Study on the Construction of Indicators and Path Models for Smart Leadership, Smart Schools, and Smart Education

Introduction

In recent years, research on smart leadership, smart schools, and smart education (Demir, 2021; Firoozi, Kazemi, & Jokar, 2017; Girardin & Duell, 2017; Hsu, 2020; Jackson, 2022; Li & Wong, 2022; Lin, 2019; Liu, 2020; Mirzajani, Bayekolaei, Kookandeh, Rezaee, Kamalifar, Shani, 2016; Mogas, Palau, Fuentes, & Cebrián, 2022; Sadipour, Ghavam, Farrokhi, Assadzadeh, & Sameti, 2017; Singh & Miah, 2020; Wang, Wilson, & Li, 2021) has been receiving attention, demonstrating the increasingly important role of smart technology in the field of education. These studies not only explore how to use smart technology to enhance the quality of teaching, but also further explore how to cultivate students' smart leadership and learning abilities to cope with future societal challenges. Smart leadership is seen as a forward-looking leadership style that emphasizes the use of information and technology to help schools and organizations achieve their goals. Smart schools refer to the use of smart technology applications to make schools operate more efficiently and provide a better teaching environment. Smart education emphasizes individualized teaching, providing tailor-made teaching content based on students' learning characteristics through smart technology applications to promote students' learning effectiveness. With the rapid development of smart technology, future education will become even more intelligent, and students will need to have the ability to use smart technology to successfully face future societal challenges. Therefore, schools and teachers need to actively explore the application of smart technology in education and integrate it into teaching practices to cultivate students' smart leadership, learning abilities, and skills needed for future work.

As an educational leader and chief teacher, principals need to possess the ability to effectively lead teachers and enhance their teaching and student learning. At this critical juncture where there is a significant shift in both old and new educational directions, how educational leaders should prepare themselves in terms of knowledge, skills, and mindset is a new issue for today's primary and secondary school principals (Lin, 2018). With the development of the internet and information technology, the trend of intelligence has also extended to campuses, gradually applying information equipment and network resources to teaching activities and administrative operations. In today's campus, whether it is school administration, teacher research, student learning platforms, campus life, etc., all are built on the basis of information and indirectly realize a multi-functional intelligent campus environment. Therefore, the smart campus is a new trend in building school learning environments for the future (Chang & Lin, 2017). Under this new trend, "smart leadership" through technology leadership, learning leadership, and integrated leadership can establish a high-quality intelligent campus (Taipei Teacher Development Center, 2018). In other words, the smart campus is an application of technology to assist schools in operating with more automation, higher efficiency, greater safety, and more environmental friendliness. With the support of information technology, the construction of intelligent campuses can gradually unfold. "Smart campus" refers to emphasizing "smart management" and "smart environment" but also focusing on "smart 'teaching' and 'learning'." Currently, some countries developed intelligent campuses only emphasize smart management and environmental intelligence while neglecting the smartification of teaching and learning. In the development of smart campuses, smart teaching and learning are the key to achieving the goal of smart education (Chang &Wu, 2014). In other words, constructing an education environment full of wisdom, applying modern educational

concepts, practicing student-centered education ideals, and achieving adaptive talent development and fair and high-quality smart education goals are essential.

The "Smart Schools for San Antonio's Future" research report conducted by the Center for Educational Leadership at Trinity University in Texas in 1992 indicated that smart schools leadership is based on shared ideas and commitments. Smart schools design what they do and why they do it based on their purpose, values, and beliefs. This thought structure becomes the power source for the work done in the school. It represents a covenant that connects people together: a shared commitment. In contrast, leadership in today's schools is based on the power of the school level, rules and regulations, and the personality of the leader. Rao (2013a) believes that smart leaders are leaders who integrate soft and hard power and soft and hard skills to achieve desired outcomes. Soft power is the method of achieving results through attraction and persuasion, rather than coercion and manipulation. Hard power is the method of achieving results through inducements, rewards, or retreats of punishment. In addition, Stronge, Xu, Leeper, and Tonneson (2013) point out that by sharing leadership, principals believe that everyone has made important contributions to ensure the indispensable role played by stakeholders in helping schools achieve their goals. Smart leadership is about leveraging the leadership and teaching strengths of teachers, by helping to develop teacher leaders, principals strengthen the school's instructional plan.

Similarly, the George Department of Education (2014) stated in its report on "The Leader Keys Effectiveness System" (LKES) that LKES consists of three components: the Leader Effectiveness Measure (LEM), which includes the Leader Assessment on Performance Standards (LAPS), Governance and Leadership, and Student Growth and Academic Achievement. In the LAPS section, it consists of four dimensions (school leadership, organizational leadership, human resource leadership, professionalization and communication), eight standards (instructional leadership, organizational climate, planning and assessment, organizational management, human resource management, teacher/staff evaluation, professionalization, communication and community relations), and multiple performance indicators. Specifically, under the instructional leadership dimension, it states that "Capitalizing on the leadership and instructional strengths of other staff members is smart leadership" (Georgia Department of Education, 2014, p.7). The LKES report further states that principals who capitalize on the leadership and instructional expertise of their teachers will benefit from: (1) teacher leaders who actively influence classroom change when asked about school improvement, then participate in answering questions; (2) when teacher leaders collaborate with principals to improve the school, they provide valuable insights and ideas; (3) teacher leaders are willing to take on additional tasks and responsibilities that are not required of classroom teachers, which benefits the school and other teachers therein; and (4) principals who develop and tap into teacher leaders' professional expertise and emphasize the learning focus of the school's improvement work are more successful than those who do not do so. The LKES report also explains that effective leaders focus on school improvement and student success, and they do so in several ways: establishing a vision for the school community, sharing leadership to distribute responsibility, guiding a learning community, and overseeing the curriculum and instruction.

Chen Li-ming (2006) pointed out that wise leaders not only possess stable emotions, open-mindedness, and high emotional intelligence, but also have personal charisma that can inspire followers to take action towards a shared vision of the common good. Wise leaders also serve as a source of inspiration and role models for

followers, contributing to the growth of their wisdom and helping them develop into wise students, teachers, administrators, and so on. Yang Shi-ying, Chang Tien-fu, and Yang Chen-sheng (2006) found that leaders who demonstrate wisdom often include elements such as integration, vision, practice, and positive influence in their leadership process. In the process of demonstrating wisdom, leaders often demonstrate unique integration in their thinking, and through concrete action, they have a positive influence on both themselves and others. Lin Jin-shan pointed out that school leadership includes four dimensions: leadership ideas, leadership teams, leadership behavior, and leadership performance. Therefore, wise leadership must be combined with wise communities, wise learning, wise administration, wise management, wise healthcare, and wise green energy to promote sustainable development on campus. The wise leader (principal) must establish a high-quality wise campus through technological leadership, learning leadership, trend leadership, integration leadership, service leadership, and moral leadership, thus enabling the wise campus to achieve the innovative educational vision of "innovative administration, creative teaching, and value-added learning" (Lin Jin-shan, 2016). Küpers believes that effective leadership must begin to focus on how to develop human resources and integrate members' wisdom, or consider what forms of interaction and dialogue can be used to achieve collective intelligence. The principal must recognize that individual teachers have different perceptions and perspectives and urgently need to share and learn continuously to enhance the intelligence of internal members and build the school into a professional learning community. In this way, the school's collective wisdom can be developed, and students' learning outcomes can be promoted (quoted from Liang Jin-du and Lin Ming-di, 2015).

Drawing on the works of Trinity University's Educational Leadership Center (1992), Rao (2013a), Stronge, Xu, Leeper, and Tonneson (2013), the Georgia Department of Education (2014), as well as Liang and Lin (2015), it can be understood that wise leaders need to possess stable emotions and an open mind and must integrate both soft and hard power and skills. They can achieve desired outcomes, such as creating high-quality smart campuses, shared ideas and commitments, strengthening school teaching plans, improving schools and students' success, developing wise students, teachers, and administrators, having a positive impact, promoting student learning outcomes, through different types of leadership, such as technological leadership, learning leadership, trend leadership, integration leadership, service leadership, moral leadership, human resources leadership, shared leadership, instructional leadership, emotional intelligence leadership, transformational leadership, vision leadership, and positive leadership. As Cheng (2018) stated, smart leadership comes from "smart education", which is discussed due to the popularization and management needs of "smart campuses", "mobile learning", and "collective smart leadership". Implementing the education of "knowledge-technology-ability-value" as a whole is called smart education.

The Purpose of the Study

Based on the above discussion, the purpose of this study is to understand the specific practices of principal's smart leadership and to construct a model of the impact of principal's smart leadership on smart schools and smart education. The specific research objectives are as follows: (1) to construct SMART indicators for principal's smart leadership in elementary schools; (2) to construct i-LEADER indicators for smart schools; (3) to construct SMARTER indicators for smart education; (4) to explore the relationship among smart leadership, smart schools, and smart education.

Theoretical Framework

Research on Smart Leadership

A search using the keyword "smart leadership" in the Taiwan Electronic Thesis and Dissertation System yielded 10 results: "Construction of Smart Leadership Competency Indicators for Elementary and Junior High School Principals" (Xu, 2020), "Study on Smart Leadership of Elementary School Principals" (Liu, 2020), "Study on the Relationship among Smart Leadership of Elementary School Principals, Teacher Maker Education, and School Effectiveness in Taipei City" (Lin, 2019), "Organizational Change of National Classic I-Ching Smart Leadership" (Ou, 2016), "Study on the Relationship among Emotional Intelligence Leadership, Organizational Citizenship Behavior, and Organizational Innovative Atmosphere of Elementary School Principals" (Yang, 2012), "Study on the Relationship among Emotional Intelligence Leadership of Junior High School Principals, School Organizational Atmosphere, School Effectiveness, and Organizational Citizenship Behavior of Teachers in Taitung County" (Liu, 2011), "Development of a Teaching Model for Cultivating Multiple Smart Leadership Abilities in Technology Curriculum" (Zheng, 2012), "Factors Affecting Emotional Intelligence Leadership Competence of Elementary School Principals" (Liu, 2006), "Comparison Analysis of Emotional Intelligence Leadership Competence of Male and Female Elementary School Principals" (Chen, 2005), and "The Display of Smart Leadership in Sports Coaching" (Liu, 2014).

Similarly, researchers searched for "smart leadership" as a keyword in the "Taiwan Journal Article Index System," and retrieved 7 results as follows: "Emotional intelligence leadership abilities of elementary school principals," "A study on the relationship between teacher organizational citizenship behavior and organizational innovation atmosphere," (Hsieh & Yang, 2013), "Analysis of the relationship between emotional intelligence leadership abilities of elementary school principals and emotional intelligence of school educators" (Yeh, 2010), "A comparison of emotional intelligence leadership abilities of elementary school principals of different genders" (Yeh, Chen, & Liu, 2009), "A comparison of emotional intelligence leadership abilities of junior high and elementary school principals" (Yeh, 2007), "A critique of the wise leadership model and its educational practice" (Chen, 2006), and "Educational administration: emotional intelligence leadership" (Yeh, 2004). Wu (2019) pointed out that wise leadership refers to a leader who has the ability to make professional and correct judgments, and to handle affairs effectively, who can exert influence and motivate subordinates towards a shared vision, demonstrate leadership qualities, show leadership effectiveness, achieve organizational development goals, and promote sustainable development of the organization. In the era of information technology, a leader who can make good use of technology in leadership can also enhance the function of smart leadership. Combining wise leadership with technology leadership can further enhance the power of leadership.

Ahmad, Salleh, Awang, and Mohamad (2013) conducted a study on the practice and effectiveness of wise leadership among outstanding secondary school principals as perceived by their senior assistants. The study used a questionnaire survey method, with 417 senior assistants randomly selected from outstanding secondary school principals in Malaysia as participants. The results showed that the senior assistants had a highly positive view of the principals' practice of smart leadership, with the principals using their knowledge to benefit their staff and the entire school. Interestingly, the data also showed that the senior assistants had a high perception of the principals' practical effectiveness, indicating that all senior assistants were suitable

for working in excellent schools. In addition, the study results would inspire educational leaders to strengthen their practice of smart leadership, promoting the development of their institutions to achieve the 2020 vision and the 2013-2025 Malaysia Education Blueprint.

Ylimaki and McClain (2009) argue that American school administrators must meet the demands of performance accountability while maintaining a balance between school accountability and student learning enjoyment. The performance accountability system originated from the US law "No Child Left Behind" (2002) and the Title II Reauthorization (2002). The increase in performance accountability has also had a significant impact on several other countries. The study suggests that effective school leaders expand their response to performance accountability through the six Buddhist virtues of wisdom - generosity, discipline, patience, right effort, meditation and concentration, and wisdom. Of these six virtues, wisdom is considered the ultimate virtue because it transcends and informs the other five virtues, allowing them to operate with precision and correctness. Without wisdom, the other five virtues are eyeless and cannot see how they operate to bring about benefits. The characteristic of this wisdom is uncommon, common sense, the ability to see both the forest and the trees, understand the thing in itself, and see the reality of the situation. These six virtues of wisdom are the foundation of smart leadership in the era of performance accountability. The study's findings led to the development of a new framework for education leadership centered on wisdom. To comply with the Buddhist tradition of teaching, the organizational content of this article follows the research on the six virtues of wisdom, reflects on virtues in the context of case studies, and applies them in educational leadership practices. Wisdom-centered leadership requires guidance, scenarios for integration, and experiences that need to be integrated. Further research is needed to test this framework, which may provide hope and practical recommendations for educational leaders preparing for and practicing in the era of high-stakes accountability worldwide.

Research on Smart Schools

Technology is constantly revolutionizing various industries and fields, and the development of "technology" with a focus on "education" is thriving. For many years, all sectors in Taiwan have been concerned about the issue of smart education. The Ministry of Education has also listed the strengthening of digital teaching and learning information application environment as a key focus in the Forward-looking Infrastructure Development Plan. The intelligent education system (innovative AI technology - AI artificial intelligence) can help schools integrate software and hardware perfectly, synchronously improve student learning and teacher professional development, and help campuses achieve AI intelligent schools (Guo, 2018). There are three key points to define a smart classroom. The first is to create a smart learning environment in the classroom, where each teacher and student has a smart terminal, such as an electronic whiteboard, tablet device, remote control, or mobile phone. The second is to have a data collection channel that can collect and analyze all classroom interactions. The third is that the teacher's teaching methods must use these devices and data channels and be deeply integrated with teaching. A smart school goes further and covers these three things for all teachers and students. Based on the smart school, artificial intelligence, big data, and Socratic platform technologies are further used to support teaching. Through AI analysis systems, four schools in Taiwan, including Hwa-Sheng Junior High School, Ci-Xiu Senior High School, Taipei Municipal Da-Fu Elementary School, and Xin-Min Elementary School, have all been upgraded to intelligent schools (Digital Times, 2018). After studying the technology leadership of

principals, the relationship between smart classrooms and teaching effectiveness, and the current status and effectiveness of teachers' use of smart classrooms, it can be understood the importance of smart classrooms and related variables (He, 2013; Huang, 2015; Tseng, 2016). In combination with the construction of the smart campus index and its gradual planning and construction (Li, 2013; Lin, 2017), the development and promotion of smart schools has become a trend. Chang (2013a) has published the concept of smart education and smart schools using SMART education, while Liu (2013) used Nan Gang Elementary School in Taipei as a blueprint for smart schools. Chang (2018) summarized two key points from relevant literature: one is the transformation of smart learning and smart classrooms and campus to enhance cloud education competitiveness, and the other is the benefits of cloud technology for learning support and autonomy.

The "6i Smart Campus" system covers six major areas, including smart learning, smart administration, smart green energy, smart healthcare, smart community, and smart management. It emphasizes student-centered learning and aims to enable individualized, self-directed, and collaborative learning through the smart campus. By analyzing knowledge points, it gradually constructs a "student learning growth record." In the smart green energy area, the "Campus Smart Energy Cloud" technology is used to manage and create a smart campus, with a focus on "smart, energy-saving, and sustainable" principles (Chang, 2019). The emergence of digital learning and smart school concepts has resulted in the "5 transformations," including responding to changes in "administrative cloud computing," addressing changes in "curriculum networking," adapting to changes in "teaching distance learning," responding to changes in "learning intelligence," and echoing changes in "digital assessment" (Li, 2019). To narrow the urban-rural gap using digital learning and smart school concepts, Hong (2019) proposes concrete implementation strategies, including establishing consensus action for digital learning and smart school in rural schools, constructing a vision for digital learning and smart school development, establishing a professional administrative team, shaping teacher professional culture, creating a smart learning environment, integrating and sharing rural school resources, building a digital learning exchange platform, and conducting ongoing evaluations of digital learning programs.

Information technology has become the foundation for driving revolutionary changes in education. By grasping the pulse of the information age and building intelligent classrooms, cultivating smart teachers, creating smart classrooms and schools, Rongrong School of Zhuhai, Guangdong Province, China, links the center of life education with the times and creates the core tools for achieving the way of life curriculum. The school has implemented a smart teaching system and adopted an AI artificial intelligence system to collect and analyze classroom teaching behavior data. With the most advanced concepts and technology, it promotes the professional development of teachers and realizes the vision of smart education. Rongrong School is not only an AI smart school but also the first school in Guangdong to have a smart classroom. In addition to hardware and software upgrades, the teaching system also assists Rongrong School in implementing the Sokrates three-step and three-ring teacher professional development model, including training, coaching, and local collections. Teachers understand how to use and integrate technology into teaching (Zhuhai Rongrong School, 2018). Technology empowers the concept of "smart machines" that can receive new information and change their operations accordingly, replacing the repetitive operations of rote memorization. The emerging global economy requires workers with similar "smart" skills: analyzing new situations,

proposing creative solutions, and being responsible for decisions related to job performance. The functions of modern democracy require citizens with similar skills and produce "smart" workers and citizens, requiring "smart" schools and children. Therefore, as goals and visions change, schools must also change. Yesterday's schools will not work for today's solutions. Schools themselves must be completely restructured. They must become smarter in how they engage in teaching and learning, and they must become smarter in how they manage themselves. The following are design principles for smart schools: augmented teaching and learning for all students, authentic assessment, cooperative learning settings, interdisciplinary teaching, functional schedules and time frames, core curriculum studies, and a commitment to technology (The Center for Educational Leadership, 1992). Based on the concepts and research results of smart schools, they echo the findings of Wei, Ruan, Chen, and Han (2019), who discovered that applying the smart school platform environment to mathematics teaching can effectively improve students' math grades. Furthermore, by focusing on smart schools, we can know that policy and regulations, organizational structures, smart learning environments, teaching materials, curriculum, teaching models, and school support systems are the most direct and important implementation conditions that affect the construction of smart schools. Its basic goal is to use the new generation of technology appropriately and effectively to enhance the smart level of the school's existing business, which is the advanced development stage of the digital campus, the deep improvement of educational technology, and the deep integration of informatization and educational reform (Yan, 2019; Lu, 2017; Lu & He, 2017).

Research on Smart Education

"Smart Education" refers to the application of ICT to promote educational innovation and development. It aims to develop smart schools as a basis and smart districts as a vision, using ICT to create an intelligent educational environment, apply modern educational concepts, develop student-centered educational ideals, and achieve the realm of adaptive talent development, fairness and quality (Chang &Wu, 2014). "SMARTER" education is a student-centered approach to teaching and learning that motivates students to learn through a variety of approaches, provides access to learning anytime, anywhere, and on any device, offers rich learning resources, uses technology to support and service instruction and learning, provides real-time assessment of learning outcomes through diagnostic tools and cloud services, and allows teachers to innovate and refine their teaching skills using technology. The purpose of SMARTER education is to provide learners with rich learning resources and expand their horizons in a technological way, improving the limited teaching resources available today. Under the trend of SMARTER education development, traditional school teaching systems will be broken through. Teachers and students will no longer be limited to using paper textbooks and limited resources for teaching in the classroom. Instead, they can further use e-books and network smart teaching to successfully create the concept of "mobile learning" (Chang, 2013b, 2013c). In response to the trends of the times, schools are seeking innovative development by organizing core teams to participate in technology-driven teaching design, creating a lively, interactive, and proactive three-action teaching environment. Through cloud-based diagnostic analysis, e-learning insights for diagnostic teaching and remedial teaching are achieved to attain precise, exquisite, and advanced three-excellence teaching outcomes. Innovative teaching models are developed in various fields to realize smart education. By integrating technology with curriculum instruction, every class can be a smart classroom and every lesson can be a smart class, creating a learning-centered smart education school (Tseng, 2019).

The promotion of smart education has its own procedures and steps, from the establishment of smart classrooms to the implementation of smart campuses, ultimately creating a new territory for smart schools. Both the implementation of smart curriculum and the training of smart teachers, as well as the diffusion and replication of smart models, require the joint efforts of teachers and students. Therefore, using digital technology to transform education is not only a technological revolution but also a comprehensive reform from curriculum and teaching to teacher training and learning environment. By applying technology to education and embracing the opportunities and environment for smart education, the use of digital teaching in smart classrooms will provide students with concrete opportunities for digital learning. Through interactive smart learning, the construction of smart knowledge and the cultivation of new roles as knowledge and creativity directors will create new opportunities for future smart education (Wang, 2019).

IBM's advocacy of smart education has prompted international attention to this development trend. For example, in Australia, a smart, interdisciplinary, student-centered education system is being implemented, connecting different schools, secondary schools, and employee training and application. The goal of smart education is achieved through five ways: providing students with adaptive learning courses and learning profiles; providing teachers and students with collaborative technology and digital learning resources; enabling classroom teachers to perform computerized management, monitoring, and reporting; providing learners with better information; and enabling students to have online learning resources no matter where they are (IBM, 2013). From a contemporary perspective, future smart education needs to be built on the foundation of technology immersion, personalized learning paths, knowledge skills, global integration, and economic alignment (IBM, 2010). As information technology is increasingly applied in the field of education, smart education refers to the use of next-generation information technology to promote the sharing of quality educational information, improve the quality and level of education. In short, smart education is the intelligentization of the education field (Jin, 2012). In other words, smart education advocates creating a learning space with certain intelligent characteristics (such as perception, reasoning, and decision-making assistance) through the power of information technology, aiming to promote learners' comprehensive, coordinated, and sustainable development of intelligence. It adapts, shapes, and selects learning and living environments to ultimately achieve the common good of humanity (benefiting individuals, others, and society) (Zhu & Shen, 2013).

Research Method of the Primary Study

Research Sample

In the first stage of this study, 15 expert scholars were selected to conduct a Fuzzy Delphi survey, and the questionnaire results were analyzed to construct various indicators. In the second stage, 42 elementary schools were randomly selected from ten counties and cities, including Taipei City, New Taipei City, Taoyuan City, Miaoli County, Changhua County, Nantou County, Taichung City, Tainan City, Kaohsiung City, and Pingtung County. A total of 420 primary school teachers were invited to complete the questionnaire, and 407 valid questionnaires were collected, with 7 invalid questionnaires, resulting in a valid questionnaire rate of 95%.

Research Instrument

The fuzzy Delphi method questionnaire used in this study covers three dimensions: Smart Leadership (SMART), Intelligent School (i-LEADER), and Smart Education (SMARTER). Under the Smart Leadership (SMART) dimension, there are

five levels and a total of 39 indicators; under the Intelligent School (i-LEADER) dimension, there are six levels and a total of 33 indicators; under the Smart Education (SMARTER) dimension, there are seven levels and a total of 35 indicators. In accordance with the research purpose, this study set the threshold value alpha to 0.6 and removed four indicators from the "assessment, evaluation, and research" level under the Smart Leadership (SMART) dimension that did not meet the threshold. Finally, appropriate indicators were selected, and the construction of the indicator system was completed. The "Smart Leadership, Intelligent School, and Smart Education Questionnaire for Principals" used in this study includes 35 questions for each of the three dimensions, for a total of 105 questions.

Data Processing and Analysis

This study used Microsoft Excel 2019 to perform fuzzy Delphi method calculations, and the geometric mean in the triangular fuzzy membership function of each indicator represented the consensus of the decision-making group. To achieve the research purpose, this study used a threshold value of α (0.6) to remove four indicators from the "Assessment, Evaluation, and Research" dimension under the SMART leadership dimension, and selected appropriate indicators to complete the indicator system. Therefore, in the three dimensions of smart leadership, smart school, and smart education, there are 35 indicators in the smart leadership dimension, 33 indicators in the smart school dimension, and 35 indicators in the smart education dimension. Based on these 35 indicators, this study developed a "Smart Leadership, Smart School, and Smart Education Survey Questionnaire" and then randomly selected 420 elementary school teachers to fill out the questionnaire, and received 400 valid responses, with a questionnaire recovery rate of 95%. This study used LISREL 8.8 software to examine the relationship between the three variables of smart leadership, smart school, and smart education.

Findings and Discussion

SMART Indicators for Principal's Intelligent Leadership

Smart leadership refers to the ability of a leader to make professional and sound judgments, handle affairs effectively, and inspire their subordinates towards a shared vision, exhibiting leadership qualities and effectiveness, achieving organizational development goals, and promoting sustainable development. In the era of information technology, a leader who is proficient in utilizing technology can complement the functions of intelligent leadership. The elements constructed by the SMART model of smart leadership include the following five dimensions: S (Skills of interpersonal communication), M (Management, vision and planning), A (Assessment, research and evaluation), R (Requirements for staff development and training), and T (Technology support and infrastructure). This study set a threshold value of α=0.6 for research purposes and removed four indicators from the "Assessment, research and evaluation" dimension of the SMART model, as they did not meet the threshold value. The indicators for each dimension of the SMART model are shown below.

Skills of interpersonal communication

The first dimension of SMART - "Skills of interpersonal communication" - includes the following eight indicators:

1-1 Understanding the needs and concerns of faculty and students regarding technology

1-2 Fair and respectful treatment of all school personnel regarding access to and training in technology

1-3 Maintaining positive relationships with faculty, staff, and students regarding technology issues

1-4 Demonstrating patience when faculty and staff are learning to use technology
1-5 Maintaining positive relationships with outside technology support groups
1-6 Effectively communicating technology issues with faculty, staff, and students
1-7 Effectively communicating technology issues with outside support groups
1-8 Encouraging school personnel to use information resources to grow in their technology expertise.

Management, Vision and Planning

The dimension of "Management, Vision and Planning" includes the following ten indicators:
2-1 Clearly articulate the vision for technology use within the school.
2-2 Develop a shared vision and long-term plan for technology.
2-3 Empower a technology planning team with diverse membership.
2-4 Implement a technology-rich school improvement plan.
2-5 Advocate for technology resources for the school.
2-6 Equitably and fairly allocate technology resources through sound judgement.
2-7 Manage technology change effectively.
2-8 Allocate resources to enhance implementation of technology plans.
2-9 Utilize technology to manage administrative operations effectively.
2-10 Manage technology equipment and resources efficiently.

Assessment, research and evaluation

The dimension of "Assessment, research and evaluation" includes the following four indicators:
3-1 Implement evaluation procedures for teacher technology professional development.
3-2 Consider effective use of technology as part of evaluating staff performance.
3-3 Evaluate the use of technology in instructional planning.
3-4 Apply technology-related research to guide the use of technology in the school.

Requirements for staff development and training

The dimension of " Requirements for staff development and training" includes the following six indicators:
4-1 Encourage in-service training in the field of technology
4-2 Provide in-service training to acquire specific technological skills
4-3 Allocate resources for in-service training in technology
4-4 Support and design an in-service training program for technology
4-5 Support and promote in-service training in technology
4-6 Provide time for technology training

Technology support and infrastructure

The dimension of " Technology support and infrastructure" includes the following six indicators:
5-1 Provide appropriate technology equipment.
5-2 Ensure that the use of technology equipment is appropriate.
5-3 Ensure that school personnel have equal opportunities to access technology resources.
5-4 Ensure that technological support is available when school personnel need assistance.
5-5 Ensure that equipment is promptly repaired and maintained.
5-6 Provide a variety of software applications for school personnel.

Smart School i-LEADER Indicators

The i-LEADER indicator in Chinese translates to "Smart Leader" or "Smart Leadership". The six capital English letters correspond to the following six

dimensions: i-Learning, i-Teaching, i-Health, i-Administration, i-Environment, and i-Green. Based on relevant literature, two key aspects of smart schools are identified: first, the transformation of intelligent learning and smart classroom/campus to enhance the competitiveness of cloud education; second, the use of cloud technology to support learning and promote autonomous learning, and to realize the benefits of this technology. This study set a threshold value of alpha = 0.6 for the research objectives, and all indicators met the threshold. The indicators for each level of i-LEADER are shown below.

i-Learning (Smart Learning)

1-1 Provide digital learning resources
1-2 Establish a learning management platform (digital learning platform, personal learning portfolio)
1-3 Provide personal learning performance analysis
1-4 Provide personalized learning
1-5 Strengthen student self-directed learning
1-6 Establish an interactive platform
1-7 Provide distance learning

i-tEaching

2-1 Monitor students' real-time learning status
2-2 Encourage innovative teaching models
2-3 Provide differentiated teaching
2-4 Establish an online teaching platform
2-5 Implement new evaluation models

i-heAlth

3-1 Establish electronic medical records
3-2 Establish health monitoring systems (health monitoring, tracking of healthy lifestyle)
3-3 Provide mobile medical services (telemedicine, telecare)
3-4 Establish real-time epidemic warning systems

i-aDministration

4-1 Establish school administration platform (e.g. office information system, student management system, personnel management system)
4-2 Develop member evaluation system
4-3 Establish resource management platform
4-4 Develop research support platform (research management system, collaborative research support system, etc.)
4-5 Establish mobile office system (e.g. sign-in/out, application approval, class notifications, assignment distribution, etc.)

i-Environment

5-1 Establishing safety management systems (such as access control management systems, emergency alarm systems, etc.)
5-2 Building Internet of Things sensing systems (such as air conditioning management systems, lighting management systems, etc.)
5-3 Providing smart living services (such as campus smart card systems)
5-4 Utilizing big data and cloud computing
5-5 Using social networks
5-6 Establishing a campus-wide internet connection
5-7 Utilizing smart terminals to acquire various monitoring information.

i-gReen

6-1 Establish a smart sensor management system (smart air conditioning

management, smart lighting management, etc.)
6-2 Establish a recycling system (such as a rainwater collection system)
6-3 Establish an energy consumption management system (such as an energy consumption monitoring system)
6-4 Promote digitization to achieve a paperless campus
6-5 Establish a renewable energy management system (such as solar power generation and wind power supply system)

SMARTER indicators

The SMARTER indicators of smart education comprise seven dimensions that aim to develop students' potential and provide multiple learning opportunities to stimulate active learning. It enables students to use various learning devices and facilities anytime, anywhere, and provides diverse learning resources for effective knowledge integration and construction under the guidance of professional teachers. By integrating technology systems, it creates a teaching and learning environment that meets the needs of education, uses multi-level learning assessment methods to diagnose learning outcomes, and promotes teacher professional development to achieve the ideal of SMARTER education. All indicators in each dimension of SMARTER meet the threshold value of $\alpha = 0.6$, as shown below.

Student-centered approach

1-1 Implement student-centered teaching methods
1-2 Design learning materials that cater to individual student needs
1-3 Provide appropriate learning workload according to students' abilities
1-4 Arrange suitable learning modes based on students' developmental stages
1-5 Implement appropriate teaching activities according to students' individual differences.

Student Motivation for Learning

2-1 Utilize smart classroom environment to enhance student motivation and interest
2-2 Create vivid situations to stimulate student learning motivation
2-3 Incorporate technology media into teaching to innovate learning content
2-4 Use smart technology and teaching materials to improve student learning outcomes
2-5 Use technology to present diverse teaching content for adaptive learning.

Any-device, anytime, anywhere

3-1 Implement innovative teaching with mobile learning devices to achieve effective learning.
3-2 Utilize online cloud platforms to share knowledge and quickly disseminate information.
3-3 Combine sensory teaching materials with technology devices to make learning applicable to real-life situations.
3-4 Use cloud systems to collect data to promote teacher-student interaction and provide feedback.
3-5 Record learning progress using online cloud platforms.

Resource availability and diversity

4-1 Foster active knowledge construction in students by applying innovative classroom models with the use of technology.
4-2 Design classroom learning materials based on the characteristics of smart classrooms.
4-3 Effectively use team collaboration learning models.
4-4 Guide students to fully express their ideas in the classroom through the use of technology.

4-5 Properly utilize technology tools in the curriculum to enhance learning outcomes.
Technology integrated
5-1 Utilize technology integration in teaching to enhance students' learning outcomes.
5-2 Use technology to assist students in creating and applying knowledge.
5-3 Use interactive electronic whiteboards to enhance learners' learning effectiveness.
5-4 Guide students to use technology tools to acquire knowledge.
5-5 Master multimedia technology to improve classroom teaching efficiency.
Evaluation of learning outcomes
6-1 Adjust teaching and provide remedial measures in real-time based on learning diagnosis and analysis reports
6-2 Use information technology to analyze charts and gain insight into learning outcomes
6-3 Use learning process information to diagnose learning difficulties
6-4 Use cloud-based platforms to track learning progress and conduct effective teaching
6-5 Use technology aids to accurately grasp students' learning status and promote teaching.
Refinement of teaching skills
7-1 Promote the effectiveness of technology-integrated teaching through professional discussion among peers.
7-2 Use technology-integrated teaching and continuously refine it to help students learn.
7-3 Possess expertise in technology to facilitate its integration into teaching.
7-4 Foster teachers' professional growth through collaboration and interaction within small groups.
7-5 Enhance teaching skills through public teaching and sharing of teaching experiences.

The Path Model among Smart Leadership, Smart Schools, and Smart Education

The structural equation model of this study is shown in Figure 1. The influence coefficients of intelligent leadership on smart schools are 0.74, 0.84, 0.32, 0.55, 0.42, and 0.44, respectively. The influence coefficients of smart schools on smart education are -0.03, 0.70, -0.10, 0.17, 0.02, and 0.21, respectively. The results of the absolute fit index test showed that the model chi-square value ($\chi 2$) was 1249.71, the degree of freedom was 378, and $p < .001$, indicating a statistically significant result. However, the chi-square value is easily affected by a large sample size or non-normal distribution, so other fit indices were considered: GFI was .83, AGFI was .79, RMR was 0.056, and SRMR was 0.056. The results of the relative fit index test showed that NFI was 0.97, NNFI was 0.98, CFI was .98, IFI was 0.98, and RFI was 0.97, all of which were greater than 0.90. The results of the parsimony fit index test showed that PNFI was 0.85 and PGFI was 0.68, both of which met the requirement of reaching 0.5 or higher. Overall, these indices indicate that the model fit of this study iswell-fitted.

Conclusions and Implications

In the era of AI, what kind of wisdom should school leaders possess? What is the essence of smart leadership? How can school principals drive the construction of AI-powered smart schools and promote the development of smart education through "smart leadership"? These issues highlight the importance of this study. Achieving precision teaching through smart teaching and learning requires a smart environment, the application of AI, and the smart leadership of school principals. The indicators and models proposed in this study can adapt to the trend of the AI era and influence school

principals to construct smart schools through smart leadership and move towards smart education.

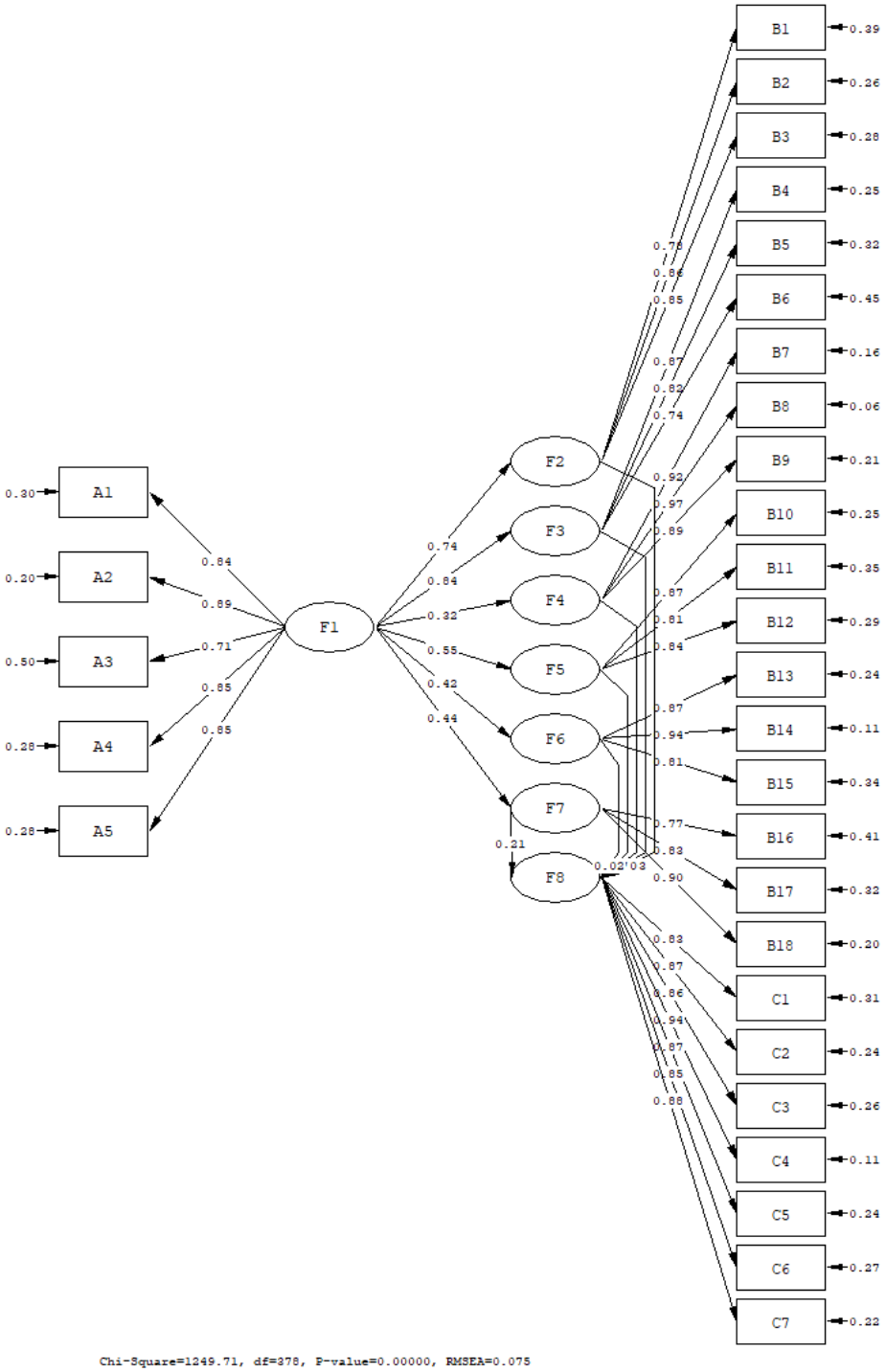

Figure 1. Path model among smart leadership, smart school, and smart education

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