

Article

Generating Innovative Ideas for School Improvement: An Examination of School Principals

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Abstract: The purpose of this exploratory study was to examine school principals' tendencies and practices that bring forth innovative ideas for school improvement. School principals (N = 124) responded to a survey, which included an open-ended question, on their innovative practices toward school improvement. With the Innovator's DNA framework as a basis for generating innovation for school improvement, path analysis was used to assess how well school principals' thinking and practices aligned with the framework. School principals believed it was important to help generate innovation through idea networking, being open-minded, and challenging the status quo. However, through path analysis, school principals' improvement areas associated with the Innovator's DNA framework were identified. School systems should help principals develop innovative problem-solving skills for school improvement by applying the Innovator's DNA framework in their professional development opportunities. More research is needed that examines if and how school systems foster school innovation leadership for principals.

Keywords: principalship; innovation; school improvement; path analysis; survey



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1. Introduction

School leaders are constantly pressured to improve student outcomes to comply with governmental policies and public demands due to increased accountability. The school principal has been facing this predicament head-on. As principals attempt to lead in such a climate, schools have become more decentralized, giving principals more autonomy and local control to implement strategies and interventions that suit their school community needs [1]. As a result, the school principal's role has evolved into a complex position that goes beyond improving teaching and learning [2–4].

With the ongoing integration of technology in the classroom, reshaping instructional and leadership strategies [5], changing demographics [6], and the management of scarce resources, school principals are in a compelling position to be innovative and creative problem solvers [7–9] to effectively drive change [10]. However, research has indicated that, among the applied skills necessary to lead in today's schools and organizations, the skill with the largest gap between employer needs and the level of preparation among workers is creativity and innovation [11–13]. Many barriers to innovation stem from leaders' lack of decision-making skills, failure to recognize the social and contextual setting of their environment, and that most innovations are interconnected to other innovations [3].

When it comes to school improvement, the context in which schools operate plays a crucial role [14]. Each school has its unique context, thereby necessitating a nuanced understanding of its intricacies. As such, principals must learn how to adjust their leadership approach according to their given context and learn how to creatively respond to specific needs of the school [15]. Indeed, research has noted key leadership traits for school improvement include knowing how to creatively solve problems with teachers [16], idea

generation [17,18], open-mindedness [19], and executing innovative changes for improvement [20]. Parlar [21] noted that the essential process for school improvement, regardless of context and demographics, depends largely on the school leaders' capacity for innovation and a creative approach to enhancing human capital and pedagogy.

Thus, knowing how to generate novel ideas and fostering a school culture of innovation are significant skills needed to help schools meet today's demands for school improvement [22,23]. However, few, if any, studies have examined school principals' propensity and practices to generate innovative ideas for school improvement. With the myriad of abrupt challenges and leadership activities in which principals engage, examining what and how principals generate innovative ideas for school improvement may provide a deeper understanding of the skills, knowledge, and disposition needed for effective 21st-century school leadership.

2. Purpose of Study

The purpose of this exploratory study was to examine school principals' tendencies and practices that bring forth innovative ideas for school improvement. We define innovation as the "development of a novel idea that helps us to do our job in a new way" [24]. Such a definition is transferable within education especially as it pertains to the job function of the school principal. By examining their tendencies and practices of how school principals generate innovative ideas for school improvement, we posit that researchers and practitioners will better understand the complex nature needed to lead innovation in schools. This study will contribute to the dearth of literature coverage of school innovation leadership and introduce new research regarding how school principals generate innovative ideas for school improvement. The following questions guided this study: (1) To what extent are the leadership practices of school principals for school improvement associated with the Innovator's DNA framework? and (2) What skills do school principals believe are important to help generate innovative school improvement ideas? The hypothesis for the first research question is that generally school principals fall into habitual patterns that may not necessarily illustrate their behavior toward the use of innovative practices as described by the DNA framework, meaning path analysis would result in statistical non-significance. Given the first hypothesis, the second research question was then used to uncover what skills did school principals consider as vital for generating innovative ideas. The hypothesis for the second research question was rooted in the belief that school principals were being innovative but not following a proven framework for innovation such as the DNA framework.

2.1. Innovation Framework

The conceptual framework for this study is patterned after Dyer, Gregersen, and Christensen's [25] Innovator's DNA model (Figure 1). The Innovator's DNA model is the result of an eight-year study that aimed to unveil the origins of entrepreneurial and disruptive organizations that generated innovative ideas to address challenges, disruptions, and changes within an organization and industry. This framework asserts that most organizations typically fail at creating and implementing innovative ideas because their leaders are predominately individuals who are only highly adept in delivery skills (e.g., executing, planning, detailed-oriented implementation). Dyer et al. [25] affirm that the key to generating innovative ideas lies within the leader's ability to apply discovery skills, the cognitive skill of associating thinking, and the courage to challenge the status quo while engaging in behavioral skills of questioning, observing, networking, and experimenting. In turn, leaders develop systematic processes in the organization to facilitate the innovative process. Thus, to lead an innovative organization, leaders need to develop and master discovery skills.

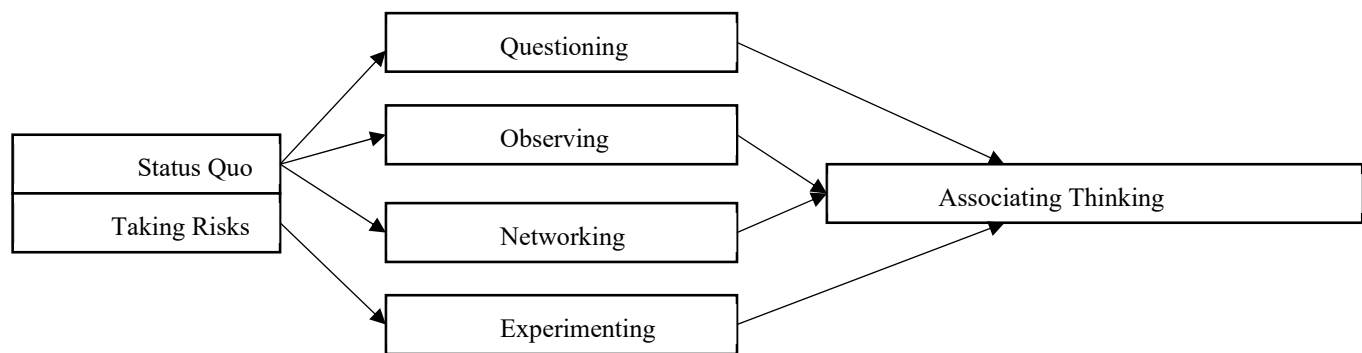


Figure 1. Innovator's DNA Framework.

Upon engaging in the discovery skills, leaders must first establish a disposition to challenge the status quo and the courage to take risks. True innovative leaders “steer entirely clear of a common cognitive trap called the status quo bias; the tendency to prefer an existing state of affairs to alternative ones” [25] (p. 25). The courage to challenge the status quo and take risks is foundational in the innovation process and conducive to engaging in the discovery skills’ behavioral components.

One key step to generating innovative ideas within organizations is to develop the ability of associating thinking which is considered the backbone of the Innovator's DNA model. Associating thinking is the ability to successfully connect seemingly unrelated questions, problems, or ideas from different people, fields, or industries [25]. As leaders diversify their interactions and knowledge, they can secure more connections which will trigger new associations that can lead to novel ideas. To help establish associating thinking, leaders must apply the behavioral practices of discovery skills. The following is a brief description of each behavioral component of discovery skills.

2.2. Questioning

The first behavioral component to discovery skills is questioning. Innovative leaders are constantly asking questions that challenge assumptions. They have a habit of asking provocative questions that force out-of-the-box thinking because it ignites new associations and perspectives [25]. Provocative questions start by asking what is, what might be, and why not. Innovative leaders invoke a series of what-caused questions to get to the root of why things are the way they are.

2.3. Observing

Observing entails an innovative leader who intentionally and consistently looks for small behavioral details to discover new ways of doing things. They are intense observers with an anthropological type of examination of the world around them prompted by compelling questions. They strategically observe people in different environments who have found solutions to similar problems. Dyer et al. [25] explained that, when leaders engage in such observations, they connect common threads across unconnected data which often leads to innovative ideas.

2.4. Networking

Networking requires connecting the ideas and experiences in one's area of expertise with those outside of one's sphere or industry. Generating innovative ideas comes more readily when leaders “gain a radically different perspective when they devote time and energy to finding and testing ideas through a network of diverse individuals” (Dyer et al., 2011, p. 117). Innovative leaders intentionally engage with people, conferences, and organizations from different backgrounds and perspectives to extend their knowledge domains.

2.5. Experimenting

Innovative leaders engage in some form of active experimentation. By conducting experiments, leaders construct “interactive experiences and try to provoke unorthodox responses to see what insights emerge” [26]. Through experimentation, “What if?” and “What might be?” questions are answered. Experimenting provides leaders with data for potential solutions to problems they are attempting to solve.

2.6. Why the Innovator’s DNA Model for This Study

In many school systems across the world, there has been an increase in delegating local financial and personnel control to school leaders, as seen in charter schools in the United States, free schools in Sweden, and academies in England [27–29]. The economization and autonomy of schools have significantly changed the roles and responsibilities of school leaders [30]. Thus, it is imperative for school leaders to cultivate and exemplify entrepreneurial and business leadership models in their administrative approaches [31,32]. Brauckmann and Pashiardis [33] posit that entrepreneurial and instructional leadership styles exhibit a closer alignment than commonly perceived, both strategically oriented toward improving organizations through high expectations, innovation, and experimenting. Consequently, the discovery skills presented in the Innovator’s DNA model such as challenging the status quo, observation, questioning, networking, and experimentation are essential school leadership competencies that promote innovation and the school improvement process [34–36]. As an example, studies have found that principals who commit to staying at their schools for more than three years and actively challenge the status quo within their educational system and among teachers tend to foster enduring changes [3,37]. Studies have also shown that school leaders who have a proclivity to asking many questions enhance the school’s effectiveness [38,39]. Closely observing instructional practices and collaboration leads to improve student outcomes [40,41]. Creating a healthy culture of experimenting with new instructional strategies and ideas has led to improvement in learning for both students and teachers [42,43].

Thus, in consideration of the prevailing school context and the frequent imperative for principals to function as creative problem solvers, the researchers determined that the Innovator’s DNA model was suitable for this study and aligned with the scholarly call to use entrepreneurial models in school leadership research. To date, the Innovator’s DNA model has been most utilized in business, engineering, and healthcare education [44–46]. This study extends the current literature to examine school principals’ tendencies and practices for generating innovative ideas for school improvement that are associated with the Innovator’s DNA model.

2.7. Innovation and Education

Innovation is an essential component to the overall survival and success of any industry or organization. Serdyukov [24] observed, “Innovations in education are of particular importance because education plays a crucial role in creating a sustainable future” (p. 5). The Organisation for Economic Co-Operation and Development (OECD) [47] purports that innovation in educational organizations (e.g., schools, districts) is demonstrated through product innovation. The OECD suggests innovation as a means to introduce new or improved products (i.e., textbooks) and services (i.e., new pedagogy) that significantly change how educators collaborate and manage learning. The U.S. Department of Education Office of Innovation and Improvement (OII) affirms that innovation in education comes in many forms. The OII [48] explained that “the willingness to take risks, and experimenting to test assumptions. Innovation is based on questioning and challenging the status quo. It is also based on recognizing opportunity and taking advantage of it” (para 1).

The topic of innovation in education has been of interest for decades in the United States [49–51]. Looney [51] observed four general trends that drive innovation in education: (1) social and economic pressure to improve student achievement and ensure greater equity for all students; (2) changes in work, family, and social life; (3) influx of advancing

technologies; and (4) the need to better engage students. Such trends have played an influential role in mandating changes in practices and policies. However, research has indicated conflicting results as to whether policies expedite or slow down the rate of innovation in our school systems [52]. Although education systems have a reputation for conformity and a disinclination to make drastic and fast changes [53], paradoxically, education is among the most innovative sectors, second only to manufacturing [54].

School leadership plays a salient role in creating, operationalizing, and sustaining innovation. One of the main responsibilities principals have is to lead their staff and teachers toward the attainment of meaningful goals and objectives. Given the complex nature of schools, principals must be effective problem solvers and creative thinkers and influence change [55,56]. Often school principals go beyond their traditional role to embed innovative responses that will mediate policy and internal challenges. Yet, there is a dearth of literature focused on how school leadership practices and behaviors influence innovation for school improvement [57,58].

Studies have explored the impact principals, especially school leadership teams, have on establishing effective practices and policies for school improvement. In an international review of school improvement best practices, Day et al. [59] found that school effectiveness and improvement are enhanced when leadership provide stakeholders with opportunities to collaborate and to actively engage in change and innovation. When principals encourage teachers to have more authorship and autonomy when implementing innovative instructional and curricula practices, student achievement increases [60]. Government agencies across the globe are promoting more policies that encourage learning opportunities for teachers and school leaders [61]. For example, one of Australia's Professional Standard for Principals [62] is to lead school improvement, change, and innovation. This standard advocates for principals to "embed a culture of continuous improvement, ensuring research, innovation and creativity are core characteristics of the school" (p. 16). Countries in South America are also advocating for policies that help school leaders develop an entrepreneurial spirit within their school systems [63,64].

Innovation among school principals is tied to transformational and entrepreneurship leadership styles [65,66]. Principals who embody transformational leadership transition schools to new levels of school improvement provide intellectual stimulation and expect teachers to also become effective innovators [67]. Transformational leaders "seek new ways of working, seek opportunities in the face of risk, prefer effective answers to efficient answers, and are less likely to support the status quo" [68] (p. 33). In a study conducted on principals' leadership styles on innovative practices, Heissenberger and Heilbronner [57] found highly transformational leaders sought out novel ideas for school improvement. Although improving student outcomes would ideally be the ultimate goal for school transformational leadership, it will also require changes in teacher practices and structures within a school system [4]. As such, principals being innovative and transforming schools rely heavily on their skills to contextualize and solve challenges for school improvement.

In a study conducted on school principals' transformational leadership for school improvement, Yang [67] observed three obstacles that impede school transformational leadership: (1) having difficulty finding what the real problems in the school might be, (2) having difficulty analyzing the relationship between real problems, and (3) understanding the basic process of developing transformational leadership. This study concluded that to better understand and develop transformational school leaders for school improvement, principals need to effectively learn how to form novel ideas, create a shared vision, empower teachers, and have successful outcomes from experimenting with the ideas formatted.

Entrepreneurial leadership has been applied to both business and education sectors [66,69]. Entrepreneurial leadership is described as the ability to generate new organizational agendas and convert innovative ideas into tangible organizational initiatives [70]. Entrepreneurial school leadership has been associated with positive effects on teacher creativity [71]. In 2013, Pihie and colleagues [72] conducted a study which examined the relationship between a principal's entrepreneurial leadership behavior and school organiza-

tional innovation. They found entrepreneurial school leaders tend to have a high propensity to develop innovative ideas and explore new opportunities to improve their schools. The researchers concluded with a call for “entrepreneurial knowledge and competence to be developed in school principals” (p. 1039).

3. Method

The research design for this study was a cross-sectional survey (School Innovation Survey) to explore and assess principals’ thinking and practices on innovation for school improvement. The purpose of a cross-sectional design is to capture data at one point in time to assess the unique characteristics or behaviors of the intended group of individuals [73]. This approach is helpful for descriptive and comparative research.

The School Innovation Survey was initially crafted by the authors and guided by the Innovator’s DNA framework [25]. After the initial survey was constructed, we engaged in a three-phase content and response validity process, which involved three content experts per phase in the field of school leadership, administration, and survey methodology for constructive feedback. Additionally, three principals reviewed the survey and provided feedback as another form of response validity. After each content expert review and feedback, the authors incorporated feedback to improve the survey, which enhanced survey validity. Thus, the survey underwent response validity to ensure potential respondents would correctly interpret survey questions as intended. The survey was then formatted for online dissemination through Qualtrics and tested for internal consistency (i.e., reliability estimates through Cronbach’s alpha). Through the survey, we assessed how well principals resembled the behavioral and cognitive aspects of the Innovator’s DNA framework.

3.1. Data Collection

The sampling frame involved random selection of school principals in school districts in the western region of the United States. An email contact list of all available school principals was created and served as the pool of survey respondents. From the pool of available school principals, the survey response rate was 8%. There were three attempts to obtain school principals’ responses, which took place within a one-year period. The survey started with a consent question before prompting the principal to participate in the series of questions.

In addition to the twenty-seven survey questions (including the open-ended question), five demographic questions (total questions = 32), two describing the school type and three describing the principal, were added to match specific participant characteristics to the DNA framework. Composite variables were used by combining similar survey items with one another in exploratively defining DNA framework factors (e.g., reliability estimations). For example, Taking Risks ($\alpha = 0.81$) was defined by combining two survey items while Observing was defined by three survey items ($\alpha = 0.62$). Networking ($\alpha = 0.54$), Experimenting ($\alpha = 0.73$), and Questioning ($\alpha = 0.71$) were defined by two questions each. Associating Thinking and Status Quo were defined as directly observed variables. Thus, Figure 2 illustrates the operationalization of survey items in defining our analytical model. The open-ended survey asked principals ($N = 124$) what skills they believe generate innovative ideas for school improvement.

There were 122 responses to gender and 124 responses to ethnicity/race. The sample was mostly women (58.9%; $n = 73$) compared to men (39.5%; $n = 49$). Not all ethnicity/race categories had representation. For instance, there were no school principals who indicated they were Native Hawaiian/Pacific Islanders. The most represented ethnicity/race category was White (80.3%; $n = 98$) followed by Hispanic/Latinx (10.7%; $n = 13$), Black/African American (4.8%; $n = 6$), other/multiracial (2.5%; $n = 3$), and American Indian/Alaska Native (1.6%; $n = 2$). There was one Asian (1.6%; $n = 2$) and three other/multiracial (2.5%). Thus, the sample response closely resembled White women school principals ($n = 59$ or 80.8%). Among men, White males were most represented at 79.2% ($n = 38$ of 48 males).

The most frequent number of years as principal was between 3 years ($n = 11$) and 6 years ($n = 11$) with 5 years mentioned the most ($n = 14$).

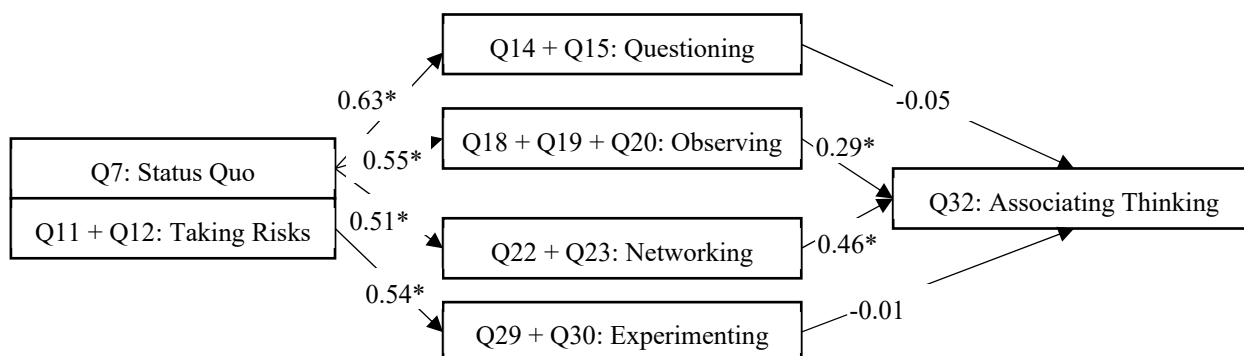


Figure 2. Path Analysis with Standardized Coefficients for Innovator's DNA framework. Note. * = $p < 0.05$.

Although student demographics have changed across the United States to reflect more students of color than White students, the face of school leadership has been predominantly White. Approximately 80% of schools across the country are led by White principals with slightly over half identifying as women [74]. Thus, this sample reflects the current principal demographics across the United States.

The schools represented were mostly Title I status (71.8%; $n = 89$) with 25% as non-Title I status ($n = 31$). The majority of schools were elementary level (59.7%; $n = 74$) with the numbers of middle school ($n = 15$ representing 12.1%) and high school levels ($n = 14$ representing 11.5%) being close. Five schools were K-12 and 16 schools were identified as other (13.1%). Thus, the general school profile was elementary with Title I status.

3.2. Data Analysis

In assessing the DNA framework reflected in the survey, we conducted path analysis using the lavaan R package [75,76]. Path analysis was used for its ability to assess the visible pathways described in the DNA framework. In relation to path analysis, the composite variables were used to define the model. Robust estimation (WLSMV) was used for addressing any non-assumption for normally distributed variables [77]. Commonly accepted fit indices were used in assessing the path model [78–81]. The implication of good fit meant the respondents already had a creative problem-solving mindset for school improvement (i.e., innovation) while poor fit was an indication that school principals did not have the mindset for innovation according to the Innovator's DNA framework.

The survey had one open-ended question, which informed research question two. From the open-ended survey question, responses were reviewed and coded using Atlas.ti to identify emergent themes. The coding process took an inductive approach and was conducted by the first and second author. Once the coding process was complete, the researchers merged coded responses into themes [82]. The researchers then discussed how the themes, which were the identified coded practices of school principals, were aligned with the Innovator's DNA model [25] as theoretical coding.

Although we used the DNA framework as it is described in the literature, there is the potential to examine indirect effects in the path model by adding pathways supported by other research ideas. For example, the direct effect of discovery skills on each other and their indirect effects on associating thinking. Despite the efforts made to increase survey precision, there is room to improve measurement by reassessing survey items for greater internal consistency and adding more opportunities for validity testing.

4. Results

In addressing the research questions, the main profile observed within the sample was mostly White women school principals (81%). The number of years as principal tended toward 5 years of experience from the sample. The school profile was generally a Title I status elementary school. Thus, when observing the findings it is important to consider the sample profile context.

4.1. To What Extent Are the Leadership Practices of School Principals Associated with the Innovator's DNA Framework?

The Innovator's DNA framework (as the path model) is defined by specific variables, which were crafted from survey items into composite variables. Path analysis is used to assess to what extent school principals' innovative thinking aligns with the Innovator's DNA framework. In Figure 2, there is the summative account of standardized path coefficients describing the relationship between variables. Generally, the path model was observed to have poor fit in line with several fit indices. For instance, CFI = 0.85, TLI = 0.69, SRMR = 0.14, and RMSEA = 0.19 with 90% confidence intervals of 0.13–0.27. The performance of model fit indices indicates that principals were not yet utilizing innovative thinking as defined by the Innovator's DNA framework.

The magnitude of the direct effects between Status Quo and Taking Risks from the four variables of Questioning, Observing, Networking, and Experimenting range between 0.51 (CI = 0.33, 2.09; Cohen's $f^2 = 0.35$ for Networking) and 0.63 (CI = 0.54, 1.66; Cohen's $f^2 = 0.66$ for Questioning). The other variables Observing (0.55, CI = 0.36, 1.82; Cohen's $f^2 = 0.43$) and Experimenting (0.54, CI = 0.65, 2.03; Cohen's $f^2 = 0.41$) were relatively similar in their estimates to Networking. Assessing the direct effects from the four DNA framework variables on Associating Thinking illustrates the standardized path coefficients were varied in their estimates (see Figure 2). For example, the path coefficients between Questioning and Experimenting are the only coefficients that are not statistically significant ($p < 0.05$; Questioning = -0.05 , CI = $-0.67, 0.35$, Cohen's $f^2 = 0.00$; Experimenting = -0.01 , CI = $-0.31, 0.26$, Cohen's $f^2 = 0.00$) toward Associating Thinking. Such a finding indicates that participants' responses related to Questioning and Experimenting did not have a direct effect on Associating Thinking, a critical component of the DNA framework. However, Observing (0.29, CI = 0.18, 1.03; Cohen's $f^2 = 0.09$) and Networking (0.46, CI = 0.50, 1.05; Cohen's $f^2 = 0.27$) did have a statistically significant effect on Associating Thinking and indicated a relationship to Associating Thinking. The direct effects on Associating Thinking illustrate that where school principals' depart the most from the DNA framework is in the skills of Questioning and Experimenting.

In describing indirect effects from Status Quo and Taking Risks, the total estimated effect on Associating Thinking was 0.36 (without holding variables constant), meaning, as Status Quo and Taking Risks increase by one standard deviation, Associating Thinking will increase by a third of a standard deviation (SD). Among indirect effects, Status Quo and Taking Risks through Networking resulted in 0.23 SD, indicating approximately a quarter of an SD increase for Associating Thinking from Status Quo and Taking Risks. Through Observing, the indirect effect on Associating Thinking was 0.16, indicating a fifth of an SD increase as Status Quo and Taking Risks increased by one standard deviation.

4.2. What Skills Do School Principals Believe Are Important to Help Generate Innovative School Improvement Ideas?

Data analysis from open-ended survey questions revealed three skills school principals believed were important to help generate innovative school improvement ideas: (1) idea networking within education and outside the industry, (2) being open-minded, and (3) challenging the status quo and taking risks.

4.3. Idea Networking

Principal responses indicated building relationships was an essential part of idea networking. For instance, one principal affirmed, “Relationships are the most important thing to me and allows me to create a community that will try new ideas and really give new things a shot to see if they work”. Another principal noted, “I need sensitive group members to give me feedback on group needs or to help me make sure I’m sharing the message effectively”. A principal exclaimed the key to sustaining innovation in schools was having a strong connection between teachers and principals. One principal implied that obtaining fresh ideas for school improvement involves having solid people skills. This principal added, “I know people really well and can use my knowledge of people to get their genuine reactions and buy-in”.

Responses from principals also included statements such as asking for teacher input to seeking fresh perspectives from outside the education industry. A principal wrote about the importance of seeking outside perspectives, adding “Look to private business for ideas and not just other schools outside of the district”. Another principal explained, “Over the years I have learned to take a broader perspective to examine more options for my small world of education. This perspective has helped me to see more of what is possible and what is needed in the world”.

One principal expounded the need to not only seek out new perspectives but to do so in teams that can mold the idea to fit the school’s needs. This principal concluded, “It is not my job to have the best or right idea, it is my job to make sure the best or right idea is the one we build upon”. Another principal emphasized the need to reach outside the education industry. This principal concluded, “A willingness to ask questions of other professionals. Critical reading and analysis skills that allow me to examine other practices to see whether or not they would be a fit”. Other comments from principals included phrases such as “looking beyond the boundaries”, “leadership from outside education”, “asking outside education sources for ideas”, and “experience with business people across the city through the Chamber of Commerce and service organizations have provided me with the willingness and ability to try new approaches”.

Some principals mentioned that they worked outside of education prior which helped them apply ideas from other industries to their schools. For example, one principal wrote, “Prior to working in the education field, I had the opportunity to work in other ‘outside’ professions that readied me for this position. I use many of the concepts at school that I learned in my other job field”. Another principal disclosed, “My experience in the Emergency Responder Field as a Fireman has brought a different look into the ‘chaos’ of education”.

4.4. Open-Mindedness

Principal responses indicated the need to be open-minded to innovative ideas for school improvement. Frequent comments from principals included “open-mindedness”, “I am open-minded”, and “I am open to new ideas and suggestions”. One principal explained that being open to outside ideas and perspectives helped to “become far more reflective of practice and self in terms of leadership and self-growth”. Another principal noted an “open mindset and strong belief in not judging people but evaluating practice” led to “identifying problems and work towards long term solutions”.

Being a good listener was also part of being open-minded. One principal explained, “The ability to listen and collaborate with teachers is a vital skill so we work together to find a solution for our team and school”. Another principal observed, “Hopefully, I have become a better listener. Try to not react. Put myself in the place of others”. A principal described that listening to others intently was key to “try new ideas and really give new things a shot to see if they work”. This principal added, “People on my team know that I will listen and try to implement their ideas as long as they are aligned to the vision. They know their ideas matter, so they are willing to share school improvement ideas”.

4.5. Challenging the Status Quo and Taking Risks

Principals emphasized commitment to not only challenging the status quo but also embracing opportunities to find novel solutions. One principal wrote “I do not shy away from challenges and embrace them for their potential growth opportunities. I do not feel that I know everything and am reliant on others who have more expertise or experience to share their perspective and provide feedback”. To generate innovative ideas, one principal suggested all school leaders should develop “The ability to think creatively, to see outside ‘the box’, and to challenge assumptions about current practices”. Another principal noted, “I have a diverse background in industry and life that has helped me be a problem solver and innovator at my school”.

Several principals indicated the need for leaders not to be afraid to fail. One principal explained that innovative school leadership includes a “willingness to try and fail to learn from the process, an insatiable need to seek new ideas from a broad spectrum of place; ability to let others dream and brainstorm to broaden our options, and courage to seek assistance when needed”. A principal noted, “I am not afraid to try things. I am willing to be vulnerable and tell people I don’t know and talk about it”. Another principal wrote, “I am comfortable with ambiguity and knowing that problems that truly need to be solved tend to have messy solutions that are not quick-fixes”. The need to be a “risk-taker” was also indicated. One principal emphasized, “I am a risk taker backed by research on what has worked for others”. Another principal wrote, “I consider myself to be innovative. I create a safe working environment for risks to occur”. Other responses from principals included a “willingness to try and fail”, “willingness to try something outside the box”, and “challenge others’ thinking”.

5. Discussion

According to the Innovator’s DNA framework, it is essential to have the disposition to challenge the status quo and take risks to generate novel ideas [25]. Findings from this study indicate principals are positively inclined toward taking risks and challenging the status quo for school improvement. From our findings, principals did emphasize the importance of taking risks and challenging the status quo. As mentioned previously, Hill et al. [83] found five styles of school leadership that drastically improved failing schools. Of the five leadership styles, the “Architect” style outperformed the other styles. One of the essential leadership traits of the “Architect” was their ability to effectively challenge the school system, teachers, and community (Hill et al., 2017b). Such characteristics of the “Architect” are aligned with the Innovator’s DNA framework. Findings from this study also suggest principals lacked questioning and experimenting skills. Although school principals may lack questioning skills that aid in generating the necessary Associating thinking to increase the likelihood of creative problem-solving for school improvement, school principals need to develop such questioning skills as defined by the DNA framework. In his book titled *Questions Are the Answer*, Gregersen [84], who coauthored the Innovator’s DNA framework, explained when leaders and organizations “revisit questions they are asking and ask better ones, people arrive at dramatically better answers...no dramatically better solution is possible without a better question. Without changing your questions, you cannot get beyond incremental progress along the same path you’re pursuing” (pp. 16–17).

For principals to find better solutions to school improvement practices, they must develop questioning skills. Such skills can be developed by establishing accountable practices that will help principals recognize the amount and type of questions they ask to systematically redesign school improvement and its engagement with the community. For example, principals can collaborate with parents (e.g., National Parent Teacher Association) to engage in activities that involve brainstorming questions for school improvement. Such questioning activities will aid the school principals in generating the essential Associating thinking for innovation. Furthermore, researchers and practitioners should explore ways in which principals can engage in effective professional development that involves literal exercises of questioning school improvement opportunities and practices.

One common trait of innovative leadership is the ability to develop novel ideas into effective solutions. Turning novel ideas into solutions not only has the potential to improve the quality of teaching and learning but can also be a determining factor to establish more equity, especially with high-need schools [85,86]. Constraints in high-need communities have the potential to be gateways to creating innovative schools, such as the case of Escuela Nueva in Colombia [87]. However, to do so requires experimentation with established ideas [88]. Findings from this study suggest that principals lacked experimenting skills as described in the DNA framework. However, the lack of experimenting skills presented may reflect a broader implication of a school system that is designed to have the central function of principals managing structures and processes that are conducive to the onslaught of ongoing assessment preparation and not necessarily experimenting with novel ideas for school improvement [89]. Leithwood et al. [90] argue that successful large-scale reform depends highly on the commitment to experimentation and innovation at the local school level. Thus, school districts should encourage and provide principals with ample and safe opportunities for them to experiment with novel ideas for school improvement. By doing so, they will be reflecting many of the practices and habits of innovative organizations (e.g., Google's 20% Project) of the 21st century [91,92]. Thomke [92] explained that innovative organizations need to make experimentation an integral part of their culture "even when budgets are tight. That means creating an environment where employees' curiosity is nurtured, data trumps opinion, anyone can conduct or commission a test, all experiments are done ethically, and managers embrace a new model of leadership" (p. 42).

Findings indicate that school principals used observing and networking skills to foster Associating thinking for school improvement. Principals indicated that they observed and networked with people in both educational and other professional settings. Some principals even alluded to the fact that they came from different industries which helped them generate innovative ideas for school improvement. Generating innovative ideas requires leaders "linking the ideas in your area of knowledge with those of others who play in different boxes. Innovators gain a radically different perspective when they devote time and energy to finding and testing ideas through a network of diverse individuals" [25] (p. 113). Studies have shown that networking within and outside schools enhances innovation and school improvement practices of school leaders [9,34].

Although findings suggest that principals demonstrated higher levels of observing and networking than the other discovery skills, there are still ways in which these skills can be improved. When there are more outlets for school principals to learn from each other and discuss efforts toward school improvement, then it is more likely that ideas for innovation can be fostered. Building a professional learning community (PLC) of principals to collaborate with each other is an effective way of idea networking. In a study conducted by Bickmore et al., [93], principals who were strategically placed in a PLC of principals organically developed a platform to share innovative ideas for school improvement. School districts should also provide principals with opportunities to observe other schools with similar and non-similar student demographics. It is also imperative that principals network outside the field of education. This can be carried out by organizing a school coalition or advisory board of non-educators that meet frequently to discuss ways in which school improvement efforts can be accomplished. Professional development for principals could also include time to observe leaders in other industries that face similar challenges to K-12 schools.

Fostering a school culture of innovation is a multifaceted endeavor characterized by its complexity for school improvement. School leaders are constantly faced with serious challenges from bureaucratic roadblocks to limited resources. Resistance to change and learning anxieties will always play a role when attempting to innovate [20,94]. School leaders need to also be aware of the balancing act of experimentation and accountability. Complex as it may appear, it is precisely this context that requires courageous innovative school leadership. One underlying characteristic of innovative school leadership is a willingness to challenge the status quo [95,96]. Fullan [3] noted, "Challenging the status

quo includes the willingness and ability to question common practices, take risks, explore innovations, and not let rules slow down action. These leaders have an eye on the end game, which in our case is improving the learning of all students” (p. 129).

5.1. Implication for Practice

The Innovator’s DNA framework [25] started in the business field and has helped entrepreneur leaders exercise creative problem-solving for innovation. A transfer of this framework to school principals would aid them in creative problem-solving for school improvement. As previously stated, there is a growing body of research that advocates for the transferability of business leadership models, especially those that specialize in entrepreneurial skill sets [33]. A practical application is to create professional development focused on principals cultivating and implementing the Innovator’s DNA framework within their classrooms and schools. One of the largest gaps in our educational system pertains to the inadequate preparation of workers for a global economy that imposes a demand for creativity and innovation in their interactions with employers [13,97]. Thus, such professional development should start in leadership preparation programs. Such early exposure to the DNA framework can help school leaders develop more depth in discovery skills and build up such skills over time. In a curriculum and leadership program context, case studies and examples of creative problem-solving for school improvement can be brought into the learning environment.

Beyond engaging in professional development, school principals should explore methods to form teams within their schools capable of applying the Innovator’s DNA framework to specific grades or departments. By adopting such a distributed leadership approach, there is the potential for fostering a heightened culture of innovation within the school. Teachers should be encouraged to utilize this framework in their curriculum and instructional strategies.

Developing adequately innovative school leaders has been recognized as an indispensable necessity to meet the complex demands of the current educational landscape. [9,10,98]. Thus, we call on school leadership preparation programs to establish curricula and courses on the foundational principles of entrepreneurship and innovation alongside instructional leadership. The need to marry the two concepts has given rise to what [33] coined as Edupreneur Leadership. As more leadership preparation programs prioritize developing Edupreneur Leaders, aspiring school leaders will be more adept at creative problem-solving and generating and executing innovative ideas for school improvement.

5.2. Future Research

This study is the first to examine school principals’ tendencies and practices for generating innovative ideas for school improvement that are associated with the Innovator’s DNA model. Further research should be conducted that examines school improvement results between principals who have mastered discovery skills and those in the developing stages. Furthermore, since school improvement depends highly on the commitment to experimentation and innovation at the local school level [90], it is imperative to conduct studies that examine if and how school districts encourage and foster a culture of innovation for principals.

Conducting comprehensive research on each of the discovery skills in the context of school principal leadership would be beneficial. Exploring in more depth how principals ask questions to spark school improvement, their disposition to challenge the status quo, and how often they conduct experiments based on ideas they receive would provide greater insight into how the framework can help foster innovation for school improvement.

5.3. Limitations

Survey-specific limitations are also worth noting. For example, the survey was conducted prior to and during the pandemic, which may have influenced the survey response rate (8%). However, Harris et al. [34] noted the COVID-19 pandemic led to unprecedented

levels of collaboration and networking among schools. They argued a new leadership approach, termed “network leadership”, was essential for school improvement and this form of leadership was imperative in the transformed landscape of education, emphasizing the necessity of interconnected leadership for school improvement.

Additional time to take the survey and more than one survey reminder helped increase survey response to reduce bias that may be attributed to non-response. Despite efforts, the survey response rate of 8% is considered a limitation toward the generalizability of findings to the greater population of school principals in the western U.S. region. Also, not considering random interviews of school principals to connect with survey findings could have added to the study’s internal validity. Another limitation was related to those who responded to the survey, who were mostly White and could have had an affinity toward taking surveys or having characteristics such as being industrious or proactive.

The obtained sample size was also assessed by the N:q rule [99] in conducting path analysis, which states ten cases per variable are needed [100]. However, a ratio of 1 to 10 or 1 to 15 can be used in determining if there was a large enough sample size for conducting path analysis [99]. The Innovator’s DNA framework consisted of seven variables (see Figure 2), indicating the minimum sample needed would be 70 (1 to 10 ratio) or 105 (1 to 15 ratio), well within the total study sample of 124.

Although the survey underwent several levels of content validity checks, statistical validity illustrated that internal consistency could be improved concerning the discovery skills. In connection with survey and path model findings, the results were based on observational data, which have to be viewed with caution. As a subset of structural equation modeling, path analysis is not causal but variables have effects on other variables, and it can be used to examine the plausibility of different hypotheses on associating thinking toward generating innovative ideas. Ultimately, the proposed path model was used as a standard in comparing principals’ responses to innovative school improvement practices. The use of open-response questions aided in gaining further insight into the principals’ innovative practice, but the use of qualitative approaches could have resulted in more information. Thus, we acknowledge the limitations of data collection and survey use.

6. Conclusions

We posit that as principals develop and practice skills related to the Innovator’s DNA [25] framework, it will increase their ability of associating thinking for school improvement. Helping principals develop such skills and dispositions will require school systems to provide professional development that is deliberately associated with the Innovator’s DNA framework. School systems should be expected to provide principals with ample opportunities to engage with other school and non-educational leaders as well as provide a safety net for experimentation. This study introduces a new conceptual leadership framework that advances how principals can think about innovation for school improvement.

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