher mean score indicates very effective leadership, whereas a lower mean score indicates less effective leadership (Bass & Avolio, 2004).

In terms of questionnaire validity and reliability, the data gathering tools were utilized in several nations; the author and other academics have evaluated and verified them in numerous studies. For instance, the MLQ 5x, which can accurately quantify transformational, transactional, and laissez-faire leadership styles, was used (Muenjohn & Armstrong, 2008). As Bass and Avolio (2004) indicated, the MLQ has been utilized in several research programs, as well as graduate theses and Ph.D. dissertations, to assess a full range of leadership by identifying better outcomes. Furthermore, it has exhibited commendable levels of reliability and validity. Besides, Bass and Riggio (2006) show that the reliability was tested many times in different samples and contexts, and the result reported is above 0.8. Besides, the MLQ used by Kebede and Demeke (2017) in an Ethiopian context. The study also used Cronbach's alpha to assess reliability. The result indicated a Cronbach alpha of 0.92 for 20 items of transformational leadership style. As Singh (2007) notes, split-half dependability values of 0.75 or above are regarded as a general guideline for describing acceptable internal consistency.

Spector's 1985 job satisfaction survey (JSS) has 36 items and nine components with six rating scale possibilities, from strongly disagree to agree. It measures how employees feel about their jobs. Pay, promotions, supervision, fringe benefits, contingent rewards, operating procedures, nature of work, coworkers, and communication are the nine components (Spector, 1985). Thus, certain JSS elements are rectified and corrected before analysis. Based on 2,870 sample respondents, the internal consistency (a measure of scale reliability) of all aspects of job satisfaction was 0.91

(Spector, 1997). The nine job satisfaction factors' Cronbach alpha coefficients range from 0.7 to 0.82. As Singh (2007) noted, alpha is over 0.7 and above dependable, as was already mentioned. Testing showed 36 items had a Cronbach alpha of 0.72. The JSS was also used in local investigations by Zeleke and Kifle (2020). The JSS is suitable for assessing the job satisfaction of polytechnic college academic staff.

Data Analysis Techniques

The Statistical Package for Social Science (SPSS) version 20 was used to process the data. Statistics was used for both descriptive and inferential analyses. The analysis was carried out quantitatively using descriptions from the data gathered through surveys and organized with tables. Percentage was used to analyze the characteristics of respondents. To evaluate the extent of academic staff job satisfaction and perceptions of transformational leadership, descriptive statistics (the mean and the standard deviation) were used (Gay et al., 2012).

To evaluate the link between the variables in polytechnic colleges, the person-r correlation coefficient was employed. Previous research was utilized, like Kebede and Demeke (2017), and in an Ethiopian setting. The level of significance for this investigation was set at an alpha level of 0.05 (Gay et al., 2012). Besides, inferential statistics were employed, such as linear regressions, to measure the extent of leadership style that determines academic staff job satisfaction. This analysis shows not only the relationship between variables but also the degree to which the link occurred (Gay et al., 2012). Local studies such as Zeleke and Obang (2021) and Zeleke and Kifle (2020) also used regression analysis to see the link between leadership style and job satisfaction in the Ethiopian context.

RESULT AND DISCUSSION

General Characteristics of Respondents

The study result showed that out of 221 academic staff, the majority were male (182, 82.4%). Concerning the educational background of study participants, the majority of academic staff respondents (132, 59.7%) were B-level or BA/BSC graduates, 26 (66.9%) were C-level or diploma graduates, and 23 (10%) were MA/MSC graduates. With regard to the teaching experience of academic staff respondents, the majority (100/45.2%) have served from 6–10 years, and 56 (26.2%) of them have served from 11–15 years of service in polytechnic colleges.

The Extent of Academic Staff Job Satisfaction as Perceived by Academic Staff

Table 1 provides descriptive statistics for facets of academic staff job satisfaction with their corresponding sample size (N = 221), mean, and standard deviation in polytechnic colleges. The component of job satisfaction pertaining to the mean score of operating procedures has obtained the highest score (3.21). The mean score of pay, with a value of 2.80, it is the average compensation received by the participants, which ranks second highest among all the subjects included in the study. The presence of a standard deviation of 0.70 indicates the dispersion of values around the mean. The average score and variability of fragile benefits are 2.75 and 0.68, respectively. The scores for the remaining features range from 2.53 to 2.66, with corresponding standard deviations ranging from 0.59 to 0.72. The standard deviations of the components of job satisfaction indicate the dispersion of participants' replies.

A mean score of 2.70 for the overall job satisfaction score indicates the average level of job satisfaction among the participants. The calculated standard deviation of job satisfaction,

which is 0.32, indicates that the scores pertaining to job satisfaction exhibit a comparatively narrow dispersion around the mean. This implies that there is less fluctuation in job satisfaction compared to other variables. As Spector (1997) noted, the six scales of job satisfaction can be classified into three distinct categories. The scoring system assigns the label "dissatisfied" to scores falling within the range of 1-3, "ambivalent" to scores falling within the range of 3-4, and "satisfied" to scores falling within the range of 4-6.

The research reveals that the operational procedure exhibits the highest mean score (3.21) based on the descriptive statistics. However, it also indicates that the participants' satisfaction level is ambiguous, as they were not clearly inclined towards either satisfaction or dissatisfaction. The term "operating procedure" or "working condition" also encompasses the contextual setting within which personnel do their tasks. As Singh and Jain (2013) noted, the provision of a sense of safety, comfort, and motivation is afforded to employees. The findings of the study indicate that the participants' job satisfaction score was 2.70, with mean scores for various components ranging from 2.53 to 2.80. These scores suggest that the average satisfaction level among academic staff in their organization was below average.

Job satisfaction facets	N	Mean	Std. Deviation
Pay	221	2.80	0.70
Promotion	221	2.64	0.72
Supervision	221	2.66	0.72
Fragile benefit	221	2.75	0.68
Contingent reward	221	2.64	0.62
Operating procedure	221	3.21	0.71
Coworkers	221	2.53	0.60
Nature of work	221	2.56	0.67
Communication	221	2.60	0.59
Job satisfaction	221	2.70	0.32

 Table 1. Perceptions of academic staff on job satisfaction and its facets

The study's findings were consistent with those of Yohannes and Wasonga (2021), who found that the level of job satisfaction among secondary school teachers was quite low. But, in technical vocational education training (TVET) studies such as Rimal (2021) and Bin Reduan (2023), moderate levels of job satisfaction were evaluated in different settings. In general, a qualitative study by Metaferia et al. (2023) also suggested the importance of improving transformational leadership to enhance teachers' job satisfaction.

Perception of Academic Staff on Transformational Leadership Style

Table 2 presents the viewpoints of academic staff in polytechnic colleges regarding the transformational leadership style and its associated characteristics, with n = 221. The average score for inspirational motivation is 2.40. The average score surpasses other elements of the transformational leadership style. Inspirational motivation refers to the leader's capacity to inspire and encourage their people by communicating a common vision and goal (Northouse, 2016). The elevated mean score suggests that the participants view their leaders as possessing a superior level of inspirational motivation compared to other aspects of transformational leadership.

Transformational leadership factors	N	Mean	Standard Deviation
Idealized influence attributed	221	2.25	0.79
Idealized influence behavior	221	2.31	0.76
Intellectual stimulation	221	2.30	0.83
Inspirational motivation	221	2.40	0.79
Individualized consideration	221	2.21	0.81
Transformational leadership style	221	2.30	0.71

Table 2 perceptions of academic staff on transformational leadership style and its factors

With regard to other factors, the average score for idealized influence assigned is 2.25, considering other aspects. This aspect relates to the leader's capacity to acquire the admiration, respect, and trust of their followers (Bass & Riggio, 2006). The average score for idealized influence behavior is 2.31. This quality pertains to the leader's capacity to exemplify admirable behaviors and beliefs. The average score for intellectual stimulation is 2.30. Intellectual stimulation pertains to the leader's capacity to provoke and foster creativity and innovation among their subordinates (Northouse, 2016). The average score for individualized consideration is 2.21, which is nearly identical to the score for intellectual stimulation. Individualized consideration pertains to the leader's capacity to address the specific requirements and worries of their followers (Bass & Riggio, 2006). The results show that the standard deviation of components of transformational leadership style varies between 0.76 and 0.83. This indicates that there is a degree of variation in the perceptions of academic staff about these aspects.

In general, the average score for the overall transformational leadership style is 2.30, with a standard deviation of 0.71. This mean score indicates the comprehensive perspective of the transformational leadership style, which includes all the factors described earlier. The average score indicates that the participants view their leaders as demonstrating a moderate level of transformational leadership style. The result was not consistent with the Zeleke and Obang (2021) local study, which accounts for a mean score of 1.70 for transformational leadership style. Transformational leadership involves active interaction with academic staff, fostering a relationship that motivates and encourages both academic leaders and staff. Academic leaders prioritize their staff's needs and help them reach their full potential (Northouse, 2016). Thus, a transformational leadership style is essential to leading academic staff in polytechnic colleges.

Link between Academic Leaders' Transformational Leadership Style and Academic Staff Job Satisfaction

The Pearson correlation coefficient (r) measures the strength and direction of the linear relationship between two variables (Gay et al., 2012). Based on the correlation table 3 provided, it is possible to draw inferences regarding the association between transformational leadership styles and job satisfaction. A weak and statistically significant positive correlation has been seen between the transformational leadership style and job satisfaction (r = 0.36, p = 0.00). This finding indicates a significant positive correlation between polytechnic college academic leaders' transformational leadership style and academic staff's job satisfaction in the study area.

The findings are consistent with research by Cansoy (2019), which shows a significant positive relationship between school administrators' displays of transformational leadership and teachers' job satisfaction. The findings of Elmazi (2018) also align with the results obtained from

a study conducted on high school teachers in Albania and Kosovo. Furthermore, this finding aligns with a study undertaken by Kebede and Demeke (2017) in Ethiopian public universities and Mgaiwa (2023) in Tanzanian universities. Thus, the correlation analysis found a link between transformational leadership and job satisfaction; however, it is weak. This implies that polytechnic college academic staff job satisfaction is significantly increased by exercising transformational leadership style with their academic leaders'.

		Job Satisfaction
Transformational Leadership style	Pearson Correlation	.36*
	Sig. (2-tailed)	.00
	Ν	221

Table 3 Link between transformational leadership style and job satisfaction

The Influence of Academic Leaders' Transformational Leadership on Academic Staff Job Satisfaction

Linear regression measures not only the relationship between two variables but also the extent of the influence of the independent variable on the dependent variable (Gay et al., 2012). Based on the ANOVA table 4 shown, the outcomes of the analysis conducted to predict job satisfaction, which serves as the dependent variable, use transformational leadership as a predictor. The observed F-statistic value of 31.97 suggests that the regression model exerts a statistically significant influence on job satisfaction. The p-value linked with the F-statistic is 0.00, suggesting that the regression model exhibits statistical significance. The regression model explains 12% ($R^2 = 0.12$) of the variability seen in job satisfaction. This implies that the predictor variable of transformational leadership accounts for roughly 12% of the variance in job satisfaction. The remaining 88% can be attributed to unexplained variability. In the Zeleke and Obang (2021) study, the observed variance showed that 45% of the observed variation in job satisfaction may be attributed to the influence of transformational leadership. Therefore, the findings of this study are not consistent with previous local research, despite the notable differences in the study's setting.

Additionally, Table 4's coefficient and the t-value of 34.26, which demonstrate statistical significance, suggest that the coefficient for transformational leadership style has an impact on academic staff members' job satisfaction. The significance p-value corresponding to the t-value is 0.00, suggesting that the constant term holds statistical significance. As Pallant (2020) noted, the significance value is highly influenced by the selection of variables included in the equation and the degree of overlap among the independent variables. Therefore, in order for the factors to have a significant contribution to predicting the dependent variable, the significance value should be less than 0.05.

		AN	OVA ^{a,b}			
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.85	1	2.85	31.97	.00
	Residual	19.48	219	.09		
	Total	22.33	220			

Table 4. The influence of academic leaders' transformational leadership on academic staff job satisfaction

Coefficients ^{a,b}						
Model Un	standardi	dardized Coefficients Standardized	Standardized Coeff	d Coefficients		
	В	Std. Error	Beta	t		
(Constant)	2.34	.07		34.26	.00	
Transformationa	1.16	.03	.36	5.66	.00	
leadership						

a. Current job = Academic staff b. Dependent variable: Academic staff job satisfaction

c. Predictors: Transformational leadership

As indicated in Table 4, the standardized beta is 0.36. While maintaining other variables equal, a one-standard deviation increase in the independent variable increases the dependent variable by 0.36 standard deviations. Transformational leadership has a statistically significant coefficient (t = 5.66, p = 0.00). Both the unstandardized and standardized coefficients are statistically significant, indicating that transformational leadership boosts job satisfaction. Thus, academic staff job satisfaction was influenced by academic leaders' transformational leadership style; however, the extent was less. As indicated in the literature, educational organizations' job satisfaction is linked to transformational leadership. Transformational leaders boost academic staff job satisfaction by inspiring and encouraging them, supporting their professional progress, creating a healthy work culture, empowering them with autonomy, and acknowledging their efforts. Thus, motivated and satisfied academic staffs are more likely to improve student learning and growth.

CONCLUSION, RECOMMENTAIONS AND IMPLICATIONS

Conclusions

This study looked into the connection between academic leaders' use of transformational leadership and the levels of job satisfaction among academic staff members. It employed a correlational research design to analyze the data and draw conclusions. The results indicate that there was a lack of job satisfaction among the academic staff, and they perceived their leaders as having some attributes of transformational leadership, although to a moderate degree. The study also found that there was a statistically significant, positive, and weak association between the academic leaders' transformational leadership style and academic staff job satisfaction at polytechnic colleges.

Job satisfaction is multifaceted and influenced by individual, organizational, and environmental factor. Workload, work-life balance, salary, career growth prospects, organizational culture, and support systems may also affect job satisfaction in polytechnic colleges. The weak link between transformational leadership and job satisfaction suggests that polytechnic colleges should investigate the elements affecting staff satisfaction. This knowledge can help colleges identify areas for improvement and create specific tactics to boost academic staff job satisfaction. Consider that various factors may influence the association between transformational leadership and job satisfaction. When combined with a supportive organizational culture or good communication, transformational leadership may boost job satisfaction. Thus, investigating moderating factors helps illuminate complex dynamics.

Recommendations

To improve academic staff job satisfaction, colleges should prepare different trainings on transformative leadership programs for administrators and supervisors. Help leaders communicate, motivate, and support their workers to create a great work environment through training and support. Encourage leaders and academics to communicate openly. Communicate expectations, give regular feedback, and make sure employees understand their jobs, responsibilities, and performance criteria. Applaud academic staff accomplishments. Use rewards, incentives, or public recognition to celebrate their triumphs and encourage them to succeed.

To develop academic staff performance and job satisfaction, Polytechnic College academic leaders should enhance their transformational leadership skills by participating in capacity-building initiatives with the Amhara Region Labor and Training Bureau. Besides, polytechnic college academic leaders should grow themselves and seek opportunities to improve their transformational leadership skills. Examples include attending leadership development seminars and staying updated on leadership research and best practices. They should also actively improve their transformational leadership behaviors and skills, focusing on style aspects.

This finding provides additional evidence that the transformational leadership style of academic leaders is a significant predictor of job satisfaction among academic staff. However, it could be considered that the explained variance, or the amount of variability this relationship accounts for, is very low. In this particular scenario, additional investigation and examination would be required to gain a comprehensive understanding of the precise elements or constituents of this leadership style that exert the greatest influence on job satisfaction. Furthermore, it is essential to consider the potential intervening or moderating factors that may affect this association.

Implications for Educational Planning and Practice

The findings can help educational planners create transformative leadership programs for administrators and supervisors. Planners can improve academic staff morale and job satisfaction by investing in leadership training. Besides, improved job satisfaction can boost staff retention and reduce turnover. Educational planners can use the findings to establish succession planning techniques to identify and prepare transformational leaders. Planners can prioritize candidates who demonstrate or exhibit potential for transformational leadership skills, ensuring that future leaders can positively influence worker satisfaction.

Moreover, the National TVET Strategy MOE (2008) aims to create a skilled, flexible, and imaginative workforce through demand-responsive, top-tier technical and vocational education programs to advance socioeconomic growth. The study implies academic leaders' transformational leadership to boost academic staff job satisfaction in polytechnic colleges. Thus, using varied leadership styles, especially transformational leadership, and adapting to changing settings are essential to improving academic staff job satisfaction and, as a result, achieving the goal effectively and efficiently. Besides, policymakers will use the research study to recommend to polytechnic college leaders the appropriate leadership styles that boost academic staff job satisfaction.
Limitations

The research study solely focuses on transformational leadership within the full range of leadership models. It is also important to note that the study's scope is limited to one specific zone (area) of polytechnic colleges, which may restrict the generalizability of the findings to other polytechnics across the country.

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SECURING EXTERNAL RESOURCES TO ENRICH PROGRAM QUALITY IN HIGHER EDUCATION: HOW ONE COLLEGE ACTS

ARVIN JOHNSON TAK CHEUNG CHAN Kennesaw State University, U.S.A.

ABSTRACT

This study examines the effort of one higher education college in China to see how it secures external funding resources to enhance its educational programs. The college is known for its success in getting external funding in addition to public revenue appropriations. The researchers took a case study approach by first reviewing the current literature to find out what has been done by other universities worldwide to secure external funding. Data in this study were retrieved by reviewing relevant documents in the college files. Additionally, five college administrators were interviewed to solicit their experiences in seeking external funding for the college. The findings of this study disclosed that the college administrators and staff have contributed tremendous effort to secure external resources to help achieve the college goals. The findings were also discussed relating to the current literature and the implications for educational planning.

INTRODUCTION

The funding in support of higher education usually comes from two sources: internal and external. Internal sources are mainly generated from academic fees paid by students. External sources of funding come from different channels. While the increase in academic fees could generate more revenue for a university, it would also decrease the degree of affordability of the university. On the other hand, the external funding sources are almost unlimited to the university. Therefore, intelligent higher education planners strongly encourage university administrators to develop plans and strategies to secure external funding in support of university programs.

This paper is the report of a case study developed to explore the approaches and strategies employed by a higher education college in China to secure external resources for the university's long-range development. A literature review was first performed to examine effective ways and strategies for securing external financial resources in other higher education institutes.

REVIEW OF LITERATURE

Program Quality in Higher Education

Assurance of quality in programs of higher education is the key element of program survival. Therefore, before an academic program is delivered to the public, in-house and/or external auditors are invited to check on the processes of production to assure program quality (Zhang & Su, 2016). Beza (1984) claimed five essential elements to support the teacher education programs: entry screening, increased program competencies, mentoring student teachers, exit evaluation, and probation for beginning teachers. Beza was followed by many scholars who developed their approaches to improving teacher education programs. Meek and O'Neill (1997) proposed to improve teacher education programs from the perspective of policies and procedures. Sutherland (1997) also took a practical approach to assess the program quality of higher education by examining the quality of program graduates. Furthermore, Leong (2000) created six indicators to measure program quality: institutional mechanisms for course approval and monitoring, course design and delivery

methods, staff qualifications and appointment procedures, student support services, assessment procedures and criteria, and course management. Daniel (2000) also recommended that these six indicators should be developed into criteria to assure program quality.

Pursuing for External Funding Resources

For public colleges, state and local fundings are generally not enough to support the daily operation of the colleges. Insufficient funding support will certainly deteriorate the quality of the educational programs (Kudła, Stachowiak-Kudła & Figurski, 2014). Therefore, all public higher education institutes need external funding to subsidize their financial needs. For private colleges, besides the student tuitions, their revenues are solely dependent on external support for survival. Even though many institutes of higher education have their revenues mainly coming from public sources, they still work hard to seek for external sources of funding to enrich their programs (Liu, Chen, Wang, & Wang, 2020). However, when external sources of funding are increasing, they begin to dominate the direction of policy changes of the colleges (Speck, 2010). In some instances, it could even upset the balance of graduation rates among ethnic groups (Wekullo, 2022).

Types of External Resources to Support University Programs

All the institutes of higher education, whether public or private, depend on external resources of funding support for daily operations. There are four main categories of external funding: city, provincial, and central government funding; private business funding; alumni donations; and crowdfunding. Most universities encourage their faculty to submit applications to complete for all the qualifying funds to win a chance for acquisition.

City, Provincial and Central Government Funding

In many countries in the world, public universities of good standing are supported by both provincial and central government funding. Some city universities are supported by tax revenues of individual cities. The formulae of funding appropriation are usually approved by legislation based on student enrollment and academic programs. In addition, city, provincial, and central government grants for research and academic activities are also available for application on a competitive basis by public and private universities. In recent years, public funding in support of higher education has been unstable. Because of economic recessions, all levels of government, city, province, and central, have been experiencing budget balancing problems (PEW Charitable Trusts, 2019). In some situations, even appropriated portions of public funding for higher education have shrunk to meet balanced budgets.

Private Business Funding

Private businesses provide strong support for higher education through direct funding because of common interests and tax reduction allowances. Some of the support is also provided through partnership programs, such as businesses providing support by offering universities advisory services and training opportunities. Businesses also work closely with institutions of higher education in offering scholarships and preparing graduates to suit the job market needs. Additionally, working with local universities helps promote the products of businesses in local markets. Some large businesses even offer to support higher education by donating educational equipment and facilities. (Harnisch, 2022)

Alumni Donations

Alumni are generally very faithful and loyal to the higher education institutes they graduated from. Therefore, alumni associations supported by the universities could serve as an excellent channel of communication with them. Through alumni associations, universities could launch their fundraising campaigns by encouraging alumni donations. Many universities have worked with the government to make alumni donations tax deductible. Recent data analysis shows that approximately one-fifth of the total university donations come from alumni. In addition to the university-wide alumni associations, college or program alumni associations are also established to draw closer relationships with the alumni. As a matter of fact, alumni consider it an honor to make donations to their alma mater because their contributions would help build the programs and prestige of the universities they are proud of (Berman, 2019).

Crowdfunding

Crowdfunding, as elaborated by Tomasis (2023), is the practice of collecting money from multiple individuals or sources for the purpose of initiating a proposed task. The crowdfunders usually seek social media to share their innovative ideas and inspire interested partners to contribute to the crowdfunding drive. Sometimes, the goal of crowdfunding is for charity or events for the common good. Regardless of the reason for seeking funds, the trend of crowdfunding has become more and more popular. In starting a crowdfunding process, a fundraising goal and the project amount must be well stated. Setting a time limit for the campaign and keeping the contributors informed are important steps in crowdfunding implementation.

Horta, Meoli and Vismara (2022) studied the employment of crowdfunding as a measure of soliciting external funding for higher education programs. The findings of their study indicated that crowdfunding was used to secure external funding more by universities that have fewer resources. These universities usually have a student body largely from lower socio-economic families. The study suggested that crowdfunding could complement the funding of higher education from many other sources, but concerns are brought about the use of crowdfunding to finance university activities instead of university administration having to seek for resources to begin with.

Why External Resources

Tetrevova and Vlckova (2018) studied the external resources for higher education in the Czech Republic. The findings of the study indicated that higher education managers considered the available external funding to contribute to the development of knowledge and experience of students, academics, and researchers of the universities participating in the study.

To evaluate the benefits of securing external sources of funding, Mississippi Institutions of Higher Learning (2021) summarized the reasons for encouraging higher education institutions to seek external funding. First, external funding facilitates research impact. Second, the amount of externally funded support is used commonly as a measure to rank research universities. Third, the increase in externally funded research is an indication of the return on investments the universities make. Fourth, externally sponsored projects contribute to the regional economy mainly through discoveries and innovations with commercial value and through the application of research findings to policy and practice.

PURPOSE OF THE STUDY

The purpose of this study is to examine the effort of one higher education college in China to see how it goes about securing external funding resources to enrich its educational programs. The college in this case study is a public college supported by city tax revenues. In addition to public funding support, the college is also known for its success in getting external funding. In investigating the approach and strategies employed by this college to apply for external funding support, the researchers also reviewed the current literature to find out what has been done by other universities worldwide to secure external funding. The findings of this study are discussed with reference to the current literature.

RESEARCH QUESTIONS

The following research questions are developed to guide the direction of the study:

- 1. What strategies are employed by the college in this case study to secure external resources to enrich its educational programs?
- 2. How are the strategies of this college compared with those of other universities mentioned in current literature in securing external resources to enrich their educational programs?

METHODOLOGY

Research Design

As described by Fraenkel, Wallen and Hyun (2011), "What case study researchers have in common is that they call the objects of their research cases, and they focus their research on the study of such cases." (p. 435) This study takes a qualitative approach and is particularly focusing on the instrumental type of case study in which the researchers are interested in studying the case to some larger goals (Fraenkel, Wallen & Hyun, 2011). The researchers intend to investigate how the college in the case study could secure opportunities for external resources to achieve its program goals. Therefore, this study's purpose and setting suit the instrumental case study design well.

Case Setting

In this case study, a teacher education college in the southern region of China was cited as a typical example of utilizing external resources in support of the college programs. The college is financially supported by public funding of the city government based on the formula calculated by enrolment and program factors. Even though the public funding support of the college is generous, it is not sufficient to cover all the general expenditures of the college. The fiscal report of the college in FY 2022 indicates that approximately 60% of the revenues come from public funding appropriations. The external resources in this study go beyond the basic public funding. The college administrators understand that the external resources are rich, and the faculty and the staff of the college are strongly encouraged to explore strategies to reach out to these external resources in support of the college.

Procedures

The researchers first reviewed the current literature on external funding support for higher education. Then, the available documents of the college were reviewed to identify the established goals the college is trying to achieve. It was found that the accomplishments of many goal-related tasks of the college were supported by different sources of external funding without which the goals would not be able to be achieved. The researchers further analyzed the orientations of the different kinds of external financial support and their significance to the development of the college. Five top administrators of the college were also invited for interviews to solicit their experiences in securing external funding. The findings of this study were discussed with reference to the current literature reviewed.

Data Analysis

The data collected through the review of college documents were examined by using a documentary analysis approach in which relevant contents are highlighted and coded accordingly into themes (Creswell, 2009). The data collected from interviews were transcribed into scripts which were sent back to the interviewees for checking and verification. The process of triangulation was performed between the data collected from the documents and the data collected from the interviews. The commonly agreed emerging themes were then matched with the college academic goals by category.

THE GOALS OF THE TEACHERS' COLLEGE OF EDUCATION

In its long-range development plan, the college has established goals to achieve in gaining public support. These goals are targeted toward growth in two major areas: Teaching and Learning and Scholarly Activities. The details of these two goal areas have become the conditions for public funding and are presented in the following:

A. Teaching and Learning

1. Curriculum Review and Updates

The curricula of all the college programs will be constantly reviewed to assure that they respond to the changing societal needs and community demands. All curricula will be updated as needed.

2. Pedagogical Innovation

The faculty will prepare future educators and social leaders by introducing and practicing innovative teaching methodologies.

3. Technology Implementation

The administrators and faculty will follow up on the latest development of technology and integrate it to facilitate the management and academic activities of the college.

4. National and International Connections

The college is aimed at building strong collaborative relationships with other national and international institutes of higher education through different formats of partnership.

B. Scholarly Activities

1. Strong Scholarship Positioning

The college is aimed at building the college to become a strong hold of leadership in the major areas of academic research and activities.

2. Application of Scholarly Production

The college faculty will engage in scholarly activities resulting in scholarly production to benefit the community.

FINDINGS

The data of this study were obtained through detailed review of the college documents and interviews with the college administrators. After data analysis, it was found that the college has employed many different strategies to seek external resources to achieve its educational goals. These strategies are categorized in the following to answer Research Question 1:

What strategies are employed by the college in this case study to secure external resources to enrich its educational programs?

- 1. **Internationalism**: Strategies are used to connect with international scholars and institutes of higher education.
 - To initiate exchange programs with other international universities
 - (To achieve Goals A1, A2, A3, A4 and B1)
 - To invite international scholars to serve as honorary professors (To achieve Goals A1, A2, A3, A4 and B1)
 - To invite international scholars to serve as external markers (To achieve Goals A1, A2, A3, A4 and B1)
 - To invite international scholars to serve as judges on program benchmark exercises (To achieve Goals A1, A2, A3, A4, B1 and B2)
 - To recruit international students to help finance and diversity (To achieve Goals and A4)
 - To secure new program innovations through attending international conferences. (To achieve Goals A1, A2, A3, A4 and B1)
- 2. Schools and Educational Organizations: The college works closely with local K-12 schools and educational organizations to ensure that the college is graduating students to maintain high professional standards to suit the market needs. The following strategies are used:
 - To invite veteran teachers and school administrators to serve on program advisory councils. (A1, A2, A3) (B1, B2)
 - To work with external education organizations to develop internship programs for student field practice. (A1, A2)
 - To offer professional services to help with field organizations. (B1, B2)
 - To offer training programs to help prepare current teachers to meet with new challenges (B1, B2)
 - To work with schools/educational organizations to secure a field to try out new program initiatives. (B1, B2)
 - To support program graduates in their new positions and seek feedback to current students in the program. (A1, A2, A3)
 - To secure recognition of program external accreditation. (A1, A2, A3, A4) (B1, B2)
- **3. Business and Community:** Local community representatives and businesses and industries support the higher education institutes with substantial funding and help develop up-to-date programs for the institutes. Therefore, the college has assigned staff specifically working on strategies to secure financial resources from the business groups.
 - To work with technology-developing entities for the advancement of program efficiency and effectiveness. (A1, A2, A3) (B1, B2)
 - To invite businesses and industries as partners/donors (A1, A2, A3)
 - To invite community representatives to serve on the program advisory councils (A1, A2, A3)

- 4. External Grants and Public Funding: Staffs in the finance department of the college are assigned with the special responsibility to see that the programs of the college are positioned in ways to secure the equitable public funding appropriation by the funding formula. Additionally, strategies are placed to seek opportunities to apply for all other available external public or private grants.
 - To encourage the faculty to apply for external grants for research and scholarly projects. (A1, A2, A3, A4) (B1, B2)
 - To apply for public funding appropriations in support of college programs (A1, A2, A3, A4) (B1, B2)

The strategies for securing external resources to achieve the college goals are also tallied in the following Table 1 to facilitate convenience of references.

In reviewing these strategies of securing external resources, it is found that the college administrators are exerting a balanced effort in each of the strategy categories. These strategies are characterized by their special features:

- 1. The resources the college is seeking are not always in terms of dollars. It could be in the format of expert assistance or equipment facilitation.
- 2. The college is smart enough to assign special groups of staff to manage external funding affairs. These staff will keep their eyes open to take advantage of each funding opportunity.
- 3. Seeking external resources could be under mutual exchange terms. The college could offer some other services to other partners in return for obtaining the needed external resources.

Part of the data collection procedure is to invite college administrators for interviews to understand more of their experiences with the college strategies in securing external resources to achieve the college goals. A total of five college administrators were interviewed including the Vice-President for Academic Affairs, the Director of Finance, the Director of Public Relations, the Dean of the School of Business, and the Dean of the School of Education. The interviews were aimed at confirming with the interviewees what the researchers have found in the college-filed documents about the strategies for securing external resources. Additionally, the researchers would like to hear the direct voices of the college administrators as to how these strategies for securing external resources are implemented.

During the interview with the Vice-President for Academic Affairs, she indicated that her main role was supervising the academic programs of the college to make sure that they contribute to achieving the college goals. Seeking external resources was certainly one of the significant approaches. She claimed,

"I am playing a supervisory role as Vice-President of Academic Affairs to see that all the programs in the college work towards achieving the college goals. The program directors' report to me needs to demonstrate their strategies and achievements of securing external resources to enrich their programs and achieve the college goals."

"Securing external resources is one of the significant items for annual program evaluation."

The Director of College Finance, who serves in multiple capacities, was interviewed. He watched for external funding opportunities and worked with the faculty in applying for them. He was also responsible for the management of funded programs. He declared,

"Many public and private organizations are ready to work with higher education institutes to provide funding resources to help with program enhancement. You really need to watch for your available opportunities. I always call the attention of different program directors to make sure that their programs qualify for them."

"How to position yourself in the application process to be more competitive is a task. I have completed enough fund applications to understand what is needed for submission. I work closely with the program staff in sending in the most aggressive applications."

"The management of funded programs is the work of my office. I usually assign a person in my office to be responsible for managing one program. He/she needs to thoroughly understand the ins and outs of the conditions of funding of that particular program and to make sure that we are in full compliance."

External Funding Strategies	Goal	Goal	Goal	Goal	Goal	Goal
Category 1: Internationalism		~_	A3	A4		02
* To initiate exchange programs with other international universities		x	x	x	x	
* To invite international scholars to serve as honorary professors	x	x	X	X	X	
* To invite international scholars to serve as external markers	x	x	X	X	x	
* To invite international scholars to serve as judges on program benchmark exercises	X	x	X	X	x	X
* To recruit international students to help finance and diversity	X			x		
* To secure new program innovations through attending international conferences.	x	x	x	x	x	
Category 2: Schools and Educational Organizations						
* To invite veteran teachers and school administrators to serve on program advisory councils	x	x	x		x	x
* To work with external education organizations to develop internship programs for student field practice.	x	x				
* To offer professional services to help with field organizations.					x	x
* To offer training programs to help prepare current teachers to meet new challenges					x	x
* To work with schools/educational organizations to secure a field to try out new program initiatives.					x	x
* To support program graduates in their new positions and sought feedback from current students		X	x			
* To secure recognition of program external accreditation	x	x	x	x	x	x
Category 3: Business and Community						
* To work with technology-developing entities for the advancement of program efficiency and effectiveness.	x	x	x		x	x
* To invite businesses and industries as partners/donors	x	x	x			
* To invite community representatives to serve on the program advisory councils	X	x	X			
Category 4: External Grants and Public Funding						
* To encourage the faculty to apply for external grants for research and scholarly projects.	X	x	X	X	x	X
* To apply for public funding appropriations in support of college programs	x	x	x	x	x	x

Table 1: Strategies for Securing External Funding – Aligning with College Goals

The Director of Public Relations was interviewed saying that he focused on cultivating positive relations between the college and the local and international entities. He disclosed,

"The college needs to build a positive image in the local community and the international professional arena. The reputation of the college counts a lot in securing external sources of help as well as partnership development."

"Many public and private organizations are willing to help higher education institutes in developing their programs. They want to work with institutes with well established relationships."

"I serve as a liaison between the college and the external organizations to develop and maintain constructive working relationships. When the donors/external organizations contribute to help the college, they also want to see the outcomes of their effort. Therefore, we need to stay connected and keep them updated of the latest development of the programs resulting from their generosity."

The Dean of the School of Education stated that she worked closely with the K-12 schools in her effort to connect with external entities for assistance. Her staff also sought opportunities for grants for scholarships, research, and professional activities. She verified,

"We work with public and private K-12 schools to secure resourceful assistance not in terms of monetary values. The schools offer our students internship opportunities and provide veteran teacher guidance to our students. They allow our staff and students to perform academic research in their schools and also give us permission to experiment with innovative teaching methods."

"Some of our educational projects are made possible with the support of external education grants. Allocated grants also provide funding for hiring additional staff and purchase of needed equipment."

"We also receive funding support from alumni of the School of Education with small research projects and professional workshops."

The School of Business has confirmed that the school received substantial financial support from local businesses and communities annually. During the interview, the Dean said that he maintained close connections with local commercial firms and influential community members. He stated,

"The local businesses often donate to the School of Business in terms of scholarship in

support of students to successfully complete the business programs. They also pay the School to train their employees for innovative business initiatives."

"Two years ago, one of the industrial firms donated to the School a substantial amount of funding to upgrade all the equipment in the technology laboratory."

"We have established a panel of experts consisting of distinguished businessmen and community representatives to advise the School on program qualities and updated standards."

"In working with local businesses and industries, we recommend our honored graduates to them to fill their positions. So far, they are very satisfied with the good performance of our graduates in their companies." In summary, the researchers found that the administrators and staff of the college understand the importance of having external resources in support of their programs. Therefore, they all work hard to catch every available opportunity to submit their applications for these competitive resources. The conversations with the college administrators have confirmed the strategies the researchers noted in the college document review. The researchers are impressed with the initiatives the administrators and staff have taken to actively seek external resources to enrich their programs to meet the college goals.

DISCUSSION

The findings of this study are significant. These findings disclose some of the major strategies the college used as means to secure external resources for program enhancement. They also show the administrators' and staff's positive attitudes and confidence in pursuing external funding to achieve the college goals. Some of the findings of this study deserve further discussion to provide answers to Research Question 2:

How are the strategies of this college compared with those of other universities mentioned in current literature in securing external resources to enrich their educational programs?

First, the college administrators and staff recognize the importance of program quality toward achieving the college goals. Therefore, they all work hard to seek opportunities to secure external resources, monetary or otherwise. The finding is in support of the same points of view as expressed by Beza (1984), Leong (2000), Meek and O'Neill (1997), Sutherland (1997), and Zhang and Su (2016), who emphasize the program quality to build the reputation of the higher education institutes.

Second, Kudła, Stachowiak-Kudła and Figurski (2014) and Liu, Chen, Wang, and Wang (2020) agreed that external funding was a main source of revenue for higher education institutes. Even publicly funded universities need to depend on additional external funding for survival. The finding of this study that all the college administrators and staff are anxious to seek external funding sources is in alignment with the findings of Kudla, etc. (2014) and Liu, etc. (2020).

Third, Tetrevova and Vlckova (2018) stated that successful external funding applications would help higher education institutes enhance student activities, faculty teaching, and research. Mississippi Institutions of Higher Learning (2021) also listed convincing reasons for institutions seeking external funding. The findings of this study are in total agreement with Tetrevova and Vlckova (2018) and the Mississippi Institutions of Higher Learning (2021).

Fourth, in Berman's study (2019), alumni of universities enthusiastically participate in raising funds to support their alma mater. However, in this study, the college administrators admitted that alumni participation in college fund drives only happens at the school or program levels.

Fifth, Horta, Meoli and Vismara (2022) and Tomasis (2023) described crowdfunding as a very popular fundraising strategy employed by universities in support of small-scale projects. However, crowdfunding has not been used by the college in this study.

Sixth, the administrators and staff of this college are very interested in working with international higher education institutes. Through different formats of partnerships and exchanges, the programs of this college have been gaining strength by absorbing external resources.

Seventh, a unique strategy employed by this college is to work with K-12 schools and business organizations to offer expertise services to help train veteran teachers and company employees in learning new knowledge and innovative skills. In this way, the college, in return, has gained much popularity and support in monetary and non-monetary rewards.

RECOMMENDATIONS FOR ADDITIONAL EFFORT

Since alumni's fundraising efforts have been so successfully employed by other universities worldwide, the researchers recommend that the college give this approach serious consideration. Many loyal graduates of the college would love to help support their alma mater in fundraising campaigns. Since some schools have already started doing it well, consider bringing it up to try at the college level.

It is further recommended that different programs of the college consider joining their effort in conducting collaborative projects which would benefit the faculty and the students of the participating programs. There are always common grounds in between programs for sharing purposes. Joint efforts in submitting external funding applications could strengthen the applications and increase the chances of acceptance.

CONCLUSION

The administrators and the staff of the college in this study have generated many strategies in securing external sources of funding support to achieve the college goals. They consider external resources to be significant revenues for the college even though it is a publicly funded institute of higher education. How the college administrators and the staff acted in this study could serve as a valuable lesson for other universities to learn. The findings of this study should stimulate the interest of educational planners of higher education to investigate many other possible strategies for securing external funding for program improvement.

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ENHANCING MATHEMATICS ACHIEVEMENT THROUGH ONLINE PROBLEM-POSING: A STUDY DURING THE COVID-19 PANDEMIC

WASUKREE SANGPOM NARONGSAK SANGPOM

Rajamangala University of Technology Suvarnabhumi Suphanburi, Thailand

ABSTRACT

Problem-posing has been recognized for enhancing students' engagement, problemsolving skills, and mathematical knowledge, which leads to higher mathematics achievement. This research is experimental research with a randomized comparison groups pre-test and posttest design, which aims to examine the effect of using online problem-posing to develop students' mathematics achievement during the outbreak of the COVID-19 pandemic in Thailand. Sixty electrical engineering students of Rajamangala University participated in this study. The research instruments included a mathematics problem-posing lesson plan and a mathematics achievement test. The participants were tested for mathematics achievement before and after attending the programs. The result indicated a statistically significant difference in the mathematics post-test mean scores between the experimental and control groups. The experimental group gained higher mathematics achievement than the control group. Therefore, it is recommended that the problemposing be used in teaching mathematics to the students.

INTRODUCTION

Problem-posing teaching techniques have attracted the attention of educators and researchers (Cai, 1998; English, 1997; Kilpatrick, 1987; Stoyanova, 1997). Many researchers presented consistent findings that posing mathematical problems can develop problem-solving skills, mathematical knowledge, and mathematical process skills that lead to higher mathematics achievement. (Cai, 1998; 2003; Cai & Hwang, 2002; Moses et al., 1990; Silver et al., 1996; Yuan & Sriraman, 2010). Problem-posing can be used to improve the mathematics achievements of students at the university level. For instance, Radmehr, Nedaei and Drake (2020), exploring undergraduate engineering students' competencies and attitudes toward mathematical problem-posing in integral calculus, found that about 60 percent of students had positive attitudes toward mathematical problem-posing activities. Roble, Lomibao and Luna (2016) investigated the effect of pre-withinpost problem-posing activities in enhancing students' achievement and mathematical flexibility in Differential Calculus. The participants of this study consisted of 36 second-year university students of Escola Naval. The finding revealed that the pre-within-post problem-posing activities helped students improve their achievement and flexibility scores in Differential Calculus. Moreover, Nedaeia, Radmehr and Drake (2022) suggested that problem-posing tasks could be used more often, alongside problem-solving tasks, as part of the teaching and mathematical achievement evaluation at the university level.

In December 2019, the world acknowledged two confirmed cases of Coronavirus patients in Wuhan, China. On 11 March 2020, the World Health Organization (WHO) officially declared the outbreak of the COVID-19 pandemic. Thailand is one of many countries experiencing this ongoing pandemic and was the first to report a case outside China on 13 January 2020. (Abuza, 2020) This severe epidemic which greatly expanded the virus in the country, had severely affected Thailand in many ways, and education was one of them. (Panyaarvudh, 2020). In the middle of March 2020, all universities in Thailand were requested by the Ministry of Education to suspend any school activities and move to online classes (Mala, 2020). The sudden changes have caused significant impacts and disruptions to the learning progress of learners and teachers. Regarding the teachers, they had to design online learning lessons, develop learning materials and media, online measurements, and online evaluations. As for the learners, advances in information and communication technology have enabled them to access technology for learning quickly and allowed them to study anytime and anywhere according to their needs (Trifan et al., 2014). Therefore, online learning has played an essential role in higher education under globalization and borderless education. (Office of the Higher Education Commission, 2018).

The Rajamangala University of Technology Suvarnabhumi is a state university that provides higher vocational certificates, bachelor's degrees, and master's degrees under the Ministry of Higher Education, Science, Research, and Innovation. This University was established in the year 2005 with the current vision to be the leading University in professional and advanced technology and the core objective of providing professional and technological workforces that meet international standards. Mathematics knowledge is fundamental for preparing students for their profession (Rajamangala University of Technology Suvarnabhumi, 2022).

Although there are previous articles concerning problem-posing in Mathematics (Christidamayani & Kristanto, 2020; Puspitasari, et al., 2019; Suarsana et al., 2019) most of them were limited to the conventional classroom. Therefore, this study aims to investigate whether problem-posing methods can improve the performance of university students in an online mathematics classroom.

RESEARCH QUESTIONS

- 1. Do the students in the experimental group (learn mathematics lessons via the problemmethod posing) gain a higher post-test mean score than the pre-test mean score?
- 2. Do the students in the experimental group gain a higher post-test mean score than the control group (learn mathematics lessons via conventional method)?

REVIEW OF LITERATURE

Problem-posing

The definition of problem-posing varies among researchers ' perspectives. For instance, Silver (1994) and English (1997) stated that problem-posing was a process of defining a math problem from a conditional context, information, or situation in which the original problem was made using conditional modifications. At the same time, Leung (2013) defined problem-posing as the process of defining a problem or question at each step of mathematical problem-solving. In this case, problem-posing was used to find solutions for the problems (Leung, 2013). Mathematical problem-posing is a guideline for designing and organizing mathematical learning activities. The characteristics and the uses of mathematics problem-posing are as follows (Silver, 1994; Leung, 2013):

1. Mathematical problem-posing can be performed in parallel with problem-solving.

There are three ways to implement mathematical problem-posing. The first feature is problem-posing followed by problem-solving, which is the technique that focuses on learners raising problems or asking questions from a given context which could be information, daily situations, charts, pictures, and so forth. These activities encourage students to use mathematical knowledge to analyze and find relationships between information in a given context, create problems or questions, and then solve the problems.

Another technique of problem-posing requires students to set problems during the problem-solving process. This activity focuses on students' creation of the questions at each stage of the problem-solving to consider the condition of the problem and determine the problem-solving approach that leads to the answers to the problem.

The third approach is the problem-posing after one problem has been solved. This method focuses on students' problem creation after the previous question has been resolved. This kind of problem-posing activity encourages learners to expand their ideas about problem-solving results into new problems that may come from modification or information of the problem that has been answered.

In this study, the researchers used the first techniques to enable the students to create the mathematical problem-posing from the given context, condition, and situation to find the proper method to solve the problem.

2. Context of the problem- posing

The context of problem-posing refers to information, conditions, situations, or problems that students use to create problems that should be diverse and cover both mathematics and everyday contexts. The problem-posing context can be divided into three types. The complete structural context is the setting of a new problem that focuses on adjusting initial problem conditions. The second type is a conditional context which focuses on a required specific question. The third one is an independent context to set new problems from context based on the unconditional interest (EI Sayed, 2002; Leung, 2013; Silver, 1994).

3. Problems arising from problem-posing activities depend on each learner's knowledge and experience of problem-posing.

The problems set by the students can be diverse from the easy level to the complex level, not to mention whether those problems can be solved or not. Generally, the solution can be found in a given problem. However, if the students' problems are inconsistent with the setting context, the teachers' roles are needed to guide the students to adapt the problem set to the context. (Kwek, 2015).

The concept of mathematical problem-posing has received interest and support from mathematics educators to use it to manage mathematics learning concretely and continuously to help develop knowledge and skills in mathematical processes in the learners (Suarsana et al., 2019).

Online Learning

The COVID-19 pandemic has changed how people work and students conduct their studies. During national lockdowns, working and studying at home has become the norm, with some classes permanently moving to online-based learning to continue the study and maintain interaction between the teachers and the students (Carolan et al., 2020). Online learning has become a topic of interest in the 21st century (Hurlbut, 2018). It was defined as the delivery of instruction via digital resources since this kind of learning is delivered through electronic devices (Kennedy & Archambault, 2012). It was also called by other names, such as distance education, computerized electronic learning, and internet learning. The debut of online learning denotes that students can access their learning materials online at any place and anytime (Santos et al., 2019).

According to Reushle et al. (1999), online learning comprises critical components which

are:

Cognitive skills: Teachers and students who engage in online teaching and learning environments require a complex range of skills to achieve their teaching and learning goals (Jonassen et al., 1995).

Content structure: The design of the content structure in the website is essential for the learners. The websites must organize the materials into manageable sizes. Moreover, concept maps and graphic organizers will help learners navigate materials and observe the relationships between the concepts.

Learner control: A 'learner-centered' approach requires teachers to be facilitators (Jonassen, 1993) rather than lecturers and view learners as active participants in the learning process. The high level of learner control in a flexible online environment may encourage not only learning of new content but also improve personal learning strategies.

Ease of use: Excellent interface design is determined by simple site navigation and the ability to present the users with friendly, self-evident, and predictable pathways through the site content.

Online learning skill: The online learning skill is pivotal to the learners' achievement of online learning. Therefore, helping to improve learners' skills in learning online is essential. **Online evaluation:** Evaluation is integral to all aspects and levels of any educational design and development process. A reliable and validated evaluation instrument will ensure that students receive feedback from the instructor's point of view. The ability to complete and submit an evaluation online is an essential element of any web design.

Feedback: Feedback from the teacher is a vital part of the learning process during which misconceptions are corrected. Feedback seems to be more effective when it is both immediate and in sufficient detail for the student to initiate corrective action (Waldrop et al., 1986). Moreover, feedback should be given frequently during instruction for small steps rather than large chunks of learning.

HYPOTHESIS DEVELOPMENT

From the literature review, we found few studies related to the effect of using online mathematic problems- posing on students' mathematics achievement. Rosli, et. al (2014) conducted a meta-analysis study on "The Effects of Problem Posing on Student Mathematical Learning" and concluded that problem-posing activities provide considerable benefits for mathematics achievement, problem-solving skills, levels of problems posed, and attitudes toward mathematics. Roble, Lomibao, and Luna (2016) investigated the effect of utilizing pre-within-post problemposing activities in enhancing students' achievement and mathematical flexibility in Differential Calculus. The participants of this study consisted of 36 second-year university students of Escola Naval. The finding revealed that the use of pre-within-post problem-posing activities helped students improve their achievement and flexibility scores in Differential Calculus. Suarsana, et al (2019) studied "The Effect of Online Problem Posing on Students' Problem-Solving Ability in Mathematics," and found that among three methods of teaching, namely online problem-posing, problem-posing, and conventional study, students who attended online problem-posing had higher achievements. Moreover, Nedaeia, Radmehr and Drake (2022) explored undergraduate engineering students' mathematical problem-posing and suggested that problem-posing tasks could be used more often, alongside problem-solving tasks, as part of the teaching and assessment of mathematics at the university level.

From the mentioned review of related literature, we anticipate that the post-test mean score of the experimental group (using the problem-posing method) should be higher than the pre-test. Therefore, the H1 and H2 are set:

H1: The post-test mean score of the experimental group is higher than that of the pre-test.

H0: $\mu 2 = \mu 1$

Ha: $\mu 2 > \mu 1$

Where:

 $\mu 1$ = pre-test mean score of the experimental group

 $\mu 2 = \text{post-test}$ mean score of the experimental group

H2: The post-test mean score of the experimental group is higher than the post-test mean score of the control group.

H0: $\mu 1 = \mu 2$

Ha: $\mu 1 > \mu 2$

Where:

 $\mu 1 = \text{post-test}$ mean score of the experimental group

 $\mu 2 = \text{post-test}$ mean score of the control group

METHOD

Research Design

This is an experimental study with a randomized comparison groups pretest and posttest design.

Population

The population of the research was 229 first-year electrical engineering students of the Rajamangala University of Technology Suvarnabhumi.

Participants

Sixty research participants were randomly selected from the population. Systematic random sampling was used to select research participants whose student numbers ended with odd numbers (1,3,5, 7,9). Then, they were randomly organized into two groups using the draw lot technique. The first group was the experimental group (using problem posing through online class). Another group was a control group (using conventional teaching online). To control the bias effect from the instructors and the content of the study, both groups shared the same instructor and learning content but different learning methods.

Research Procedure

The research procedure was divided into 2 phases:

Phase I: Development of the online lesson plans and achievement test on the subject "Partial derivative"

Phase II: Organizing the online class through "Google Classroom". The problem-posing online class was organized for the experimental group every Wednesday from 2 to 5 p.m. for five weeks from June to July 2022. The online conventional learning was organized every Thursday during the same period. The pre-test was conducted at the beginning of the program while the posttest was conducted at the end of the program using a mathematics achievement test.

Research Instrument

1. Lesson plan:

The lesson plans were drafted for each group. (Experimental group with problem-posing through online class and the control group with conventional learning through online class). Both groups study the same learning content, using the "partial derivative" curriculum for undergraduate students developed by the electrical engineering faculty, at Rajamangala University of Technology Suvarnabhumi. The partial derivative subject is a part of the Calculus subject which is an essential fundamental knowledge for the student to study in the higher level. The teaching plan is comprised of 4 learning sessions:

- Session 1: Subdivisions of Two Variable Functions
- Session 2: Subdivisions of Multivariate Functions
- Session 3: Sub-Derivatives of Implicit Functions
- Session 4: Applications of Sub-Derivatives

Learning models and Class schedules are presented in Table 1 and Table 2

Table 1 Learning models for each group

	Experimental group (Problem-posing online class)	Comparative group (Conventional learning online class)	
1. 2.	Grouping the students of 5 persons into 6 groups. (30 participants)	 Grouping the students of 5 persons in 6 groups. (30 participants) 	to
3.	The teacher provides information, situations, charts, and pictures and	2. The teacher gave a lecture about th content of each lesson.	ne
4.	encourages the students to use mathematic knowledge to analyze and find relationships between information in a given context, create problems. or questions, and then solve the problems.	 The teacher asks each group to do a assignment and upload it to Goog Classroom. Then the teacher give feedback. Q &A and discussion. 	an ;le es
5.	The teacher asks each group to switch the problems that they have formulated with other groups and then solve them.		

- 6. Three selected groups are asked to present their problems and the gained problems from another group
- 7. The students upload their assignments to Google Classroom and the teacher gives her feedback.
- 8. Q &A and discussion.

Class Schedule	Experimental group (Wednesday class)	Control group (Thursday class)
Week 1	-Introduction of the course; objectives, structure, learning method (online problem- posing) and evaluation. -Pretest	-Introduction of the course; objectives, structure, learning method (online lecture) and evaluation. -Pretest
Week 2	Session 1: Introduction to partial derivatives	Session 1: Introduction to partial derivatives
Week 3	Session 2: First-Order Partial Derivatives	Session 2: First-Order Partial Derivatives
Week 4	Session 3: Second-Order Partial Derivatives	Session 3: Second-Order Partial Derivatives
Week 5	Session 4: Chain Rule and gradient - Posttest	Session 4: Chain Rule and gradient - Posttest

 Table 2 Online Class Schedule

2. The Achievement Test.

The mathematics achievement test was developed based on the content of the teaching plan on the subject "Partial derivative" for the undergraduate students of the electrical engineering faculty, Rajamangala University of Technology Suvarnabhumi, to measure the students' learning achievement.

The achievement test consists of 15 multiple-choice questions, each one contained four optional answers, and only one is correct. This test measures the student's knowledge before attending the online mathematics class (pre-test). It was also used in the post-test where the positions of multiple choices were switched to ensure that the students could not remember their previous answers.

Instruments Test

1. Lesson plan

Three experts were asked to verify the lesson plan in mathematic problem-posing techniques and online learning regarding accuracy, utilization, appropriateness, and possibility. (Joint Committee on Standard for Education Evaluation, 2010) The revision was made based on their comments.

2. Achievement test

The achievement test was verified for its content validity judged by the index of congruence (IOC), reliability as determined by Cronbach's Alpha, Discrimination (R), and item difficulty (P). The results of the items analysis yielded the following values:

- IOC values of the questions were ranging between .80-1.00 which were above the cut off criterion at .67 (Turner & Carlson, 2003).
- Cronbach's Alpha value of overall 15 questions was at 0.85 which passed the cut-off standard at .70 (Eisinga et al., 2012).
- Item-discrimination (R) of each question was between 0.60-0.85, representing the high discriminant quality of the items in separating intelligent students from poor students (Ronna & Laurie, 2003).
- Item difficulty (P) of each question was between 0.40 -0.35, which indicated the level of difficulty at a medium to a pretty difficult level (Ronna & Laurie, 2003).

Data Collection

Data collections were organized at the beginning and at the end of the program to compare the mathematics achievement of the students in the experimental group and the control group before and after attending classes.

Data Analysis and Statistics

The data from the achievement test were compiled and analyzed by the computer program using two types of statistics, descriptive statistics such as mean and standard deviation to indicate the mean values of the student's learning achievement before and after classes. At the same time, the independent and paired t-tests were used to determine the differences in the mean score of students' achievement before and after attending classes.

FINDINGS

This part presents the result of the analysis according to the research hypothesis as follows: H1: The post-test mean score of the experimental group is higher than the pretest.

H0: $\mu 2 = \mu 1$

Ha: $\mu 2 > \mu 1$

Where:

 $\mu 1 =$ pre-test mean score of the experimental group

 $\mu 2 = \text{post-test}$ mean score of the experimental group

Table 3 Comparis	son of pre-test	and post-test mear	n scores of the ex	xperimental grou	p. $(N = 30)$
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Grou	ps	Mean	t-value	Sig (p-value)	Df
Experimental Pre-test		4.9333	-16.349	.000	29
	Post-test	14.2000		1 1 1	

** Significant at .01 level

60

The analysis result indicates the t-value at -16.349 and the p-value at .000, which is lower than the significant level at .01. Therefore, we reject H0 and accept Ha. This result indicates a significant difference in the mean values of the experimental group before and after learning mathematics lessons via an online problem-posing method. The post-test mean score is higher than the pre-test mean score.

H2: The post-test mean score of the experimental group is higher than the post-test mean score of the control group.

H0: $\mu 1 = \mu 2$

Ha: $\mu 1 > \mu 2$

Where:

 $\mu 1 = \text{post-test}$ mean score of the experimental group

 $\mu 2 = \text{post-test}$ mean score of the control group

 Table 4 Comparison of the post-test mean score between the experimental group and the control group. (N=30)

Groups	i Mean	ı t-value	Sig (p-value)	Df
Experimental	14.20	6.705	.000**	58
Control	12.13	۹ ۱ ۱	1 	1 1

** Significant at .01 level

The analysis result indicates the t-value at 6.705 and the p-value at .000, which is lower than the significant level at .01. Therefore, we reject H0 and accept Ha. This result indicates a significant difference in the mean score between the experimental and the control group whereas, the post-test mean score of the experimental group is higher than the control group.

DISCUSSION

From the analysis result, we found a significant difference in the mean score between the pre-test and post-test of the experimental group where the mean score of the post-test was higher than that of the pretest. The finding implies that the problem-posing method can be used to enhance students' mathematics achievement. The finding is congruent with the findings of previous studies. Rosli, et. al (2014) conducted a meta-analysis study on "The Effects of problem-posing on Student Mathematical Learning" and concluded that problem-posing activities provide considerable benefits for mathematics achievement. Roble, Lomibao and Luna (2016) investigated the effect of utilizing pre-within-post problem-posing activities in enhancing students' achievement and mathematical flexibility in Differential Calculus and found that the use of pre-within-post problem-posing activities helped students improve their achievement score and flexibility in Differential Calculus.

The comparison of the post-test mean score between the experimental group and the control group revealed a significant difference in the mean score between the two groups where the post-test mean score of the experimental group was higher than that of the control group. The result of this experiment implies that using online problem-posing in teaching mathematics was more effective than the conventional teaching method. The result may be because the students in the experimental group using online problem posing were encouraged to actively participate and engage in learning activities. The students in the control group learned from lecturing and online materials

which was less interesting. This result is consistent with the study of Suarsana et al. (2019) who concluded that online problem-posing had a greater effect on students' problem-solving ability than problem-posing or conventional learning. Furthermore, the findings of this study are in line with the findings of Bevan and Capraro (2021). They found that problem-posing activities can positively impact students' mathematical understanding while allowing for freedom of expression, which leads to better mathematics achievement. Therefore, it is recommended that online problem posing be frequently and broadly used in schools and colleges.

Despite the benefits of the problem-posing technique, mathematics teachers do not widely use the posing of problems (English & Kirshner, 2015; National Council of Teachers of Mathematics [NCTM], 2000). Moreover, the study of Thaikam and Ugsonkid (2021) revealed that Thai teachers usually avoid setting up the questions for the students by themselves and rarely use the problem-posing technique in their teaching because they have obtained very few experiences regarding the problem posing in mathematics from their high school to college education. Thus, schools and universities should foster problem-posing techniques in their mathematics classroom so that the students who may become future mathematics teachers can deliver such knowledge and skills to their students. However, Gopal et al. (2021) found that the critical elements of online learning, such as the quality of instructors, course design, prompt feedback, and expectations of the students, influence students' performance through the students' satisfaction. Therefore, besides using problem-posing in a mathematics online classroom, teachers should improve the critical online learning elements to enhance the effectiveness of using problem-posing in mathematics online classes.

IMPLICATIONS TO EDUCATION PLANNING

Planning to use the problem-posing method in education can be organized using case studies, group discussions, and project simulation to allow students to create problems and solve problems systematically. Teachers and educational institutions can support student learning by providing resources and tools to research and solve problems, such as digital libraries. Software can help with data analysis online learning platform and provide evaluation and reflection on students' learning processes, thinking, and problem-solving. Student reflection on learning can create an open learning environment that encourages expressing opinions and asking questions. Students would feel involved and confident in creating problems and solving problems. In addition, teachers can apply technology for the students to create problems and solve problems, such as using online platforms for group work and simulation software, etc. The problem-posing method allows the students to reflect on what they have learned and how that knowledge applied to other situations.

CONCLUSION AND RECOMMENDATIONS

This research is experimental with a randomized comparison groups pretest- and post-test design, which aims to examine the use of online problem-posing in enhancing students' mathematics achievement. The participants were sixty electrical engineering students of the Rajamangala University of Technology Suvarnabhumi. The research instruments included a lesson plan and a mathematics achievement test. The result indicated a significant difference in the mean values of the experimental group before and after learning mathematics lessons via an online problem-posing method. The post-test mean score was higher than the pre-test mean score. Moreover, a statistically significant difference was found between the experimental and the control group post-test mean scores. In comparison, the students in the experimental group gained higher mathematics achievement than the comparative group. This result implies that online problem-posing is more effective in teaching mathematics than the conventional online class.

Therefore, it is recommended that schools and universities inculcate online problemposing approach rather than the traditional learning model in their mathematics classroom. However, the instructors should pay attention to other elements such as the quality of instructors, course design, prompt feedback, students' expectations, and students' satisfaction to ensure the quality and effectiveness of the online class.

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POST-COVID DIFFERENTIATED INSTRUCTION: A CASE STUDY OF PRE-K-12 TEACHERS' PERCEPTIONS IN THE GREATER TORONTO AREA

ROSELLE C. ARANHA SUSHMA MARWAHA WALTER S. POLKA Niagara University, U.S.A.

ABSTRACT

Three years after the COVID-19 pandemic, school systems worldwide are still on the road to recovery. As students return to in-person learning, there is an increased awareness among educators to investigate the areas of student need where interventional strategies could be applied to bridge the learning loss and help further student academic achievement and emotional well-being. Focused adoption of differentiated instructional practices by teachers may be one of the many ways in which educators could make classroom learning more student-centered. This case study was an exploratory investigation into teachers' desired and actual use of differentiated instruction within the Greater Toronto Area (GTA). The study was conducted to gain a perspective on the areas of particular growth for differentiated instruction in the post-COVID educational environment. The findings from this study may help educational planners, school leaders, and teachers develop relevant professional development programs that could incrementally help to reverse some of the detrimental impacts of the pandemic on student learning.

THE CASE FOR POST-COVID DIFFERENTIATED INSTRUCTION IN K-12 SCHOOLS IN THE GTA

Toronto is the largest city in Canada. It is also one of the most multicultural cities in the world. It draws its diversity from a significant immigrant population. The social fabric of the city and the surrounding Greater Toronto Area (GTA) is a blend of people with over 250 ethnicities (Ryan, 2019). Geographically, the GTA includes the regions of Durham, Peel, Halton, York, and Toronto. It is located in the province of Ontario. The latest census report for 2021 put the population figure for the GTA as 6,712,341(Statistics Canada, 2023). This is 18% of the total population of Canada. Approximately 55% of the residents of the GTA are visible minorities.

Given this demographic complexity, PreK-12 school leaders within the GTA have a challenging mission to serve a very diverse and continuously changing student population. The choices for preK-12 school education in the GTA are distributed across the public and private school sectors. There are four well-established historical public-funded school systems in Ontario. These four government-funded public education systems include the English Public Schools, the English Catholic Schools, the French-language Public Schools, and the French-language Catholic Schools (Peel District School Board, 2023). Students in these schools receive free education up to grade 12, though parents might have to spend on supplies and other amenities for their children.

Private schools within the province function independently of public funding. Students who attend these schools have to pay a tuition fee. All schools within the province of Ontario are governed by the directives of the Ministry of Education, Ontario.

The Ministry of Education, Ontario, provides guidance and organizational scaffolding for schools, principals, and teachers regarding the curriculum structure, which includes four aspects: program planning, curriculum context, curriculum expectations and teacher supports, and assessment and evaluation. Acknowledging the diversity of its student population, the Ontario curriculum is

structured to be relevant for individual students so that they can identify with the curriculum both in its content and context. Teachers are required to plan their units of study to reflect a variety of teaching approaches and strategies to address the curriculum expectations and meet the needs and abilities of students in their classes (Ministry of Education, Ontario, 2023). The Ministry of Education, in its directive on considerations for program planning, explicitly states that Ontario schools must aim to improve academic outcomes for their students through the promotion of inclusive education that fosters learning environments that are positive, equitable, non-discriminatory, and respectful towards students and all members of the school community (Ministry of Education, Ontario, 2023).

For the purposes of student assessment and evaluation, schools must follow the guidelines and procedures articulated in the Ministry policy document *Growing Success-Assessments*, *Evaluation and Reporting in Ontario Schools* (2010). This document is based on the central premise that the purpose of evaluation is to improve student learning. The objective is to ensure that practices and procedures for assessment, evaluation, and reporting of student learning in Ontario schools are consistently fair, transparent, and equitable for all students. The recommended procedures and strategies enumerated in that policy document mandate a dedicated commitment by teachers and school officials to support students through equitable learning opportunities, careful planning of curriculum expectations, and learning goals that align with students' learning styles, preferences, interests, and experiences. In addition, the document requires teachers to provide ongoing multiple evaluation opportunities for students to demonstrate their full range of learning, offering students feedback that is continuous, descriptive, and timely, and developing within students the ability to self-assess their own learning and individually plan their educational progress trajectory.

This focus on inclusive and equitable education is also consistent with the UN Plan on *Education for Sustainable Development, 2030,* where educational institutions are encouraged to further the goal of quality education (SDG #4) through the adoption of a pedagogy that is transformative, holistic, equitable and inclusive (UNESCO, 2020).

The emphasis in both the Ontario Ministry Policy and the UN Education for Sustainable Development, 2030 official documents is on equitable, inclusive learning that is student-centered as well as differentiated and nuanced to meet the needs of individual students to further their personal academic and emotional success in becoming contributing members of their respective societies. Teachers and their educational leaders have a pivotal role in fulfilling this task. This challenge mandates dedication, commitment, creativity, empathy, and strong professional skills on the part of teachers to make their teaching-learning experiences meaningful and valuable to individual students. The punctuated equilibrium brought on by the COVID-19 pandemic in 2020 made an already difficult task even more demanding for teachers and school leaders.

The pandemic forced schools to close, and most education throughout the world had to move to virtual online experiences. This widened the gaps between equity and differentiated learning for students in many school systems. Students, their families, and school personnel found themselves navigating unchartered territory to improve learning experiences. Also, government directives and policies on virtual learning in Ontario were still evolving throughout the crisis in response to the environmental requirements and advisories from the Ministry of Public Health. In most situations, parents had to take on the responsibility of their children's learning. These online educational experiences brought to the fore existing deficits in student skills and motivation regarding their inability to adapt to this new form of learning (Bennett, 2021; Butcher & Burke, 2021). Teachers found themselves in the deep end of the pool, experimenting with different technological learning packages that were hurriedly put together to meet the learning needs of students in the midst of the global pandemic lockdown. Though the learning loss was clear and present during this unique historical period, Ministry instructions on 'guaranteed student grades' saw an unexplained rise in student grades even though teachers complained that curriculum expectations were not adequately met (Gallagher-Mackay & Brown, 2021). The catastrophe and educational chaos associated with the pandemic also brought with it mental health concerns among children; the implications of which have not yet been completely mapped or understood (Bennett, 2022; Rose, 2021; Science et al., 2021). Three years later, education systems in Canada and globally are still on the road to recovery. The present research was undertaken in the context of this situation.

This research is a case study of the self-reported perceptions of PreK-12 teachers within the GTA regarding their desired and actual practices of differentiated instruction in their 2023 teaching-learning contexts. The findings of this study also further a comprehensive understanding of differentiated instruction as currently practiced by PreK-12 teachers within the GTA. The findings of this research may help to unravel areas of teaching strength and areas for specific growth so that teachers can be supported in their instructional and curriculum improvement efforts through dedicated professional development and astute planning.

LITERATURE REVIEW

The Differentiated Instruction Paradigm

Tomlinson (2001) defined differentiation thus: "In a differentiated classroom, the teacher proactively plans and carries out varied approaches to content, process, and product in anticipation of and response to student difference in readiness, interest and learning needs (p.7)." According to Tomlinson, differentiation does not mean individualized instruction, nor is it a chaotic response to perceived student needs; rather, it is disciplined, purposeful, and orderly. It is student-centered and organic. The teacher in a differentiated classroom knows how to adjust the metaphorical instructional sails they employ to direct the learning approaches for greater effectiveness in keeping with the students' learning needs, styles, and experiences.

Differentiated instruction is, therefore, rooted in constructivism (Eller et al., 2019; Hersi & Bal, 2021; Sprenger,2011; Tileston,2011). Polka et al. (2016) posited that the contemporary instruction paradigm, as understood and practiced by educators, vacillates between two diametrically opposite magnetic poles: one pole representing the teacher-centered approach at one end of the continuum and the other pole representing the learner-centered approach at the opposite end of the continuum. In addition, there are nine primary teaching-learning categories of professional decision-making behaviors that have been enumerated and researched by instructional specialists during the past 60 years. Those nine key instructional behavioral decision-making categories in several researched by Heathers (1967) and subsequently validated as key instructional categories in several research studies conducted or promoted by instructional researchers: Danielson, 2002; Darling-Hammond, 1997; Eggen & Kauchak, 2001; Foote, Vermette & Battaglia, 2001; Marzano, Pickering & Pollock, 2001; Ornstein & Levine, 2008; Slavin, 2006; Sternberg & Williams, 2002; Tomlinson, 2009; Tomlinson, 2014; Tomlinson, Brimijoin & Narvaez 2008; Tomlinson & Imbeau, 2011.

Accordingly, the nine key teaching-learning behaviors that are within the professional decision-making purview of teachers are 1) teacher objectives; 2) teacher planning and preparation; 3) teacher communication and messages; 4) teacher behaviors; 5) student objectives; 6) student planning and preparation; 7) classroom expectations of students; 8) student communication and messages; and 9) student evaluations. Figure 1, developed by Polka (2002), presents a visual of the teaching-learning polarity diagram with the nine associated teaching-learning decision-making

behaviors identified and their respective polarized instructional actions articulated for teacher professional reflection and analysis.

The Benefits of Differentiated Instruction

Differentiated instructional practices support students according to their competence and their learning needs (Nusser & Gehrer, 2020; Valiandes, 2015; Westwood, 2018). Employing such constructivist instructional practices builds a learning environment that is both equitable and inclusive. In the particular context of PreK-12 education within the GTA, there are many challenges for teachers and students given the types of schools, viz. public and private, the classroom sizes, student diversity in terms of ability, learner needs, readiness and motivation, family support, social status, and ethnicity. However, employing student-centered teaching-learning approaches, strategies, and techniques enhances student motivation and reduces or at least identifies some of the barriers to learning experienced by students, which, subsequently, maybe more specifically and more appropriately addressed (Ainscow, 2005; Wong et al., 2023).

In addition, differentiated instruction builds on teacher efficacy and promotes a valuefocused professional mindset that has the potential to transition education from a 'pedagogy of poverty' to a 'pedagogy of plenty' (Tomlinson, 2023). The emphasis on developing a culture of care within the classroom coupled with a tenacity for excellence and equity promulgates teachinglearning environments that maximize student thriving and growth opportunities and contribute to more appropriate teacher professional decision-making and instructional problem-solving.

In the aftermath of the pandemic, a renewed dedicated focus on integrating differentiated instruction practices within school classrooms may provide the much-needed impetus for bridging the learning gaps that impacted PreK-12 education in the GTA during and after COVID-19.


Figure 1: The Teaching-learning Polarity Diagram (Polka, 2002)

RESEARCH QUESTIONS

This study aimed to examine the discrepancy that might exist between the current use of differentiated instructional approaches, strategies, and techniques by practicing teachers and the degree to which teachers desire to use them in a post-COVID world. The present research is a case study with data obtained from practicing teaching professionals within the Greater Toronto Area (GTA) in the fall of 2023. The research questions that guided the academic exploration for this study were the following:

- Along the continuum from the smallest to the greatest differences, how do desired 1. and actual differentiated instruction practices align based on self-reported responses of teaching professionals within the GTA?
- 2. Is there a significant difference between GTA teaching professionals' self-reported desired and actual differentiated instruction classroom practices?

METHOD

Research Design

A cross-sectional survey design with a quantitative approach was employed to explore the teachers' self-reported perceptions of their desired and actual use of differentiated instruction approaches, strategies, and techniques in their respective teaching-learning practices. Data were collected electronically through the use of Qualtrics software. The survey was uploaded onto the Qualtrics site and disseminated via an anonymous link.

Sampling Procedures

The intended population for the survey consisted of teaching professionals in the GTA. The survey was distributed through the snowball method, where the researchers reached out to their friends and acquaintances who were practicing teachers within the GTA, and they, in turn, passed on the survey link to other practicing teachers within their professional networks. The survey was completely anonymous; there was no information solicited that could distinctively identify the participants. Participation in the survey was voluntary. The data collection was done through a voluntary convenience sampling process. This research project and survey tool were reviewed and approved by the Institutional Review Board of Niagara University (Protocol#2023-071)

The survey was kept open for a period of six weeks on Qualtrics. The initial responses gathered for the survey were 71. Of these 71 responses, 27 were found to be partially completed; these were excluded from the data analysis, leaving 44 usable surveys for the purpose of this study. The survey response rate for usable surveys was 61.97%.

Participants

The practicing teaching professionals who completed the survey questionnaire were employed in various Public, Private, and Catholic PreK-12 schools within the GTA. Since the survey instrument was only available in English, teachers from the French schools in the GTA were not included in the survey. Table 1 presents a basic demographic overview of the participants.

Variable	Coding	Distribution
Teaching role	Teacher	37 (84.09%)
C	Paraprofessional	07 (15.91%)
Teaching experience	1 to 4	09 (20.45%)
(in years)	5 to 10	07 (15.91%)
	11 to 15	07 (15.91%)
	16 to 21	06 (13.64 %)
	More than 21	15 (34.09%)
Present Teaching Level	PreK to Grade 3	13 (29.54%)
	Grades 4 to 6	04 (9.09%)
	Grades 7 to 8	06 (13.64%)
	Grades 9 to 12	20 (45.45%)
Type of school	Public	20 (45.45%)
•••	Private	03 (6.82%)
	Catholic	21 (47.73%)
Location of school	Urban	20 (45.45%)
	Suburban	20 (45.45%)
	Rural	04 (9.09%)

Descriptive statistics for demographic variables

Instrument

This research study used an existing discrepancy survey instrument, Desired and Current Use of Constructivist Activities and Techniques, developed by Polka (2010), who approved of its use for this case study. This survey tool has been previously used in multiple case studies in different states in the U.S. viz., New York and Georgia (Polka et al., 2016), Indiana (Peace et al., 2017), Idaho (Eller et al., 2019) and Maryland (Hersi & Bal, 2021). The survey has three sections: a demographic component, twenty-five statements on differentiated instruction use that consists of both "desired" and "actual" frequencies, and two open-response questions.

Demographic Questions

The demographic component included data on a participant's teaching role, total years of teaching experience, present teaching level, subjects taught, type of school, location of the school, student population within the school building, and the current average number of classes being taught by each teacher participant.

Survey Statements on Differentiated Instruction

The instrument contained 25 statements with both the "desired" and "actual" frequency of use pertaining to differentiated instruction practices. Participants had to rate each statement twice: once for their "desired" differentiated instruction practice and second for their "actual" differentiated instruction practice. Thus, there were 50 individual responses to the survey statements

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per participant. Each statement was rated on a five-point Likert scale ranging from 5-Always to 1-Never.

Open Response Questions

The two open-response questions included in the survey gave participants an opportunity to offer suggestions on what could be done to increase the use of differentiated instruction for student-centered learning within their classrooms. However, this research article is only focused on interpreting the quantitative results, including demographic information and the Likert-scale survey results based on participants' self-reported perceptions about their desired and actual differentiated instruction practices. The qualitative analysis of the open-ended questions is not included in this article.

Reliability and Validity of the Survey

Though the reliability of the survey instrument has been tested through the calculation of the Cronbach alpha statistic for reliability in earlier studies (Polka et al., 2016), the researchers calculated the statistic again with the data for this study. The 25 statements for desired practice showed a reliability statistic of α =0.91, and the 25 statements for actual practice had a reliability statistic of α =0.89. This indicates an excellent level of internal consistency within the survey statements (Cohen et al., 2018; Taber, 2017).

The construct validity of the survey statements was established through a meta-analysis of the nine instructional decision-making behavior categories indicative of differentiated instruction drawn from contemporary research studies and scholarly work (Polka et al., 2016).

Data Analysis

The data for this study were analyzed quantitatively. For Research Question 1, the researchers calculated the mean differences for the scores between the desired and actual differentiated instruction practices on each statement as reported by the teachers who responded to the survey. The statements were then grouped into four quartiles ranging from statements with the least difference between desired and actual practice of differentiated instruction and those with the greatest difference.

For Research Question 2, the data were analyzed using the paired t-Test. In the first instance the t-statistics was used to compare the overall mean scores between desired and actual practices of differentiated instruction for the whole sample and then in the second instance the t-statistics was used to compare the teachers' responses for desired and actual practice for each statement. The level of significance was set at 0.05.

RESULTS

The findings of the study to each research question are presented in this section. RQ 1: Along the continuum from the smallest to the greatest differences, how do desired and actual differentiated instruction practices align based on self-reported responses of teaching professionals within the GTA?

The mean differences between the desired and actual differentiated instruction practices for each of the 25 statements were sorted from the least to the greatest differences and divided into quartiles to answer this research question. Quartile 1 included seven survey statements. These have been listed in Table 2. The mean differences for these statements ranged from 0.159 to 0.455. This was the cluster with the least differences between desired and actual differentiated instruction practices, indicative of the greatest degree of congruency between the desired and actual practices of the teachers who completed the survey (See Table 2).

Table 2

Survey Statement Number	Survey Statement	Mean Difference between "Desired" and "Actual" practice		
14	The personal problems or learning exceptionalities of students are accepted with consideration, understanding, and empathy.	0.159		
20	The teacher communicates individually with students or in small groups, as opposed to "total" class discussion.	0.364		
11	The students and teacher respect the diverse opinions of others and come to agreements in a collegial fashion.	0.409		
15	Information is presented in a manner that promotes authentic inquiry and students are encouraged to consider questions for which a "right" answer may not exist.	0.432		
24	Students are offered instructional assistance and guidance individually rather than in a large group setting.	0.432		
02	Classroom objectives focus on cultivating and facilitating social skills, cooperation, idea exchange, and shared problem-solving, as opposed to memorizing.	0.455		
25	The teacher varies the type and degree of difficulty of questions to assure that each student understands.	0.455		

Quartile 1: Survey Statements with the Greatest Degree of Congruency

Quartile 2 included eight survey statements. These have been listed in Table 3. The mean differences for these statements ranged from 0.477 to 0.545. This was the cluster with a moderate degree of differences between desired and actual differentiated instruction practices, indicative of a high degree of congruency between the desired and actual practices of the teachers who completed the survey (See Table 3).

Quartile 3 included six survey statements. These have been listed in Table 4. The mean differences for these statements ranged from 0.568 to 0.614. This was the cluster with a high degree of mean differences between desired and actual differentiated instruction practices, indicative of a moderate degree of congruency between the desired and actual practices of the teachers who completed the survey (See Table 4).

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Survey Statement Number	Survey Statement	Mean Difference between "Desired" and "Actual" practice
16	Formal evaluation and marking are based on authentic assessment principles.	0.477
19	Pretests and other similar diagnostic instruments are used to determine the parts of a unit that individual students need	0.477
12	The time that students have to complete or master a given concept or skill varies based on individual differences.	0.5
17	Diagnostic elements, such as a student's exceptionality, learning style, reading level, and math ability, are used to plan individual student activities.	0.523
01	The teacher practices the use of open-ended questioning rather than focusing on the "right" answer syndrome.	0.545
03	Cooperative learning experiences are used so that students often receive instructional assistance from one another.	0.545
10	Knowledge of each student, including life outside of school, is used to plan instructional activities.	0.545
21	Different instructional techniques are used with different students	0.545

Quartile 2: Survey Statements with a High Degree of Congruency

Survey Statement Number	Survey Statement	Mean Difference between "Desired" and "Actual" practice 0.568		
09	Student evaluations are based on individual learning growth instead of a fixed standard all are expected to learn.			
23	A variety of diverse learning assignments are designed to meet individual student interests and needs	0.568		
13	Divergent ideas are encouraged by the teacher in evaluating student work, as opposed to expecting convergence in exams and other evaluations.	0.591		
06	Students are evaluated individually and move on to another task once they have mastered the objectives on a unit.	0.591		
04	Sufficient time is allocated for students to think, play with ideas, manipulate objects, and experiment in learning without pressure to get "the right answer" at the "right time."	0.614		
22	Students play an active role of contributing to the direction or content of the lessons in their learning experiences.	0.614		

Quartile 3: Survey Statements with a Moderate Degree of Congruency

Quartile 4 included four survey statements. These have been listed in Table 5. The mean differences for these statements ranged from 0.659 to 0.818. This was the cluster with the highest mean differences between desired and actual differentiated instruction practices, indicative of the least degree of congruency between the desired and actual practices of the teachers who completed the survey (See Table 5).

Survey Statement Number	Survey Statement	Mean Difference between "Desired" and "Actual" practice
08	The teacher's role is that of a facilitator of learning or resource "guide on the side."	0.659
05	Different students, when working on a unit of instruction, use different materials, resources, and equipment.	0.659
07	Students conduct a major part of their learning on a self-directed basis.	0.795
18	Lesson planning is done for individual students rather than for the entire class	0.818

Quartile 4: Survey Statements with the Least Degree of Congruency

RQ 2: Is there a significant difference between GTA teaching professionals' self-reported desired and actual differentiated instruction classroom practices?

To answer this research question, the researchers used two approaches: the first was to compare the overall mean scores of the teacher responses on their desired and actual practices of differentiated instruction, and the second was to compare the teacher responses for each of the survey statements. A paired t-test was used in each case, with the significance level set at 0.05. Before conducting the paired t-test, the researchers checked that the assumptions under which the test could be used were satisfied for the sample: The sample for this study was selected from the population through snowball sampling; the data were parametric and normally distributed. The paired t-tests were done using the SPSS statistical software (Version 29.0).

Table 6 shows the results for the overall survey responses of the GTA teachers on their desired and actual differentiated instruction practices. At the 0.05 level, the paired t-test for the overall mean scores of the desired and actual practices was statistically significant with p<0.001. As revealed by the computation of Cohen's d, the effect size was 0.4826, which pointed to a moderate effect size. The correlation coefficient for the desired and actual practices was 0.436, which was indicative of a positive moderate correlation. The results indicated a significant difference between the overall self-reported mean scores of the desired and actual differentiated instruction practices of the GTA teachers (see Table 6).

Table 6

Paired t-test Results for the Overall Mean Scores of the Desired and Actual Differentiated Instruction Practices

			95% CI for the Difference							
Response	Mean	SD	SEM	Р	Correlation	LL	UL	d	t	
Focus										
Desired- Actual	0.53455	0.48264	0.07276	< 0.001	0.436	0.3878	0.6813	0.4826	7.347	

The researchers also conducted paired sample t-tests for each statement to compare scores for the desired and actual practices as reported by the sample of GTA teachers. Effect size and correlation coefficient were also calculated for each statement. Table 7 presents a consolidated picture of the results for each of the 25 survey statements.

Table 7

Paired t-test results for Each Statement on the Desired and Actual Differentiated Instruction Practices

						95% CI for the Difference			
Statement	Mean	SD	SEM	р	Correlation	LL	UL	d	t
#									
1	.54545	.76111	.11474	<.001	0.456	.31406	.77685	.7611	4.754
2	.45455	.62708	.09454	<.001	0.569	.26389	.64520	.6271	4.808
3	.54545	.58883	.08877	<.001	0.676	.36643	.72448	.58883	6.145
4	.61364	.89484	.13490	<.001	0.405	.34158	.88569	.89484	4.549
5	.65909	.91355	.13772	<.001	0.526	.38135	.93683	.91355	4.786
6	.59091	.92304	.13915	<.001	0.602	.31028	.87154	.92304	4.246
7	.79545	.90424	.13632	<.001	0.467	.52054	1.07037	.90424	5.835
8	.65909	.77589	.11697	<.001	0.484	.42320	.89498	.77589	5.635
9	.56818	1.02066	.15387	<.001	0.573	.25787	.87849	1.02066	3.693
10	.54545	.84783	.12782	<.001	0.624	.28769	.80322	.84783	4.268
11	.40909	.62201	.09377	<.001	0.638	.21998	.59820	.62201	4.363
12	.50000	.69884	.10535	<.001	0.527	.28753	.71247	.69884	4.746
13	.59091	.72555	.10938	<.001	0.585	.37032	.81150	.72555	5.402
14	.15909	.56828	.08567	.070	0.472	0136	.33186	.56828	1.857
15	.43182	.58658	.08843	<.001	0.750	.25348	.61016	.58658	4.883
16	.47727	.66433	.10015	<.001	0.540	.27530	.67925	.66433	4.766
17	.52273	.90190	.13597	<.001	0.456	.24852	.79693	.90190	3.845
18	.81818	1.01781	.15344	<.001	0.623	.50874	1.12762	1.01781	5.332
19	.47727	.66433	.10015	<.001	0.673	.27530	.67925	.66433	4.766
20	.36364	.53226	.08024	<.001	0.795	.20182	.52546	.53226	4.532
21	.54545	.79107	.11926	<.001	0.543	.30495	.78596	.79107	4.574
22	.61364	.81315	.12259	<.001	0.610	.36642	.86086	.81315	5.006
23	.56818	.75937	.11448	<.001	0.416	.33731	.79905	.75937	4.963
24	.43182	.81833	.12337	.001	0.475	.18302	.68061	.81833	3.500
25	.45455	.76111	.11474	<.001	0.573	.22315	.68594	.76111	3.961

The analysis of the data showed that for all statements except statement 14, the paired t-test results were significant at an alpha level of 0.05. The fact that the difference between the desired and actual differentiated instruction practices for statement 14 was not statistically significant means that there is an appreciable level of congruency between teachers' desired and actual practice for the classroom behavior described by statement 14. All 25 statements on the survey showed a moderate to high positive correlation between the statements for desired and actual differentiated instruction practices. The effect size was greater than 0.9 for statements 4, 5, 6, 7, 9, 17 (See Table 7).

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DISCUSSION AND IMPLICATIONS

This study was an exploration of two research questions:

- 1. Along the continuum from the smallest to the greatest differences, how do differentiated instruction practices align based on self-reported responses of teaching professionals within the GTA on their desired and actual classroom practices?
- 2. Is there a significant difference between GTA teaching professionals' self-reported desired and actual differentiated instruction classroom practices?

The mean differences between desired and actual practices for the sample data were ranked from the least to the greatest. The range of the differences was from 0.159 to 0.818. The corresponding survey statements were then grouped into four quartiles from the least to the greatest differences, which were indicative of statements with the highest congruency to those with the lowest congruency between the teachers' desired and actual practices for differentiated instruction. Quartile 1 included seven statements, these could be viewed as areas of strength for teachers within the GTA in terms of differentiated instructional practices. These statements indicated a classroom climate where there was empathy, respect, appreciation for diverse opinions, authentic inquiry, and classroom instruction that was meted out to students in small groups rather than the teaching approach with a whole class focus- a one-size-fits-all strategy. The findings are evidence that teachers in the GTA sample value a culture of care for their students. Student well-being and happiness are important aspects of education; love and connection impact education in a positive way (Noddings, 2003; Truijilo, 2019)

Quartile 2 included eight statements; these were statements 16, 19, 12, 17, 13, 10, 21. These reflected differentiated instruction practices that centered on student assessment and evaluation. These statements had mean differences ranging from 0.477 to 0.545. They pointed to teacher efforts to structure assessment outcomes and evaluation practices that were grounded in the principles of authenticity, equity, inclusiveness, and the knowledge of individual differences. These are in keeping with the Ministry of Education, Ontario directives in *Growing Success* (2010), and the UN ESD 2030 vision for quality education that is inclusive and equitable (UNESCO, 2020). A high congruency between desired and actual practices for teachers in this area is a positive for PreK-12 education in the GTA.

Quartile 3 included six statements; these were statements 9, 23, 13, 6, 4, 22. The mean differences for this cluster ranged from 0.568 to 0.614. This group of statements showed moderate congruency between desired and actual practices. These statements reflected customized evaluations for individual students, diversity in learning assignments to meet students' needs and interests, flexibility with time for students to experiment as they learn, and student-directed learning. This is an area where more progress could be made regarding adapting instruction and evaluation practices. It is an area that educational planners might want to reflect upon to create professional development sessions as well as organizational modifications in terms of timetables and schedules to help teachers find more support in these practices. It might look like there is a close connection or even an overlap between the expectations of teacher behavior for the statements in Quartile 2 and Quartile 3. The difference is that the statements in Quartile 3 go beyond structured accommodations to support students to an expectation from teachers for diversity in the range and complexity of assessment practices and instruction so individual students feel more supported in their learning pathways. This is always a work-in-progress given the changing socio-cultural and economic dynamics. It is also something that schools could reflect on as a community to develop solutions that would be specific to the needs of their particular student population.

The statements in Quartile 4 reflected the highest discrepancy between desired and actual practices. There were four statements in this quartile. They were statements 8, 5, 7, 18. This is an area of growth for teachers in the GTA. The focus of these statements is on the teacher's role as a facilitator of learning, with students doing a major part of their learning on a self-directed basis, planning for individual students, and the availability of a range of different learning resources for students. Provisioning for a multiplicity of diverse learning resources might be beyond the scope of individual teachers. Resource allocation is the responsibility of the government and school boards since it is dependent on funding, which teachers have little or no influence over. Further research might be needed at the policy level to see how these differentiated resources could be made available to teachers in schools (Hersi & Bal, 2021).

The second research question examined whether there was a significant difference in the desired and actual differentiated instruction practices reported by teachers in the GTA sample. The researchers investigated this using a paired t-test for all the overall mean differences of the sample for all the survey statements and then for each pair of desired and actual statements on the survey.

The overall mean differences were found to be statistically significant. The mean differences were also found to be statistically significant for 24 of the 25 survey statements. The only statement that was not statistically significant for the discrepancy between desired and actual practice was statement 14. This statement, when compared to the results of earlier studies in Georgia, New York, Indiana, and Idaho, was found to be statistically significant, but it had the smallest mean difference between desired and actual practices.

This statement is about a teacher's empathy, consideration, and understanding of students' personal problems. It reinforces that teaching is universally a profession that calls for professionals with resilient socio-emotional skills who can transform learning environments into safe, welcoming spaces where students feel valued, cared for, and respected. The fact that the GTA teachers have achieved a very close congruency in their desired and actual practice of this behavior is a beacon of hope for PreK-12 education and students within the GTA.

LIMITATIONS OF THIS STUDY

This study is a reflection of the responses of the teachers who voluntarily participated in answering the survey. Since the data collection method used was snowball sampling, the researchers cannot be sure of how wide the geographical network of teachers who participated in the survey is. This research study has been built on the responses of 44 teachers within the GTA who completed the survey. Given the vast number of schools (which are more than a thousand) in the GTA, the responses of a small sample of 44 teachers might have limited scope for generalizability. This is precisely why this study has been referred to as a case study only. Also, since the survey was only available in English, teachers of French-speaking schools were not included in the survey. Also, for the purpose of this study, only the quantitative responses of the teachers were analyzed.

CONCLUSION

The results of this case study have revealed that the GTA teachers who responded to the differentiated instruction discrepancy survey, *Desired and Current Use of Constructivist Activities and Techniques*, Polka (2010), are working toward greater integration of constructivist classroom practices as they continue their efforts to strengthen education content, process, and products for positive outcomes and life-long learning for their students in a post-COVID world. The significant differences between desired and actual practices of differentiation, as reported by the teachers who participated in this recent case study, provide valuable instructional practice information to

educational planners in terms of developing relevant professional development programs that meet teachers at their point of need to become more student-centered and, consequently, to make more appropriate and effective instructional decisions for their students.

Student agency and planning of learning experiences for a student-directed focus on their own learning and progress has emerged as one of the areas of growth for further educational thought and planning. Schools may work on this area through teacher reflection in professional learning communities with their principals and administrators to design instructional interventional strategies that could be contextually feasible, meaningful, and beneficial for their own student community. Extending this research to include more teacher participants across different school boards, including the French language schools, will help build a more comprehensive picture of current differentiated instruction practices across the GTA.

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