Neutrosophic Framework to Analysis Factors in Leadership and Policy Undergraduate Students: A Case Study

Nouran Ajabnoor
Management Department, Applied College, Jazan University, Jazan, Saudi Arabia
Email: nyusuf@jazanu.edu.sa

Abstract

Based on evidence choices on the transition from in-person to digital delivery of leadership and policy classes to learners in the aftermath of the COVID-19 pandemic are crucial given the significance of establishing leadership abilities throughout school. The purpose of this brief study is to locate useful instructional methods for analyzing factors of undergraduates' digital leadership and policy classes. This paper used the concept of multi-criteria decision-making (MCDM) due to various factors. The concept of a neutrosophic set is used to deal with uncertain data. Effective and adaptable tools, MCDM may be used for a wide range of environmental issues. The essay suggests an innovative approach to the problem of factors of leadership and policy in education. The neutrosophic step-wise weight assessment ratio analysis (SWARA) approach is used to analyze the factors of leadership and policy in education (FLPE).

Keywords: MCDM; step-wise weight assessment ratio analysis (SWARA); Neutrosophic Sets

1. Introduction

The COVID-19 epidemic has had a significant effect on how higher education institutions approach the execution of their programs. Online instruction (electronic education) is now a new norm for various colleges throughout the globe, but public health agencies and legislatures have advocated physical separation as a critical step to stop the propagation of the virus. Online technologies and education have made it possible for teachers to rapidly adapt their classroom practices to the delivery of content over the web[1], [2].

Online education, or distance learning, is a kind of education that makes use of the world wide web to disseminate instructional materials and allow for collaborative, student-centered learning. When contrasted with classroom-based instruction, online learning has several advantages. The American Nurses Association (ANA) has acknowledged the value of online education and found it to be at least comparable to more conventional methods of instruction for students in medical fields. More effective methods of providing instruction for nurses are needed due to a worldwide nursing shortage and programmed capacity restrictions observed by many nations[3], [4].

The material of courses may be accessed at any time and from anywhere using electronic learning. Graduates of nursing benefit greatly from this adaptability since their clinical experience (nontraditional work patterns and a large amount of training hours) sometimes prevents them from attending conventional classroom settings. Finally, the variety of technology tools employed in distance learning programs may improve instructor-student connections and make data, feedback, and assessment from individuals more manageable, allowing for greater adaptation of programs to the needs of learners[5], [6].

The lightning-fast development of electronic learning in postsecondary and higher education has resulted in changes in how nursing programs are delivered across the globe. Online learning is often regarded as a more adaptable tool and a successful strategy for making nursing curricula more widely available and easily understood.

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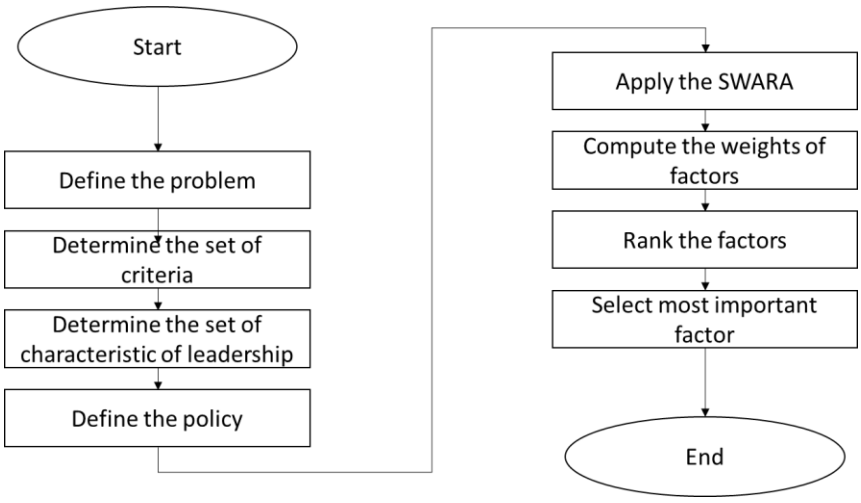
To evaluate the efficacy of instructional strategies for online interactive learning used in the teaching of nursing, Männistö et al. recently performed a systematic study. This analysis found that nursing learners' understanding, ability, contentment, and ability to solve issues were all enhanced by group work in online courses[7], [8].

Nevertheless, the available materials and technologies to assist teachers create e-learning courses are broad in scope and not designed with any particular subject or group of learners in mind. Incorrect demands placed on nursing pupils about workload and technological difficulty in obtaining educational information are two of the obstacles to delivering successful online courses or educational settings. Efficient distance education practices are needed to provide nursing e-learning programs that meet learning goals, boost nursing competence, and increase student engagement and pleasure. When conducting experiments with many fuel types and leadership tuning factors, a multi-criteria issue arises that may be handled using MCDM techniques. The MCDM approach is frequently employed to solve a wide range of scientific problems. The criterion weights were calculated using the SWARA approach. SWARA is used to evaluate educational leaders and policies[9]–[12]. The evaluation of FLPE is complicated by uncertainty. Some approaches and frameworks have been proposed in the scientific community to deal with FLPE evaluation problems related to decision-making. Nevertheless, these frameworks are notoriously difficult to implement in practice due to the presence of uncertainties, incompleteness, indeterminacy, and inconsistency in the data often used to evaluate FLPE[13]–[15].

Smarandache developed the "neutrosophic set (NS)" theory to cope with scenarios including unclear, partial, ambiguous, and inconsistent information that cannot be managed by "fuzzy sets (FSs)" and "intuitionistic fuzzy sets (IFSs)". "philosophical disciplines which investigate the genesis, the environment, and extent of neutralities, in addition to their relationships with different ideational spectra," as Smarandache puts it. In addition, various NS enhancements, such as "single-valued neutrosophic sets (SVNSs)", "trapezoidal neutrosophic sets (TNSs)", "bipolar neutrosophic sets (BNSs)", "type-2 neutrosophic sets (T2NSs)", and others, are produced. These NSs are used because different varieties of uncertainty are encountered in practice[16]–[18].

Numerous authors have shown a great lot of enthusiasm for the idea of SVNSs as one of these enhancements because of their adaptability and practicality when faced with real-world scenarios. To assess the many criterion group choice issues with uncertain and conflicting data, Nancy and Garg developed an SVNS-based technique[4], [5]. To resolve decisions using "single-valued neutrosophic" variables, Garg and Nancy investigated a decision-making approach based on a distance measure and TOPSIS. To put the "single-valued neutrosophic numbers (SVNNs)" in control, Chutia et al. developed an organizing algorithm[21], [22]. Figure 1 shows the conceptual framework of this study.



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2. Leadership in Healthcare

It has long been understood that professionals, in addition to providing direct care to patients, must also have strong leadership abilities. Although individual clinicians may believe their work to be of the highest standard, healthcare systems as a whole have more work to do before they can help all patients. Thus, the clinician is increasingly seen as a key player in enhancing healthcare delivery across the world. For more than a decade, healthcare organizations have expected physicians to take on leadership responsibilities at all levels, and special leadership training programs have been designed with clinicians in mind. Leaders in the healthcare sector should prioritize enhancing quality efforts[23].

Leadership in Healthcare Devices, delves into the theory behind the leadership expertise, ideas, abilities, and capabilities necessary to steer interprofessional groups and health medical system reform for the sake of population health[4] . A crucial talent in leadership content is the ability to analyze nurses' participation in collaboration positions throughout the decision-making process [8]. The College of Public Health (CPH) also mandates a three-hour program on healthcare economics. CPH program is designed to prepare nurses for leadership roles in instruction, study, practice, and/or service within the field of healthcare and to increase the collaborative impact of nursing in patient care[24].

Student proposals in which a system transformation for every undergraduate's field of study is specified and student involvement to accomplish change is detailed constitute a major prerequisite.

Leadership in Health Care Networks Field Practise is an additional program that helps students put their program idea into action. The learner works with others in a real-world setting to apply what they've learned about health administration, economics, and policy. A student's ability to apply knowledge of medical facilities, policy, and leadership is essential to their growth in these areas[25].

A student may learn a lot about medical facilities, policy, and management, but it won't be enough to give them the self-assurance they'll need to take on leadership roles, particularly in the policy sphere. Learners often commented on the difficulties inherent in the environment's relative unfamiliarity and difficulty.

2.1 Leadership in Nusrsing

Secure, evidence-based treatment that may favorably affect the entire patient experience must be delivered in the unexpected and sometimes chaotic healthcare context, making nurse leadership essential. The vast majority of the medical staff are registered nurses, who provide direct and indirect care to patients on a daily basis. Thus, leaders of clinical nurses have the important and difficult responsibility of guiding clinical practice and results, such as regulatory compliance, problems with human resources, fiscal transparency, client happiness, and overall service excellence. The necessity for strong nursing leadership in the healthcare system has been highlighted by the recent COVID-19 outbreak. Managers in the nursing profession are especially important in times of crisis[24].

Nurse executives have always shown exceptional management skills. Nevertheless, revolutionary leadership the ability to inspire people via creativity and produce optimum results is necessary to ascend to the rank of an excellent leader. The American Nurses Association, the preeminent organization for nurses worldwide, uses the theory of transformational management developed by James McGregor Burns to define change agents as those who are able to communicate well with others, inspire them, share their enthusiasm for making a difference, and guide their followers towards common goals[26].

Wong et al. [27] found in their comprehensive study that medication security, security in the work environment, the standard of care, reductions in hospital crashes, infection rates in hospitals, and death among patients were all positively impacted by revolutionary nurse leadership. Furthermore, it has been observed that self-efficacy, which may be described as confidence in one's own abilities to achieve certain goals, mediates the connection among revolutionary nurse leadership and employee enthusiasm. Although the research findings are small, they do provide some insight into the relationship between innovative management and increased employee satisfaction, and improved patient results (with commercial and avoidant leaders being less effective)[28].

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3. Leadership Criteria

Publishing types and the PICO framework (population, action, contrast, and objective) were used to create the requirements for eligibility. Since it was initially unclear if there would be enough papers examining learning techniques aimed at undergraduate nurses, the study initially included students from all levels of nursing education (undergraduate through doctorate). After reviewing the data, however, the researchers decided on restricting participation to undergraduate learners in nursing. Table 1 shows the set of factors of leadership.

Table 1: The set of factors of leadership

Factors	Description
Population	Nurses in the context of ongoing education Nursing students at the master's or doctorate level Students in related health fields who aren't majoring in nursing.
Action	Leadership and policy courses available online Leadership and/or policy study in a fully online or hybrid format Training for supervisors and policymakers in person Absence of direction and/or policy
Contrast	Leadership and/or policy training delivered in-person It's not even close.
Objective	Assessment of Leadership Abilities (Reaction, Understanding, Action, and Outcomes) Student retention and happiness Success in completing course goals
Type of publication	Any kind of first-hand research Non-academic writing Studies that are not primary sources include editorials, letters, opinions, and reviews. We are interested in articles written before 2010 that encapsulate the most up-to-date ideas in educational leadership and technological innovation.

3.1 Therortcial of Leadership

Implicit theories are a kind of mental structure that may be thought of as an ensemble of everyday conceptions, much like a scientific theory. People use these basic frameworks to attempt to make sense of the world, make predictions about themselves and others, and figure out what they should do next. Implicit theories of leadership are generally understood to be mental models depicting leaders' characteristic behaviors and attitudes.

Thus, individuals in overall, and supporters in particular, rely on their theories of implicit leadership to make sense of their leader's actions. Therefore, depending on one's implicit ideas of leadership, the same behaviour may be understood differently by other individuals. A leader's perspective spoken in a group setting, for instance, might be seen as domineering by some subordinates and therefore discourage further participation in the debate, while being interpreted as consultation by others and so encouraging further participation.

Without a doubt, Robert Lord and his colleagues have done the most detailed research in this field. Based on Rosch's behavioural classification theory, Lord and his coworkers established the theoretical underpinnings of implicit leadership theories. Perceivers (here, disciples) categorize stimulus people (here, their bosses) by drawing parallels to examples of a certain category (here, competent leaders).

The two terms, "efficient" and "ineffective," frequently have meanings un terms of whether or not objectives are met. Efficiency is used here just as a mental representation of whether or not the attributes stated by participants are believed

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to be profitable since we are primarily concerned with commonplace conceptions of leaders more generally. Let's look at an example to see how it works: The term "tyranny" has been discovered to be used to characterize leaders as a whole in previous studies on implicit concepts of leadership.

While numerous study participants have made references to traits that may be classified as tyrannical, it is unclear whether or not these individuals saw this style of leadership as successful. Some may believe that authoritarian leaders are necessary for efficient rule, while others may hold the opposite view.

3.2 Effective Leader

Offermann et al. performed research in which the differences between "leaders" and "effective leaders" were drawn out. They did a thorough analysis of the traits included in implicit theories of leadership.

The researchers began by having participants identify traits shared by effective leaders and managers. They culled 160 traits, which were then assigned ratings by a third group as indicative of (a) leaders, (b) successful leaders, or (c) managers. Using parallel analysis, they determined that the variable's answers to all goals were equivalent, and from that, they extracted six variables (sensitivity, tyranny, intellect, dedication, charisma, and beauty) that characterize effective leaders. The additional gender-specific study revealed a third component ("strength") and distinguished between "attractiveness" and "girth."

Offermann et al. developed a final checklist of 41 criteria that may be used to objectively evaluate implicit leadership theories. Intelligent, informed, educated, and bright are all part of the group (expertise dimensions), whereas dominant, forceful, fraudulent, loud, egotistical, and selfish are all part of the tyranny aspect.

4. Neutrosophic Framework

This section introduced the steps of the SWARA method.

Let $x_1 = \left(A_{x_1}, B_{x_1}, C_{x_1}\right)$ and $x_2 = \left(A_{x_2}, B_{x_2}, C_{x_2}\right)$

$$x_1 + x_2 = \begin{pmatrix} A_{x_1} + A_{x_2} - A_{x_1}A_{x_2}, \\ B_{x_1} + B_{x_2} - B_{x_1}B_{x_2}, \\ C_{x_1} + C_{x_2} - C_{x_1}C_{x_{12}} \end{pmatrix} \quad (1)$$

$$x_1 x_2 = \left(A_{x_1}A_{x_2}, B_{x_1}B_{x_2}, C_{x_1}C_{x_{12}}\right) \quad (2)$$

$$\omega x_1 = \begin{pmatrix} 1 - \left(1 - A_{x_1}\right)^{\omega}, \\ 1 - \left(1 - B_{x_1}\right)^{\omega} \\ 1 - \left(1 - C_{x_1}\right)^{\omega} \end{pmatrix} \quad (3)$$

$$x_1^{\omega} = \left(A_{x_1}^{\omega}, B\,{}_{x_1}^{\omega}, C_{x_1}^{\omega}\right) \quad (4)$$

Assessing the relevance of the criterion is essential while dealing with any MCDM issue. The parameter weights indicate how much emphasis should be placed on each factor when determining how options should be ranked. To solve the weight calculation issue, the SWARA technique's pairwise assessment of criteria relating to impact was used steadily and progressively. The SWARA approach is based on the consensus of specialists about the significance of the factors. Figure 2 shows the steps of the proposed framework.

The subsequent phases sum up the core of the SWARA technique, which is used to determine how much weight each criterion should be given:

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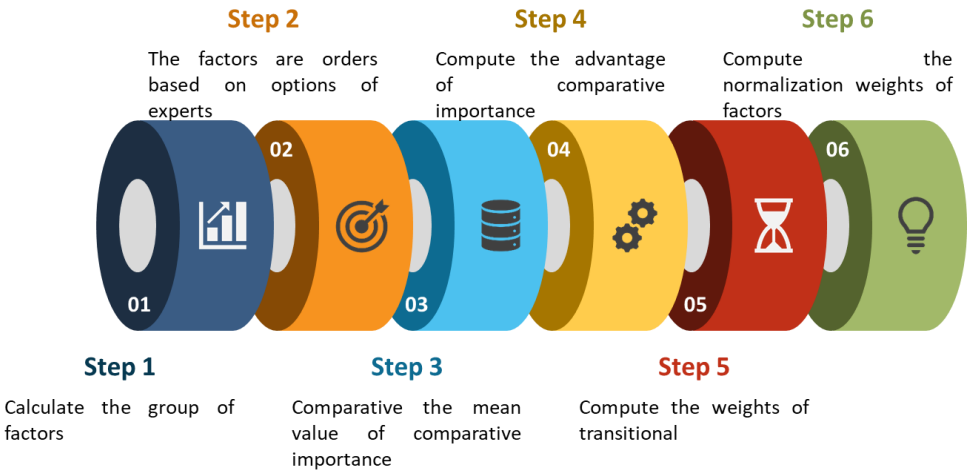

Figure 2: The framework of the proposed method.

Step 1: Calculate the group of factors

Step 2: The factors are ordered based on the options of experts

Most criteria factors are placed first and so on.

Step 3: Comparative the mean value of comparative importance (P_j)

Step 4: Compute the advantage of comparative importance

$$A_j = P_j + 1 \tag{5}$$

Step 5: Compute the weights of transitional

$$T_j = \frac{t_{j-1}}{A_j} \tag{6}$$

Step 6: Compute the normalization weights of factors

$$W_j = \frac{w_j}{\sum_{j=1}^{n} w_j} \tag{7}$$

5. Application

This section introduced the results of applying the single-valued neutrosophic SWARA method. The SWARA method is used to compute the weights of factors of leadership and policy in education. There are seven factors and strategies are presented in Figure 3.

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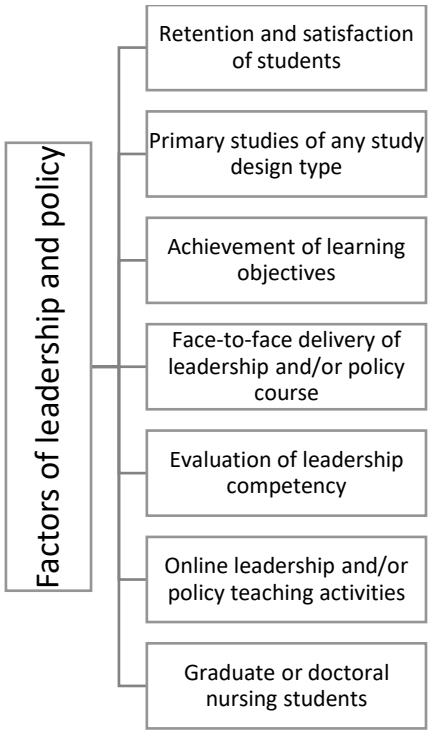

Figure 3: The seven factors of leadership and policy in e-learning.

There are three experts to evaluate the seven factors. The pairwise comparison matrix between criteria is shown in Table 2.

Table 2: The matric between seven factors.

	$FLPE_1$	$FLPE_2$	$FLPE_3$	$FLPE_4$	$FLPE_5$	$FLPE_6$	$FLPE_7$
$FLPE_1$	1	(0.9, 0.1, 0.1)	(0.6, 0.35, 0.4)	(0.4, 0.65, 0.6)	(0.8, 0.15, 0.2)	(0.4, 0.65, 0.6)	(0.8, 0.15, 0.2)
$FLPE_2$	1/(0.9, 0.1, 0.1)	1	(0.7, 0.25, 0.3)	(0.2, 0.85, 0.8)	(0.3, 0.75, 0.7)	(0.2, 0.85, 0.8)	(0.7, 0.25, 0.3)
$FLPE_3$	1/(0.6, 0.35, 0.4)	1/(0.7, 0.25, 0.3)	1	(0.6, 0.35, 0.4)	(0.8, 0.15, 0.2)	(0.3, 0.75, 0.7)	(0.8, 0.15, 0.2)
$FLPE_4$	1/(0.4, 0.65, 0.6)	1/(0.2, 0.85, 0.8)	1/(0.6, 0.35, 0.4)	1	(0.7, 0.25, 0.3)	(0.4, 0.65, 0.6)	(0.6, 0.35, 0.4)
$FLPE_5$	1/(0.8, 0.15, 0.2)	1/(0.3, 0.75, 0.7)	1/(0.8, 0.15, 0.2)	1/(0.7, 0.25, 0.3)	1	(0.7, 0.25, 0.3)	(0.4, 0.65, 0.6)
$FLPE_6$	1/(0.4, 0.65, 0.6)	1/(0.2, 0.85, 0.8)	1/(0.3, 0.75, 0.7)	1/(0.4, 0.65, 0.6)	1/(0.7, 0.25, 0.3)	1	(0.8, 0.15, 0.2)
$FLPE_7$	1/(0.8, 0.15, 0.2)	1/(0.7, 0.25, 0.3)	1/(0.8, 0.15, 0.2)	1/(0.6, 0.35, 0.4)	1/(0.4, 0.65, 0.6)	1/(0.8, 0.15, 0.2)	1

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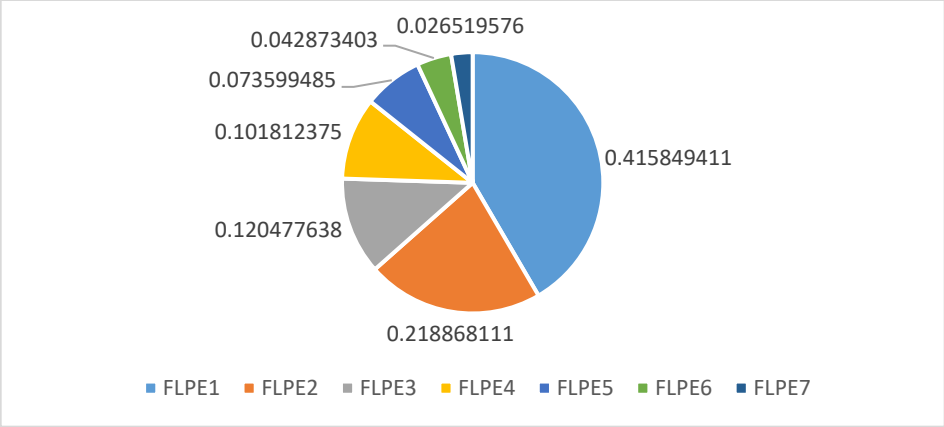

Figure 4: The weights of seven factors of FLPE.

Then compute replace the opinions of experts by the single-valued neutrosophic numbers. Then combine these values into one matrix. Then compute the comparative mean value of comparative importance. Then compute the advantage of comparative importance by using Eq. (5). Then compute the weights of transitional by using Eq. (6). Then normalize the weights of seven factors by using Eq. (7) as shown in Figure 4. From Figure 4 the first factor is the best and the last factor is the worst.

6. Conclusion

This study aimed to analyze and rank the factors of leadership and policy in the education of nursing. This study used the MCDM concept due to the various criteria in leadership and policy in e-learning. The MCDM method is a popular tool to deal with multiple factors. The SWARA method is an MCDM methodology used to compute the weights of criteria. There are seven factors are gather from previous research. These factors are concerned with the leadership and policy in e-learning. The process of analyzing and identifying FLPE is vague data, so the neutrosophic set is used to deal with vague data. The popular kind of neutrosophic set is a single-valued neutrosophic set used in this paper. The SVNS has three functions named truth, indeterminacy, and falsity. The neutrosophic SWARA method is applied to seven criteria. The first factor is the best and the seventh factor is the worst.

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