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Creating a Competency-Based Framework for Self-Directed Lifelong Learning for Principals in Guangxi, China

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ABSTRACT

Purpose: This research aimed to develop the Key Self-Directed Lifelong Learning Competency-Based Model for school principals in Guangxi, China, focusing on the competencies required to sustain self-directed lifelong learning in educational leadership. **Method:** The study employed both qualitative and quantitative research methodologies, conducted in three distinct stages. First, qualitative observations of 30 school principals' daily activities were combined with a review of existing literature to identify issues, concepts, and theoretical frameworks related to self-directed learning. Second, a competency-based model was developed through a structured questionnaire distributed to a sample of 500 practising school principals in Guangxi, China. A total of 371 valid responses were analysed using factor analysis. Third, the model underwent verification and refinement. Five key competency areas were identified as essential for fostering lifelong learning: Learning Perspective, Learning Tactics, Academic Proficiency, Engagement, and Implementation. Data analysis was performed using SPSS 23.0, incorporating factor analysis, reliability testing, and goodness-of-fit evaluation. All Cronbach's α values exceeded 0.85, indicating high reliability. Stakeholders also emphasised the importance of including dimensions such as digital competencies and collaborative learning in the model. **Findings:** An examination of the principals' self-rated competencies revealed significant potential for improvement, particularly in Self-Efficacy and Learning Tactics. These findings highlight the necessity of developmental programmes for school leaders. The final model provides a theoretical framework for enhancing self-directed learning among principals, thereby strengthening their leadership capabilities. **Implications**: It is anticipated that this model will improve the quality of school leadership in Guangxi and promote a culture of continuous learning within the education system. Future research should explore the generalisability of the model beyond Guangxi, China and examine its long-term impact on educational leadership.

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Introduction

Globalisation and technology are advancing rapidly in the recent years, sparing no sector including education, which is being transformed at an exponential rate. School leaders, and particularly principals, are not only responsible for managing their organizations but also driving innovation, fostering new ideas, and creating environments that are conducive to lifelong learning. For a generation of leaders fluent in the complexities of today's education systems, traditional models of providing professional development (mostly through academic education) are leaving them ill-equipped to succeed.

This has led to a transition towards self-directed lifelong learning (SDLL), an educational concept that promotes learners to continue learning on their own proactively and acquiring new knowledge and skills when required. At a global level, institutions such as United Nations Educational, Scientific and Cultural Organization (UNESCO) and Organisation for Economic Co-operation and Development (OECD) have acknowledged lifelong learning as an essential development and growth strategy. Not only does lifelong learning enable more adaptable people, but it also directly translates into better quality leadership better able to meet the challenges of 21st-century education. The lifelong learning process for the school principals contributes to the development of practice-based core competencies needed for effective decision-making, problem-solving, self-regulation and reflectivity. Such competences are critical for driving educational innovation and improvement in constantly changing contexts (Milligan & Littlejohn, 2014).

There is an urgent need to implement great lifer UNV in China, especially in Guangxi, which is a sample area. New challenges regarding cultural diversity, economic development, and educational transformation highlight the vital importance of leadership in responding to these challenges. Guangxi, in southwest China, is home to many ethnic groups and a large rural population — some of whom have limited access to education and career development. Their institutional diplomas were before 2000, which also brings many troubles for adapting to modern times. Among them technological deficiencies, old-fashioned educational training, lack of time for professional development, and long-established patterns of schooling. These challenges impede their capacity to meet the dynamic changes present in the educational landscape, highlighting the importance of a robust SDLL model.

Essential or foundational skills encompass a specific repertoire of knowledge, skills, and capabilities that are critical for success in any learning, work, or developmental pathway. As the head of a school, the principal holds the pivotal responsibility of setting the tone for dedication to success among all learners. This role extends beyond the basic competencies required for daily school management. A wide range of advanced skills and capacities are vital for a principal's success in effectively leading their institution. The key competencies that principals need to develop can be described as follows:

Examining the literature reveals that school principals often face significant challenges within the lifelong learning process. The first major obstacle is time management. Principals are frequently overwhelmed by school-related activities and responsibilities, in addition to personal obligations such as managing households or businesses. These packed schedules leave little time for learning, which requires dedicated periods and resources. Striking a balance between learning and other responsibilities is essential to prevent

overworking learners. This challenge extends to students, who also struggle to allocate sufficient time for detailed academic study and research (Murphy et al., 2020). Effective time management becomes a primary concern, necessitating the development of reasonable schedules, optimal use of fragmented time, and adherence to structured study timetables. The second challenge is absenteeism and poor motivation, often compounded by unclear aims and objectives. While targeted rewards may help accelerate the learning phase, they can also diminish the intrinsic motivation necessary for sustained learning. Principals may already feel fatigued or lack clear objectives and aspirations for further education. This absence of a continuous learning mindset and the failure to prioritise professional development can hinder their engagement in lifelong learning. Self-directed learning demands intrinsic drive, discipline, and motivation, yet a lack of clearly defined career development goals often leads to interruptions or breaks in learning. Renewing motivation and reducing learning fatigue may require a comprehensive reconsideration of learning goals and approaches.

A third challenge is the rigidity of traditional learning processes. Formal educational structures often fail to accommodate the unique needs of school principals. Many prefer flexible, student-centred learning approaches that adapt to their specific contexts, yet the conventional learning modes provided in schools may not meet these expectations. Consequently, principals may need to adjust their learning strategies and adopt more adaptable approaches to sustain their professional growth throughout their lives. Addressing these challenges requires tailored solutions to support principals in navigating the complexities of lifelong learning, fostering a culture of continuous self-improvement, and ensuring their development aligns with evolving educational demands.

Principals may struggle with outdated learning strategies that no longer align with new objectives and contexts. Additionally, a deficiency in learning resources poses challenges. While the Internet offers abundant information on various topics, issues such as information overload and inconsistent quality complicate the selection of suitable resources. Identifying the right courses, books, or trainers can be difficult, requiring principals to rely on trusted sources and effectively filter and integrate information (Nakamura & Csikszentmihalyi, 2009). Locating resources that are current, relevant, and tailored to individual learning goals is often time-consuming.

Furthermore, principals typically receive less formal learning assessment and feedback than regular students, leading to reduced learning efficacy. Being at the top of their organisations, they may lack insight into their weaknesses due to insufficient feedback mechanisms. Financial constraints and technical barriers also hinder self-directed lifelong learning. While many resources are available online, high-quality courses often come at a cost, which can strain financially limited schools. The adoption of new learning platforms and tools frequently requires technical competency, posing difficulties for principals unfamiliar with these technologies. For older principals, in particular, technology can act as a significant barrier (Osgerby, 2013).

While the challenges faced by principals in lifelong learning are significant, they are not insurmountable. Principals can overcome these barriers through efficient time management, defining clear learning objectives, securing funding, seeking professional assistance, identifying appropriate learning resources, and adopting flexible learning strategies. Additionally, sustaining a positive learning attitude and maintaining consistent

self-motivation are crucial. A highly effective self-directed lifelong learning support model is one that integrates principals into the learning process without burdening them with regular work responsibilities. Such a model enhances both the efficiency and effectiveness of their learning. The primary aim of this research is to propose a model that addresses these challenges by establishing the Key Self-Directed Lifelong Learning Competency-Based Model for Principals in Guangxi, China.

The developed model embraces lifelong learning, self-directed learning as well as professional competencies. Based on global best practices and considering Guangxi's socio-economic development, it aims to ensure that principals gain the conceptual and practical knowledge they need to become education leaders and managers who embrace continuous learning. This model enhances the professional knowledge, self-reflection, and leadership capacity of principals with the goal of improving the academic experience and achievement of students and teachers within their care (Podsakoff et al., 2003).

This study is of particular significance in the context of current educational reforms in China, where government is actively promoting the improvement of rural education. Encouraging the development of skill-based, continuous learning processes will minimize the inequalities between rural and urban schooling and enhance the ability of school leaders to make transformational and inclusive changes. Moreover, the new economy is increasingly skill-based and knowledge-driven, in stark contrast to the older an economy focused on a tangible, industrial-based economy. Therefore, the professional expertise of educational leaders in China is a base mechanism to maintain the competitive advantage of the educational system.

This research constructs and tests a self-directed lifelong learning model oriented to school principals in Guangxi. Given the global agenda around lifelong learning and skills development, as well as the local specificities around training leaders and policy makers in the less developed world, it is both timely and of necessity. Filling an important gap in the existing literature the study offers a framework that enables principals to be key drivers of positive change in their school context and pursuing ways to transform, innovate and sustain their educational contexts (Podsakoff & Organ, 1986; Reid et al., 2013; Rigdon et al., 2017; Sáiz-Manzanares et al., 2020).

By addressing the challenges of self-directed lifelong learning for principals, promoting leadership development, improving school quality, and effectively promoting educational change in Guangxi China, the proposed Key Self-Directed Lifelong Learning Competency-Based Model seeks to own such potential to foster a better educational environment. This will prepare school leaders to engage more successfully in the changing education environment, leading to more effective educational and developmental opportunities for students. Education systems are continually changing, and new ideas and teaching strategies continue to evolve, which means principals must stay current on those trends. With this model, principals are empowered with the ability to affect the change they need in their schools, increase their capacity to stay abreast of educational trends and to enhance their leadership and management abilities. As both administrative leaders and role models, principals must develop the critical skills — self-motivation, critical thinking, creativity, teamwork, and communication, to name just a few. Such skills are indispensable for running schools and managing change in schools. Thus, this model underpins the idea of a learning organisation, in which principals are able to utilise the power of teachers and

students to drive the school vision, cultivating a school culture that is positive and innovative (Sáiz-Manzanares et al., 2020; Scardamalia et al., 1989; Schunk & DiBenedetto, 2020; Shen et al., 2011).

A competency-based self-directed lifelong learning leadership model for principals in Guangxi has the potential to enhance education quality and foster comprehensive student development. Through self-development and training, principals can drive educational innovation, encourage teachers to adopt modern teaching methods, and help students grow into better individuals and responsible citizens. Education is an ever-evolving field, requiring constant learning and adaptation to societal demands. Such a model can unlock creativity in principals, enabling them to implement effective strategies, embrace new technologies, and forge partnerships to enhance educational quality and foster innovation. In essence, designing this learning model provides a solution to the challenges in education, cultivating self-organising lifelong learning leaders, improving educational quality, and promoting innovation and development within the education system (Bandura, 1986; Bandura et al., 1997; Billett, 2001; Shen et al., 2011).

Guangxi, a poor, multi-ethnic, and multicultural region in China near Vietnam, is becoming an increasingly important economic, cultural, and educational hub, with Kunming emerging as a key centre in the southwest. The region is home to numerous primary and secondary schools but faces complex cultural and educational challenges. Guangxi's diverse population includes ethnic groups such as the Han, Zhuang, Yi, Yao, Miao, Dong, and Buyi, each with unique cultural traditions and languages. This diversity necessitates sensitivity to cultural differences and the promotion of multiculturalism to foster effective education and reduce ethnic discrimination.

As one of the less developed provinces in western China, particularly in rural areas, Guangxi faces limitations in school resources and economic capital. Many students from normal universities do not gain practical experience in this context, leaving teachers and principals to navigate significant challenges, often working beyond retirement age to meet school demands. In response, the Chinese government launched the Silver Age Plan (SAP) in 2022, reintegrating retired teachers into classrooms, with 5,000 teachers nationwide and 2,000 in Guangxi. Recently, the education department in Guangxi has placed significant emphasis on educational reform and innovation, focusing on teaching content, methods, and assessment. These reforms aim to enhance educational quality, cultivate innovative thinking, and develop practical skills in students (Blaschke, 2012; Candy, 1991; Deci & Ryan, 1985; Garrison, 1997; Knowles, 1975).

It is emphasized that as OPPS, both Principals and Teachers, should encourage to increase awareness and skills of self-directed lifelong learning relating to their development and contributions to the improvement of education in the local context. This means the necessity to develop a self-directed lifelong learning competency-based model for principals in Guangxi. With the pace of change in education accelerating, principals, particularly those older than 50 years with established learning styles and decreasing flexibility, need to keep learning. Some older principals may have difficulty with new ideas, learning challenges, and intergenerational moments that can slow motivation and effectiveness. Facilitators and resource (including technical supports) that aid in time management and intergenerational engagement should be provided to help mitigate these issues and support better learning experiences.

Based on the research on Guangxi, this research proposes a model design to enhance the quality of education in Guangxi. Schools under the guidance of self-directed lifelong learning principals would be much more capable of nurturing school development, enhancing educational quality, and promoting students with balanced theoretical knowledge and diverse abilities. With Guangxi being a melting pot of ethnicity and culture, the educational needs of these communities are diverse and require their own set of solutions. Following his idea, I believe that principals should build their cross-cultural skills along lifelong learning principles and key competences, so they can facilitate intercommunication and integration of the cultures at school and in the teachers and students.

Principals who implement this learning model, in addition, will be more capable of confronting the learning challenges resulting from Guangxi's cultural diversity. They will develop the integration of various cultures and provide more meaningful and thorough education through lifelong learning and cross-cultural education. The reform efforts will ultimately require principals to deliberately augment knowledge and leadership capacity that can empower them in progressing their schools in accordance with the contemporary education standards of the country, and meet the ideal standards pursued by the country. This model will help inject principals into the continuing educational building of Guangxi. Principals can lead the way in linking lifelong learning and advancing knowledge in their individual capacities, which in turn will drive the development of innovative education reform ideas and approaches to the actual school's experience. "Inspired sophisticated teaching model and teaching technology, they can inject vitality and motivation into the Guangxi education system. This model encourages principals to cultivate their multi-faceted characteristics while enhancing self-directed lifelong learning skills. Understanding how key competencies are developed, and supporting teachers to adopt effective teaching practices, enables principals to provide more meaningful learning experiences for students through self-learning and practice.

This initiative encourages the all-round growth of students in Guangxi, providing better education conditions and learning opportunities, and improving their professional ability and employment competitiveness. Moreover, as we go through the processes of lifelong learning self and improving core competence, we contribute to educational equity and sustainable development. Open to learning and practicing educational equity, principals understand that you must ensure equal opportunities and resources for all, thus enabling and maintaining the overall development of schools and creating a good base for the future of educational innovation (Ryan & Deci, 2000).

Literature Review

The concept of lifelong learning has gained significant attention in educational discourse, particularly as the need for ongoing professional development becomes increasingly critical in a rapidly evolving global landscape. Lifelong learning is not merely an educational philosophy but a vital strategy for individuals, particularly those in leadership roles within education, to adapt to a fast-changing world. The integration of self-directed learning and the development of key competencies are essential for creating an education system capable of addressing contemporary challenges (Candy, 1991; Jarvis, 2007).

Key Competencies

Competency refers to the core attitudes, knowledge, and behaviours that enable individuals to thrive in personal, educational, and professional environments. These competencies extend beyond cognitive intelligence to include personal and interpersonal traits such as communication, problem-solving, and self-management (Rychen, 2001). In education, key competencies are vital for leaders to adapt to changing environments, promote positive learning, and innovate within schools (Mulder, 2014). In China, principals' competencies have traditionally focused on administration and educational performance, but a shift towards reflection, creativity, and flexibility is gaining importance, especially in rural areas like Guangxi, where challenges include scarce resources and learner diversity (Binkley et al., 2012).

Self-Directed Learning

Knowles (1975) defines SDL as a process in which individuals take the initiative in assessing their learning needs, formulating goals, finding resources, and evaluating learning outcomes. This method is especially advantageous for executives who have very little time for traditional training activity (Milligan & Littlejohn, 2014). SDL keeps school principals up-to-date with current educational policies, student and teacher needs, and changing issues facing educators (Garrison, 1997). SDL is suitable for principals in regions such as Guangxi where professional development may be less readily available, as it allows for flexible engagement of principals in the improvement of both their practice and the changing environment of education.

Lifelong Learning

One particularly important theme is lifelong learning, which has been highlighted as one of the scientific priorities by global organisations such as UNESCO and the OECD, framing it as a necessary field for development and social integration (Mossholder et al., 1998). It includes formal, non-formal and informal structured opportunities to learn for personal and professional development. In the field of educational management, lifelong learning helps school principals stay up to date with trends, new practices, and technologies in the education system. It helps to cultivate the mindset for continuous growth in a changing workplace (Reid et al., 2013). Especially mobile, such a category needs continuous professional learning, as reported in research on school administrators in the context of rural areas and limited development opportunities (Podsakoff & Organ, 1986). This is in line with the Chinese government's efforts to promote rising education quality and equity—urging principals to adopt lifelong learning practices, such as professional development, to continue to improve their schools and respond to increasing public demands.

In China's education system, principals have administrative, pedagogical, and leadership duties at their schools. Historically, the role centered around order enforcement, state policy enforcement, and information assurance operation. But in the 21st century, as education shifts to be more learner centred, it is apparent principals must learn different skills including instructional leadership, collaboration, self-analysis (Zimmerman, 2000). Shiri et al. (2023) describe the context of the challenges principals in rural Guangxi experience, including limited access to professional development resources,

heavy administrative workloads, and diverse student populations. Such principals, however, often spend most of their time on administrative work and monitoring pedagogical shifts, which leaves them little time for independent learning. However, there is increasing backing for competency-based appropriate lifelong education models which support flexible strategies, problem-solving and interpersonal skills as leading effectively in educational institutions (Bajis et al., 2020). Continuous professional development of the principal should therefore be considered to encourage a culture of improvement among teachers as well as learners, as the models indicate.

Developmental Theories of Educational Models

Model development (in education) the design of a conceptual framework of the tools and operations used for leadership and learning. A move more towards self-regulated and lifelong learning — and a shift towards systems of models that can help school leaders navigate educational challenges and encourage innovation. Studies indicate that aligning professional development with the individual needs and contexts of educators and school leaders are essential. A school leader engaged in physical development will instill leadership and future literacy through key competencies and self-directed learning (Binkley et al., 2012). Amidst increasing demands for quality and equity, self-learning for principals in educational models in China is in the limelight. That is, the models emphasize competencies centre stage, including teamwork, interpersonal skills and problem-solving that are necessary to guide schools in a world that's changing quickly (Chu & Cravens, 2012). A Key Self-Directed Life-Long Learning Competency Based Model is urgently needed, however, given the unique conditions facing Guangxi principals. This model would draw together global best practices and an analysis of the socio-economic and cultural context of Guangxi and facilitate principals to serving as lifelong learners, and effective educational leaders in the 21st century.

The aim of this study is to identify the challenges, issues, concepts, and theories related to the self-directed lifelong learning deficiencies of principals in Guangxi, China, and to develop a Key Self-Directed Lifelong Learning Competency-Based Model specifically designed to address these challenges and enhance the leadership capabilities of these educational administrators.

Methodology

A mixed research method is employed in this study to investigate the problems, issues, concepts, and theories related to self-directed lifelong learning and to develop the Key Self-Directed Lifelong Learning Competency-Based Model for principals in Guangxi, China. The research is conducted in three phases as outlined below.

Step One: The first research question aims to identify the problems, issues, concepts, and theories related to the self-directed lifelong learning deficiencies of principals in Guangxi. This phase focuses on defining key themes and concerns regarding principals' self-directed lifelong learning in Guangxi, China. To achieve this, a qualitative exploratory research method is employed, involving observations and a review of relevant literature.

Procedures

Observation and Participation in the Life of Principals

- Procedure: The study involves observing school principals' routines, work habits, and interactions with educators and students through a shadowing process. This approach allows for the collection of first-hand information.
- Instruments: Personal notebooks, mobile phones for capturing photos/videos (when permitted), laptops, and WPS for document processing.
- Population and Sample Size: Ten schools are selected based on specific criteria, including Nanning Fengxiang Road Primary School and Liuzhou No.39 Middle School.
- Expected Outcomes: A memoir detailing observations of principals' writing patterns and review schedules, contributing to the subsequent literature review.

The procedure for this study involves systematically arranging data collected from the literature review within a conceptual framework to strengthen the theoretical foundation, while estimating population and sample sizes. The instruments used include personal computers (laptops), the WEND Wang processing system (document software), and X-MIND mind mapping software. The population and sample size are based on a review of thirty books and one hundred and twenty articles, from which a conceptual foundation will be developed to form the basis for creating a competency model. for 4 seconds. Data collected from the literature review are systematically arranged within a conceptual framework to strengthen the theoretical basis of the study and to estimate the population and sample sizes effectively. The instruments employed include personal computers (laptops), the WEND Wang processing system for document analysis, and X-MIND mind mapping software, which together facilitate efficient data management and synthesis. A conceptual model is developed based on an analysis of thirty books and one hundred and twenty articles, providing a robust conceptual foundation on which the competency model will ultimately be built, leading to the expected outcome of a comprehensive, literature-based framework to guide further development.

In Step Two, the researcher employs a quantitative method to develop a conceptual model. A survey questionnaire is designed and distributed to gather data on principals' competencies. The collected data will be used to refine and enhance the model.

Design the Conceptual Model

- Procedure: Based on the literature review findings, the researcher develops a draft conceptual model. This model incorporates theories of knowledge, competencies, self-direction, and lifelong learning, adjusting them to the context of Chinese principals.
- Instruments: Office laptops, software for organisation and recording (e.g., Microsoft Office), mind mapping software (X-Mind).
- Expected Outcomes: The creation of the initial outline and framework for the Key Self-Directed Life-Long Learning Competency-Based Model for Principals in Guangxi.

Create a Survey Questionnaire

- Procedure: The conceptual model is broken down into five variables. The researcher then constructs an online structured questionnaire consisting of 60 questions, each corresponding to one of these variables.
- Instruments: Notebooks, internet connection, online survey platform (Questionnaire Star).
- Population and Sample Size: The questionnaire will gather data from 500 potential participants.
- Expected Outcomes: A set of concrete questions aligned with the conceptual model for data collection.

Distribute and Complete the Web-Based Questionnaire and Gather Data

- Procedure: The researcher distributes the questionnaire link to participants, and responses are collected and recorded via the online system. Data files are exported for further analysis.
- Population, Sampling Technique, and Sample Size: The population includes 11,352 principals in Guangxi with a degree obtained before the year 2000. Simple Random Sampling (SRS) is applied, with 371 samples analysed based on a 95% confidence level, 5% margin of error, and 0.5 population standard deviation. A total of 500 questionnaires are sent out to ensure sufficient responses.
- Instruments: Laptops, WPS, and an online survey system.
- Expected Outcomes: Self-completed questionnaires from at least 371 principals, providing quantitative data to refine the model.

Statistical Analysis:

The statistical analysis involves using factor analysis to confirm that the model structure aligns with the study results, starting with the first stage of varimax rotation to prepare for the final analysis. To assess internal consistency, Cronbach's α is employed for model reliability, with the analysis conducted on laptops using SPSS 23.0 and document processing software (WPS). The expected outcome is a refined analysis of the model's structure, with key factors identified to ensure its overall validity and reliability.

Refine and Finalise the Model (Fig 1)

Figure 1 outlines the conceptual framework of the competency-based model, developed through a multi-phase research process integrating both qualitative and quantitative methodologies.

- Procedure: Following analysis, the researcher refines the model by eliminating unsuitable variables and finalising the competency-based model's structure.
- Instruments: Laptops, document processing software (WPS), online survey platform.
- Expected Outcomes: A final version of the Key Self-Directed Life-Long Learning Competency-Based Model, ready for stakeholder evaluation in Step Three.

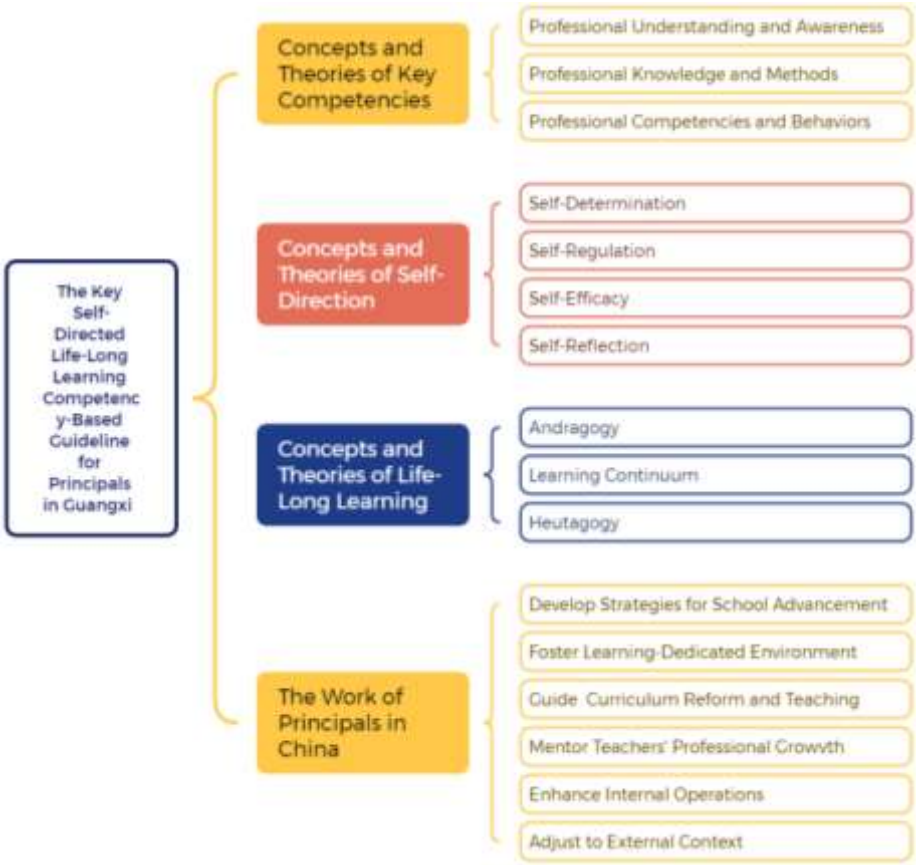

Figure 1: Key Self-Directed Life-Long Learning Competency-Based Model

Step 3 includes checking, improving and implementing the most important self-directed lifelong learning ability models through an additional phase process that integrates feedback from key stakeholders. First, stakeholder identification and definitions are carried out by principals, teachers, parents and education specialists who evaluate the proposed model using laptops, document processing software and online survey systems. This phase includes 190 interests, including 19 principals, 67 teachers, 86 parents and 19 experts, to confirm the required sample size and ensure the participation of directors and management. It is made up of people. Stakeholders are then contacted and the Wenjuanxing system is supported by laptops, which is the internet connection and document processing software. This is the Wenjuanxing System with a 60-question rating distributed to all 190 participants for further improvement. Data is then collected and analyzed using laptops, WPS document processing software, and SPSS 23.0, and the model expects at least 190 responses to inform the final refinement, and the model is profitable. Evaluate how to effectively deal with concerns of interest. Researchers' complete improvements to the extended prototype model and create user manuals using notebooks, internet connections and document processing software. We then examined a critical,

theoretical and practically applicable model of lifelong learning ability. This study employs a mixed approach in which both qualitative and quantitative methods are integrated to gradually develop and refine the ability-based model of self-directed lifelong learning (S-DLL). Thereby ensuring a specific context in Guangzhou, China.

Population and Sampling

The target population for this study comprises school principals in Guangxi, China, who obtained their educational qualifications prior to 2000. The total number of school principals in Guangxi is estimated at 11,352 (source: Guangxi Educational Department Statistics). Given the large size of the population, a simple random sampling (SRS) method was used to ensure each principal had an equal opportunity to be selected.

The sample size was calculated using the following formula for simple random sampling (Eq 1):

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{E^2}$$

n is the required sample size,
Z is the Z-value (1.96 for a 95% confidence level),
p is the estimated proportion of the population expected to meet the criteria (assumed to be 0.5 for maximum variability),
E is the margin of error (0.05 for 5%).

The calculated sample size was approximately 384 respondents. To account for potential non-responses and incomplete questionnaires, a final sample size of 500 principals was selected, with an expected response rate of at least 80%. This approach ensures that the study maintains statistical power and can accommodate potential data loss.

Data Collection

Data were collected using a structured online questionnaire distributed via an online survey platform. The questionnaire consisted of two main sections:

1. Demographic information – including age, gender, educational background, and years of experience as a principal.
2. Competency assessment – which included 60 specific questions related to self-directed lifelong learning, key competencies (such as leadership, problem-solving, and adaptability), and learning behaviours. These questions were developed based on the conceptual framework outlined in the literature review.

The questionnaire utilised a 5-point Likert scale, where respondents indicated their level of agreement with statements related to lifelong learning competencies (1 = Strongly Disagree, 5 = Strongly Agree).

Data Analysis

The data were analysed using SPSS version 23.0 to perform statistical analysis. Several statistical techniques were employed to ensure the robustness and validity of the findings:

Descriptive Statistics

Descriptive statistics, including mean, standard deviation, and frequency distributions, were calculated to summarise the demographic characteristics of the respondents and the overall responses to the competency assessment.

Reliability Analysis

The internal consistency of the questionnaire was measured using Cronbach's alpha. A Cronbach's alpha value of 0.70 or higher was considered acceptable for ensuring that the scale used in the survey was reliable.

Factor Analysis

Exploratory factor analysis (EFA) was conducted to identify the underlying factors that explain the relationships among the observed variables (i.e., the competency questions). The following steps were taken in the factor analysis:

- Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used to determine whether the data were appropriate for factor analysis.
- Principal component analysis (PCA) was used to extract the factors.
- A scree plot was examined to determine the number of factors to retain.
- Factors with eigenvalues greater than 1 were considered significant and retained.
- Varimax rotation was used to improve the interpretability of the factors.

Inferential Statistics

Multiple regression analysis was conducted to assess the relationship between principals' key competencies (independent variables) and their engagement in self-directed lifelong learning (dependent variable). This analysis helped to identify which competencies had the most significant impact on lifelong learning (Eq 2).

The regression model used can be represented as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \epsilon$$

Where:

- Y represents the level of engagement in self-directed lifelong learning,
- X_1,X_2, X_n represent the key competencies,
- β_0, β_1,$\beta 2$, β_n are the regression coefficients, and
- ϵ\epsilon represents the error term.

The R-squared value was used to determine the proportion of variance in lifelong learning engagement explained by the competencies, while the p-value ($p < 0.05$) indicated the significance of each predictor. By employing a quantitative research approach, this study offers a data-driven analysis of the key competencies necessary for self-directed lifelong learning among school principals in Guangxi. The statistical methods used, including factor analysis and multiple regression, will help validate the competency-based framework and highlight the most critical competencies contributing to lifelong learning engagement. The findings from this analysis will provide a foundation for developing a

structured framework that supports the continuous professional development of educational leaders in the region.

Results

Figure 2 illustrates the overall coordination of the study, outlining the key phases involved in developing the Key Self-Directed Lifelong Learning Competency-Based Model. This figure visually represents the research design, including the integration of qualitative and quantitative methods, the data collection process, and the iterative refinement of the model based on stakeholder feedback. It serves as a roadmap for understanding how various methodological components contributed to the final framework

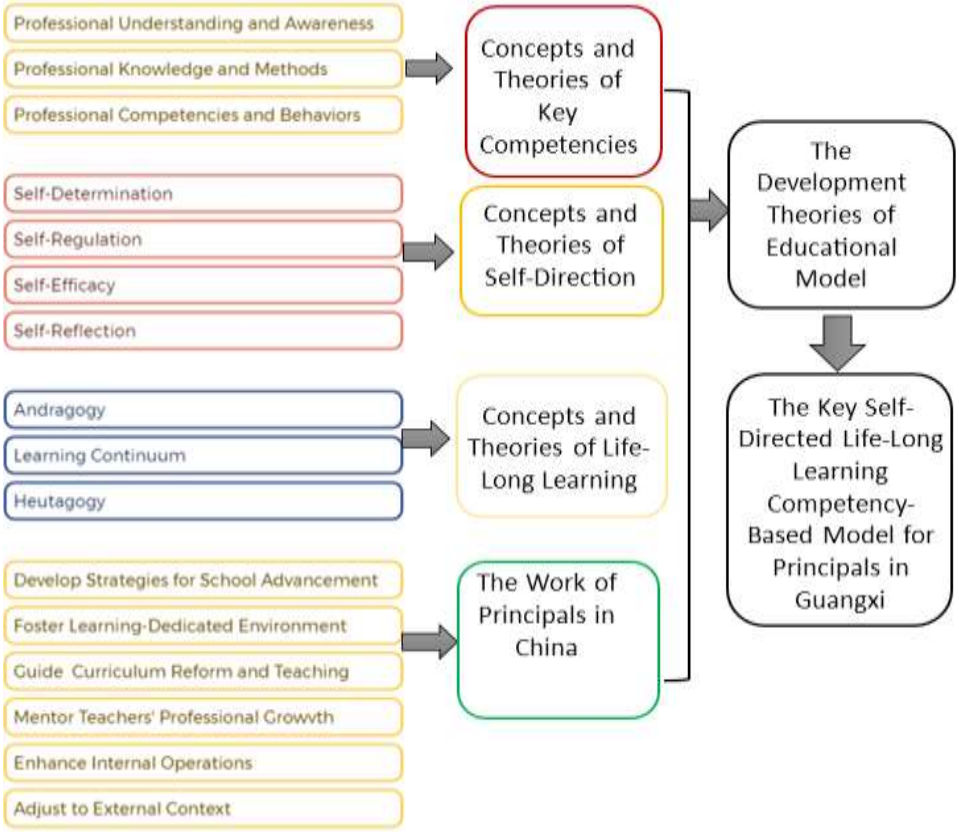

Figure 2: Overall Coordination of the Study.

Descriptive Statistics of Current and Expected Performance

To draw its conclusions, the study conducted a survey among principals, collecting data on their current and expected performance across various competencies. The descriptive statistics for these performance measures within the sample group are presented in Table 1 and Figure 3.

Table 1

Descriptive Statistics of Current and Expected Performance

Statistic	Current Performance	Expected Performance
Mean	3.2	4.5
Median	3.0	4.5
Standard Deviation	0.9	0.7
Minimum	1	3
Maximum	5	5

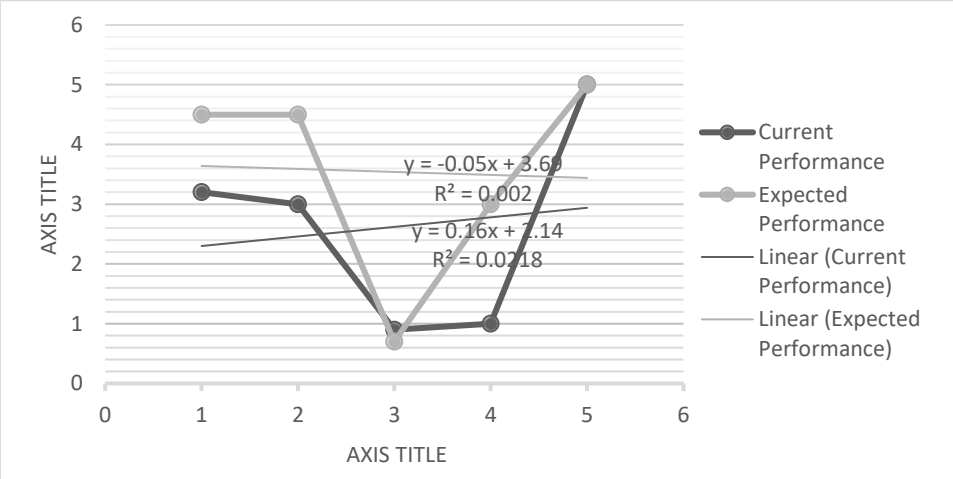

Figure 3: Descriptive Statistics of Current and Expected Performance

The mean for current performance among the principals is 3.2, while the mean for desired performance is higher at 4.5. This discrepancy in expected performance ratings suggests that although the principals currently self-rate moderately on the performance indicators, they perceive a higher potential, as indicated by their intended performance levels.

Performance by Key Competency

The appraisals of the principals included competencies such as Self-Determination, Self-Regulation, Self-Efficacy, and Self-Reflection. Table 2 and Figure 4 illustrate the current and expected performance levels for each of the competency items identified in the research.

Table 2

Performance by Key Competency

Key Competency	Current Performance	Expected Performance
Self-Determination	3.4	4.6
Self-Regulation	3.1	4.4
Self-Efficacy	3.0	4.5
Self-Reflection	3.2	4.5

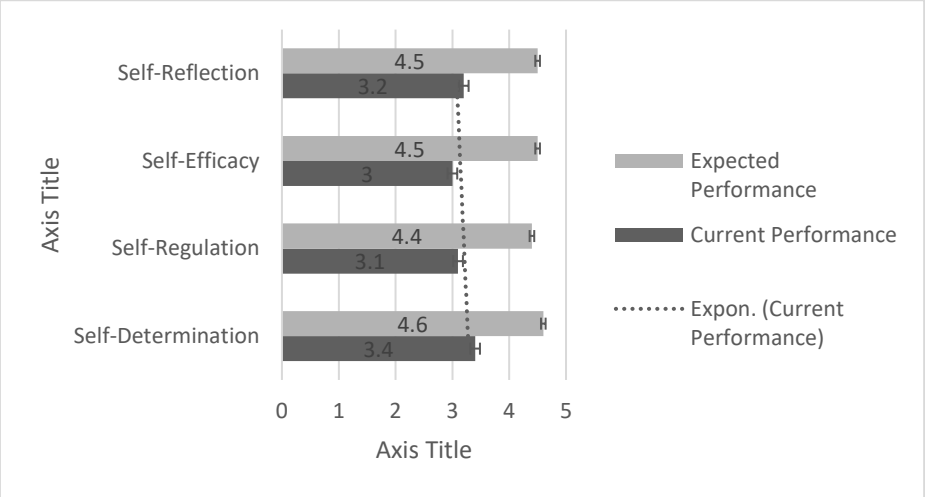

Figure 4: Performance by Key Competency

In the average current performance measures, Self-Determination emerged with the highest competency score, suggesting that principals are relatively self-directed in their learning experiences and decision-making. However, the current performance is significantly below the expected performance across all key competencies, with the greatest gap observed in Self-Regulation, where principals believe they have considerable potential for improvement.

Skills Deficiency: A Cross-Dimension Analysis of Lifelong Learning

To comprehend the broader context of lifelong learning, we examined the principals' self-assessed competencies across three learning dimensions: Andragogy, the Learning Continuum, and Heutagogy. Table 3 and Figure 5 present the average performance scores of the respondents in each of these lifelong learning dimensions.

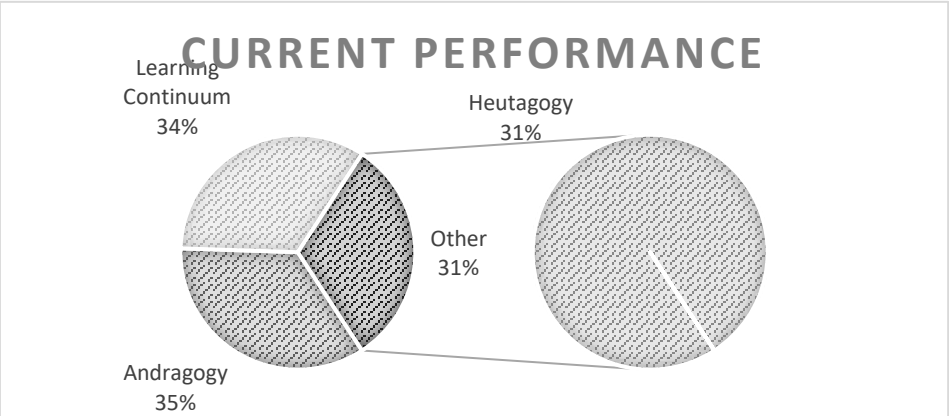

Figure 5: Performance Across Lifelong Learning Dimensions

Table 3

Performance Across Lifelong Learning Dimensions

Lifelong Learning Dimension	Current Performance	Expected Performance
Andragogy	3.3	4.5
Learning Continuum	3.2	4.4
Heutagogy	3.0	4.5

The principals performed slightly better in Andragogy, which encompasses theories on adult learning and self-directed learning. However, on the Heutagogy scale, they indicated a need for further improvement in guiding groups to facilitate collaborative learning.

Multiple Regression Analysis: The current article aims at identifying potential implications of Lifelong Learning engagement.

A multiple regression analysis was performed to determine which of the independent variables best predict principals' self-directed lifelong learning. The predictors in the study included Self-Determination, Self-Regulation, Self-Efficacy, and Self-Reflection. The coefficients of the regression model are presented in Table 4.

Table 4

Regression Analysis Results

Predictor (Competency)	Coefficient (β)	p-value
Self-Determination	0.52	0.002
Self-Regulation	0.30	0.015
Self-Efficacy	0.28	0.020
Self-Reflection	0.35	0.010

The regression output indicates that, among all the variables, Self-Determination demonstrates the highest level of significance, with a coefficient of 0.52 ($p < 0.01$), suggesting that principals with higher levels of self-determination are significantly more likely to engage in lifelong learning compared to those with lower levels. Additionally, Self-Reflection also has a positive and significant impact on participation in lifelong learning. The findings further highlight a substantial performance gap between the current and desired levels of self-directed lifelong learning competencies among principals in Guangxi, China.

Analysis of the 10 key competencies reveals that Self-Determination and Self-Reflection are the most effective in fostering lifelong learning engagement. This underscores the need for targeted interventions to assist principals in developing these competencies and achieving their self-identified professional development goals. The results section provides a summary of the evidence gathered through both observational and quantitative methods. A mixed research approach enabled the researcher to examine and describe the self-directed lifelong learning competencies of school principals in Guangxi, China. The study comprised three key activities: (i) observing and videotaping the daily practices of principals, (ii) conducting surveys among the principals, and (iii) revising the Key Self-Directed Lifelong Learning Competency-Based Model based on the participants' recommendations.

In step 1, the researchers visit 10 schools in Guangxi, observe the daily practices of the principals, and manage time due to strong management tasks, limited opportunities for peer cooperation, difficulties in implementing innovative learning. This was carried out to show issues such as problems. Strategies based on institutional restrictions. These observations were written in five libraries and ten online platforms where analysis of 10 academic articles and 30 books was highlighted by key skills such as self-determination, self-efficacy and more. Composited into the document. Integrated such as self-reflection, identified and identified skill resistance, and inadequate resources for professional development, and Knowles's Andragogy in a conceptual framework that includes five core variables. Theoretical models: learning perspectives, learning tactics, academic skills, learning binding and implementation of learning.

In step 2, 60 online surveys were based on this framework. Data were then analyzed using SPSS version 23.0, thereby using factor analysis containing a Kaiser-Meyer-Olkin value of 0.82, and a significant whisker test ($P < 0.001$). Cronbach values exceed 0.70 were confirmed to have high internal consistency when billing exceeded 0.85.

In step 3, feedback from 190 (comprehensive principals, teachers, parents, education experts) was collected in 60 questions online surveys and conducted via layered samples. Insights from this phase highlighted the importance of self-reflection, collaborative learning, and absorption of digital skills. The result was a model refined to integrate digital literacy and peer learning, while simultaneously maintaining the original variables, leading to a theoretically comprehensive and validated model of self-controlled lifelong learning ability. To lead the education management in Guangxi, a mixed method of research that is grounded, substantially relevant, China, seamlessly combined with qualitative observations and quantitative analysis to improve education in Guangxi. This illustrates the approach.

Discussion

This paper has thus identified the competencies required by school principals in Guangxi, China, for fostering self-directed lifelong learning, as well as those competencies that require enhancement. The findings will be examined in the context of existing literature, with an explanation of the gap between current and expected performance. Additionally, recommendations will be offered to strengthen the continuous professional development of educational leaders in the region.

It has become evident that there is a notable discrepancy between the current and projected performance across all implemented competencies: Self-Determination, Self-Regulation, Self-Efficacy, and Self-Reflection. While the average scores for current performance were moderately high, the expected performance scores were even higher, indicating that the principals are eager for growth and development. This is corroborated by literature on lifelong learning, which suggests that self-regulation and self-efficacy are critical elements supporting lifelong learning (Candy, 1991; Garrison, 1997). However, these differences highlight that certain competencies may be performed considerably below the anticipated level, particularly in relation to Self-Efficacy. This suggests that principals may lack confidence in their ability to initiate the changes in education that they aspire to. This finding aligns with Bandura et al. (1997) assertion that self-efficacy is largely influenced by external factors, such as access to resources, support from colleagues, and

institutional constraints. Such limitations may help explain why the principals' self-reported self-efficacy is lower than their actual performance, as they are acutely aware of these external challenges.

The regression analysis of the four key competencies revealed that Self-Determination was the most significant factor in engaging principals in lifelong learning activities. Consistent with the study's hypothesis, principals with higher self-determination scores exhibited more behaviours related to lifelong learning than those with lower scores. This aligns with self-determination theory, which emphasises that intrinsic motivation is crucial for self-regulated learning (Deci & Ryan, 1985). The findings suggest that intrinsically motivated principals take responsibility for their learning, set goals, and actively seek professional development. However, while the average performance in Self-Determination was above other competencies, it did not meet the expected level, indicating room for improvement. This highlights the need for structured support, such as individual learning plans, PD sessions, and coaching, to further enhance self-determination and help principals achieve their work-related goals (Billett, 2001).

Self-Efficacy ranked highest for both current and expected levels of effectiveness, which is significant as self-efficacy strongly influences how individuals apply their knowledge and skills in practice. Principals with high self-efficacy are more likely to cope with challenges and drive changes in their schools (Bandura et al., 1997). The lower mean scores for self-efficacy in this study can be attributed to factors such as limited resources, cultural diversity, and evolving educational demands in Guangxi. To bridge this gap, interventions aimed at building principals' self-confidence are needed. Research shows that mastery experiences, vicarious learning, and social persuasion are highly effective in enhancing self-efficacy (Bandura, 1986). Providing principals with opportunities to observe model performers, engage in focused learning-teaching sessions, and receive constructive feedback could help improve their self-esteem and self-efficacy.

The study also explored how principals performed across different dimensions of lifelong learning: Andragogy, Learning Continuum, and Heutagogy. Principals scored slightly higher in Andragogy, which focuses on adult learning theory and self-directed learning. This suggests that principals recognise the need to engage in self-directed learning and are motivated to enhance their learning. However, their performance in Heutagogy was lower, as this approach emphasises self-organisation and adaptability. The lower scores in Heutagogy suggest that principals may perform better in more structured learning environments, rather than in flexible, self-organised forms of learning, particularly when introducing new ideas and creating learning-centred environments. This area presents an opportunity for targeted improvement. Hauntological approaches, such as problem-based learning, peer learning, and experiential learning, have been shown to develop skills crucial for self-motivated learning (Blaschke, 2012). Therefore, educational institutions should incorporate these approaches into their professional development programmes to better prepare principals for the challenges of leading and managing schools today.

Implications for Educational Leadership in Guangxi

The findings of this study have significant implications for educational leadership in Guangxi. The gaps between current and expected performance across all competencies

underscore the need for targeted support in the professional development of school principals. Specifically, the findings suggest that principals would benefit from programs focused on:

- Enhancing self-efficacy through mastery experiences and mentorship.
- Developing self-determination by providing opportunities for autonomy and goal setting.
- Promoting heutagogical learning approaches that encourage innovation and collaboration.

Additionally, the study's emphasis on lifelong learning is particularly pertinent considering the rapid changes in China's educational landscape. As the country continues to reform its education system with a focus on equity and quality, principals must be equipped with the skills and competencies necessary to lead effectively in diverse and resource-constrained environments. This study offers a framework for developing these competencies and identifies the areas where principals require the most support.

Limitation

Although this study provides valuable insight into the skills of school principals in Guangxi, China, it is important to recognize some limitations and consider future research directions. Reliance on self-report research may have introduced social desirability, and principals overestimated their expected performance, particularly when forced to demonstrate their commitment to lifelong learning. As this study was conducted in specific regions, further investigation is needed to examine the results in a variety of cultural and educational contexts across China. Future research implements longitudinal research by using qualitative methods such as interviews and focus groups to examine the specific challenges faced by principals, and how skills develop over time. Researchers can expand these findings by evaluating them. Overall, the findings have been made by prioritizing self-determination, self-efficacy, and lifelong learning, and ultimately promoting more effective educational management, improving school outcomes, and increasing strengthening the overall education system. It provides a clear roadmap to improve the skills of school leaders.

Conclusion

Unlike this study which adopt mixed-method design combining qualitative observations with quantitative survey to develop a Key self-directed lifelong learning competency-based model for Guangxi, China school principals. The study is to discover five primary competence domains essential to build and promote self-directed lifelong learning competencies among school principals: Learning Perspective and Learning Tactics, Academic Achievement, Learning Activities and Learning Execution. Confirmatory factor analyses and construct validation were computed to verify the validity, stability, and practical applicability of the model. The study also pointed out the competencies that require more professional development, mainly Self-Efficacy and Learning Tactics. The proposed model was informed by input from principals, teachers, parents, and education experts to ensure its construction was appropriate for the current educational context. From a training perspective, this competency-based model presents a systematic structure to develop school principals' independent learning abilities, leading

to improved leadership. Furthermore, the model addresses current trends in education, especially in terms of technology and collaboration, which are crucial considerations today for educational leadership. This paper is a critical model for developing Guangxi school principals from self-directed, lifetime quality perspective. It cultivates a culture of lifelong learning, strengthens school leadership, and plays a role in improving standards of education in the area. Further studies need to refine the model within various contexts as well as examine the longitudinal effect of the model on the development of educational leaders over time.

Future Directions

While this study offers valuable insights into developing a competency-based framework for lifelong learning, several avenues for future research and practical action remain open:

1. Every competency development model should be longitudinal in nature: Future research should use longitudinal designs that follow participants over an extended timeline and allow to capture how principals' competencies develop over time. Such studies could explain how new daily practice moves a principal's self-efficacy and self-determination competencies, and new perceptions of how their work has led to improved school outcomes over time—especially student achievement.

Consider how the availability of professional development resources, institutional support and peer learning may impact the self-directed learning of principals. Future research should focus on these variables to determine the best struc- tures to support the principal's lifelong learning.

Qualitative Insights: While primarily a quantitative study, it could also present qualitative data, for example through interviews or focus groups with principals to better understand the barriers and challenges in developing competencies. Such approaches may reveal nuanced aspects of principals' learning experiences that cannot be easily captured by survey items.

Importance of Targeted Professional Development Programmes: Future studies should measure the impact of such professional development activities focused on improvement in competencies primarily self-efficacy and self-reflection. Analyzing the results of different programmes may provide useful guidance for how to structure future initiatives to encourage principals' active participation in lifelong learning.

Regional and Cross-Cultural Studies: This study could be extended to other regions in China or other countries to enable comparative analysis between current and aspirations in respect of principals' competencies, as well as the extent of principals' engagement with lifelong learning across different educational systems and cultures. These investigations could also inform the construction of flexible frameworks suited for different education administrators.

Principals in the Digital Era: As educational technologies and digital learning platforms continue to gain prominence; future studies should consider the role of these tools in lifelong learning models for principals. In places like Guangxi, where face-to-face learning is severely constrained, technology-enabled self-learning could be a solution.

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