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Exploratory and Confirmatory Factor Analysis of Components for Developing an Unlimited Generation Education Model in the 2050 Domain

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ABSTRACT

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Purpose: One of the inherent duties of the Cultural and Social Affairs Department of Farhangian University is to extend the governance of cultural and social spheres across all dimensions of the university. In this regard, numerous and diverse plans and activities have been implemented in recent years. The aim of this article is to analyze the cultural and social activities conducted at the university level and to provide an optimal model in this context.

Methodology: The Three-Branch Model was used as a theoretical framework. The method employed was mixed, comprising both qualitative and quantitative sections. The qualitative sample population included 30 cultural experts selected through purposive sampling. The quantitative sample population consisted of 194 active members of student organizations, chosen through stratified random sampling. Data collection techniques included in-depth interviews and questionnaires.

Findings: The findings indicate that structural factors (0.195), behavioral factors (0.368), and contextual factors (0.312) play significant roles in the formation of issues and problems in cultural and social programs and activities. Additionally, the regression results show that 63% of the variance in the dependent variable is explained by these three variables: structural factors, contextual factors, and behavioral factors.

Conclusion: The findings of this study indicate that the structural, behavioral, and contextual factors play significant roles in shaping the outcomes of cultural programs and activities at Farhangian University. This section discusses the implications of these results, drawing on relevant literature to highlight the broader context and potential strategies for enhancing the effectiveness of cultural programs in higher education.

Keywords: Cultural activities, pathology, contextual factors, structural factors, behavioral factors.

1. Introduction

One of the significant factors influencing future education is the demographic transition. The age structure of a population has profound implications for public education expenditure and policy (Tiruneh et al., 2017; Vaganova et al., 2020; Yao, 2023). As Narayana (2018) discusses, the age structure transition in India necessitates adjustments in public education spending to harness the potential growth effects. Similarly, the global demographic shift towards an aging population will require educational models that cater to lifelong learning and skill reformation for older adults (Freund et al., 2021; Garba & Yusuf, 2016; Narayana, 2018; Pelletier & Tyedmers, 2010; Piekny & Maehler, 2012; Tsatsou et al., 2017; Wójcik et al., 2018).

Technological advancements, particularly in Information Communication Technology (ICT), are reshaping the educational landscape. Mpumuje (2024) highlights the integration of ICT in rural secondary schools in Rwanda, demonstrating the potential of technology to bridge educational gaps and enhance learning outcomes (Mpumuje, 2024). As we move towards 2050, the role of ICT in education will become even more pivotal, necessitating models that incorporate advanced digital tools and platforms to facilitate personalized and accessible learning experiences.

Environmental sustainability and economic stability are critical considerations for future educational models. Pelletier and Tyedmers (2010) forecast the potential global environmental costs of livestock production, emphasizing the need for educational curricula that include environmental awareness and sustainability practices (Pelletier & Tyedmers, 2010). Moreover, economic factors, as discussed by Benz (2021), will play a crucial role in shaping educational policies and practices. The interplay between economic stability and educational dependency in Europe underscores the importance of developing resilient educational systems that can withstand economic fluctuations (Benz, 2021).

The socio-political environment significantly impacts educational frameworks. Predicting armed conflicts and their implications for education, as explored by Hegre et al. (2012), is essential for developing models that ensure continuity and stability in education during times of unrest. Furthermore, the role of policymakers and educational planners in shaping future education cannot be overstated (Hegre et al., 2012). Their actions and decisions will

influence the accessibility, quality, and relevance of education in a rapidly changing world.

The integration of bioenergy and climate management into educational models is another critical area. Rose et al. (2013) discuss the role of bioenergy in energy transformation and climate management, highlighting the need for educational programs that equip students with the knowledge and skills to address environmental challenges. As climate change continues to pose significant threats, educational models must incorporate sustainability and environmental stewardship as core components (Rose et al., 2013).

The application of system dynamics in energy and environmental education, as explored by Strapasson et al. (2022), provides a valuable approach to understanding and managing complex systems. This methodology can be extended to educational models, allowing for the simulation and analysis of various scenarios and their impacts on learning outcomes (Shikhnabieva, 2018). By adopting a systems approach, educational planners can develop more robust and adaptable models that respond effectively to future challenges.

Given these diverse influences, developing a comprehensive educational model for 2050 requires a multi-faceted approach. This study utilizes qualitative content analysis and theoretical coding to identify and evaluate the components critical for future education. The model proposed in this research incorporates factors affecting the acquisition of professional competencies, professional planning, economic influences, the role of policymakers and educational planners, individual factors, foundation-building and willingness to create change, social factors, physical factors, and technological and virtual factors.

The process of developing this model involved extensive literature review and expert consultations. The qualitative phase included interviews with experts and scholars to gather insights and refine the proposed components. The Delphi technique was employed to achieve consensus among experts, ensuring the model's relevance and applicability. The final model was then subjected to quantitative validation to confirm its robustness and reliability.

2. Methods and Materials

2.1. Study Design and Participants

This research aimed to develop a model for the education of an unlimited generation in the 2050 domain. Given the

applied nature of this research, which is not solely for scientific discovery but for examining the applicability of knowledge, the study was conducted using an exploratory approach. The data collection method was quantitative, and the primary data collection tool was a questionnaire.

The qualitative sample consisted of experts, specialists, and informed individuals in the field of future-oriented education (including planners, policymakers, managers, etc.). A non-random purposive sampling method was used to select these experts. The criteria for participants who received the Delphi questionnaire included:

- A minimum of a master's degree.
- At least three years of executive experience in a managerial position.
- Familiarity with the literature on future-oriented education.

For the interviews, aimed at exploring and describing the beliefs and attitudes of the interviewees, a sample size of 10-25 participants was recommended, depending on available time and resources. In this study, 15 participants were selected for the qualitative section using the Delphi method.

2.2. Data Collection

The research methodology, based on the objective, was fundamental-applied; based on data type, it was mixed-method (qualitative-quantitative) and exploratory; based on data collection time, it was cross-sectional; and based on data collection method or research nature, it was descriptive-survey. In mixed-method research, by examining various aspects of qualitative and quantitative methods and combining them, it becomes possible to answer research questions in different fields.

2.3. Data Analysis

In this study, the researcher initially examined the research topic qualitatively with a limited number of participants. Based on qualitative findings, the necessary tools were constructed. Given the primary goal of developing an appropriate model for unlimited generation education in the 2050 domain and to gain a deeper understanding of the components and indicators, relevant literature and background were reviewed to identify initial indicators and components (content analysis of literature and background). The Delphi technique was then used as a research method to refine, confirm, reject, or add indicators and components of unlimited generation education in the 2050 domain among experts. Based on this, the final

questionnaire was developed. Finally, quantitative (descriptive-survey) approaches were used to confirm qualitative results and test the model.

Descriptive statistics such as frequency, percentage, mean, standard deviation, and coefficient of variation were used to describe and analyze the research data. Inferential statistics, such as factor analysis, were also employed. Factor analysis is a general name for several multivariate statistical methods aimed at data summarization. This method examines the internal correlation of many variables and ultimately categorizes and explains them as limited factors. Factor analysis is used to address issues such as reducing the volume of variables or forming a new structure for them. Based on empirical and practical criteria, factor analysis reduces many variables to a few factors, making their analysis simpler. It groups variables that have medium to high correlations with each other, thus reducing the number of variables to factors.

3. Findings and Results

The examination of the gender of respondents in the sample shows that 38.2% of the respondents (96 individuals) are female and 61.8% of the respondents (155 individuals) are male. Therefore, male respondents are more frequent in this research. Additionally, the examination of the age of respondents in the sample indicates that: 32.3% of the respondents (81 individuals) are between 31-40 years old, 50.6% of the respondents (127 individuals) are between 41-50 years old, and 17.1% of the respondents (43 individuals) are 50 years old or above. The examination of the education level of respondents in the sample shows that: 37.8% of the respondents (95 individuals) have a doctoral degree, 38.6% of the respondents (97 individuals) have a master's degree, and 23.5% of the respondents (59 individuals) have a bachelor's degree. The examination of the service history of respondents in the sample shows that: 17.1% of the respondents have between 6 to 10 years of service, 15.1% of the respondents (the least frequency) have between 11 to 15 years of service, 23.1% of the respondents have between 16 to 20 years of service, and 44.6% of the respondents (the highest frequency) have more than 21 years of service.

Initially, components of the unlimited generation education in the 2050 domain were identified through literature review and analysis of existing scientific documents. Subsequently, the importance of each component was assessed using a researcher-developed questionnaire. Finally, based on the previously gathered

information and the researcher-developed questionnaire, the education of an unlimited generation in the 2050 domain was evaluated.

The components identified as influential in the unlimited generation education in the 2050 domain include:

- Factors affecting the acquisition of professional competencies
- Professional planning
- Professional competencies
- Economic factors

Actions of managers, policymakers, and educational planners

- Individual factors
- Foundation-building and willingness to create change
- Social factors
- Physical factors
- Technological and virtual factors

The questionnaire content was validated by experts, confirming its content validity. To verify the reliability or consistency of the questionnaire, Cronbach's alpha was calculated. Cronbach's alpha measures the extent to which items in a questionnaire are positively correlated. The overall alpha coefficient for the unlimited generation education in the 2050 domain was 0.90, indicating a high level of reliability.

In this study, the "Unlimited Generation Education Model in the 2050 Domain" was examined qualitatively using qualitative content analysis and theoretical coding. This section explains the interview process and the data analysis process in the stages of open coding, axial coding, and

selective coding, accompanied by coding tables. It also describes how to theorize using selective coding and research narrative, and finally presents the desired research model. To prepare the questions for the specialized interviews, the following stages were undertaken with the guidance of the supervisor and advisor and through back-and-forth interactions with experts and scholars:

- Text implementation
- Definition of the unit of analysis
- Development of categories and a coding scheme
- Pilot coding scheme
- Coding all the text
- Assessing the consistency of coding
- Extracting results from coded data
- Reporting the method and findings (extracting dimensions, components, and indicators)
- Preparation and finalization of the expert and scholar questionnaire.

These questions were then presented to experts and scholars, and the results were summarized qualitatively using a summarization approach. The core components of the unlimited generation education model in the 2050 domain from the perspective of experts and scholars were evaluated as follows.

Based on the suggestions of experts and scholars and with the approval of supervisors and advisors, the extracted components were evaluated to assess the components and indicators for providing a model for unlimited generation education in the 2050 domain. Below is a summary of the specialized opinions of experts and scholars, categorized by different components:

Table 1

Summary of Expert and Scholar Opinions Based on Coding by Components

Row	Identified Component Title	Frequency	Percentage	Percentage (Validated)
1	Factors affecting the acquisition of professional competencies	16	10.61%	11%
2	Professional planning	13	11.94%	12%
3	Professional competencies	13	10.46%	10%
4	Economic factors	14	10.23%	10%
5	Actions of managers, policymakers, and educational planners	16	9.05%	9%
6	Individual factors	18	9.03%	9%
7	Foundation-building and willingness to create change	13	10.49%	10%
8	Social factors	12	9.01%	9%
9	Physical factors	10	10.09%	10%
10	Technological and virtual factors	10	9.09%	9%
11	Total (Validated)	135	100%	100%
12	Missing	0	0%	-
13	Total	135	100%	-

In the end, according to the experts and scholars, the above components were confirmed as the components and indicators for providing a model for unlimited generation education in the 2050 domain for evaluation in the quantitative section. Below is the path coefficient output from the factor analysis of the indicators determining the unlimited generation education model in the 2050 domain. If the factor loading is less than 0.3, the relationship is

considered weak and ignored. Factor loading between 0.3 and 0.6 is acceptable, and if it is greater than 0.6, it is considered very desirable.

The results showed that none of the components were removed from the factor analysis process because there was no factor loading less than 0.3. Since the factor loading for all components was greater than 0.6, the model is considered "very desirable."

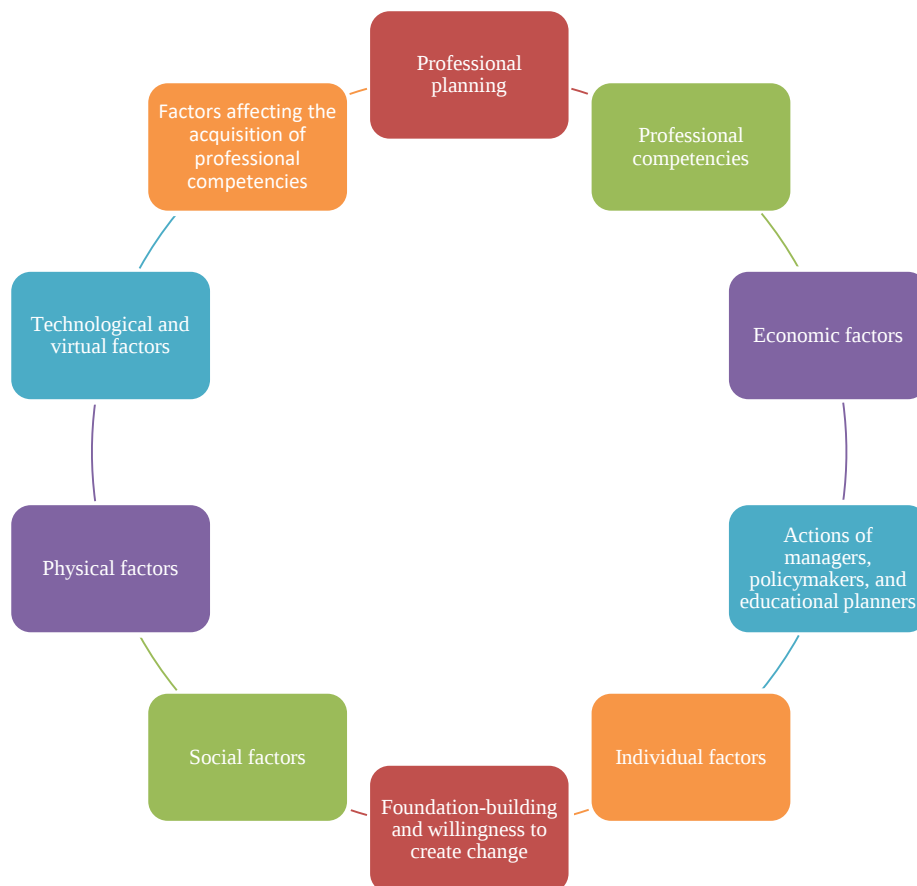
Table 2

Output from Factor Analysis

Row	Path	Path Coefficient	Significance
1	Factors affecting the acquisition of professional competencies >>> Professional planning	0.0781	Significant
2	Professional planning >>> Professional competencies	0.0702	
3	Professional competencies >>> Economic factors	0.660	
4	Economic factors >>> Actions of managers, policymakers, and educational planners	0.633	
5	Actions of managers, policymakers, and educational planners >>> Individual factors	0.629	
6	Individual factors >>> Foundation-building and willingness to create change	0.599	
7	Foundation-building and willingness to create change >>> Social factors	0.593	
8	Social factors >>> Physical factors	0.570	
9	Physical factors >>> Technological and virtual factors	0.553	
10	Technological and virtual factors	0.542	

Figure 1

Components for Developing an Unlimited Generation Education Model



4. Discussion and Conclusion

The study identified and validated several key components essential for the model of "Unlimited Generation Education in the 2050 Domain." These components included factors affecting the acquisition of professional competencies, professional planning, professional competencies, economic factors, actions of managers, policymakers, and educational planners, individual factors, foundation-building and willingness to create change, social factors, physical factors, and technological and virtual factors. The validation process confirmed that all identified components had a factor loading greater than 0.6, indicating a strong relationship and the model being "very desirable."

The factor analysis results provided significant path coefficients among the components, emphasizing the interrelationships. For instance, the path coefficient between factors affecting professional competencies and professional planning was significant (0.0781). Other notable relationships included professional competencies to economic factors (0.660) and economic factors to actions of managers, policymakers, and educational planners (0.633).

The identification of key components underscores the multifaceted nature of future education. Factors affecting the acquisition of professional competencies and professional planning are critical as they ensure that educational models remain relevant and adaptable to future workforce needs. This is consistent with Narayana's (2018) findings, which highlight the importance of aligning educational expenditure with demographic transitions to harness potential growth effects (Narayana, 2018).

The strong relationship between professional competencies and economic factors emphasizes the economic implications of education. As discussed by Benz (2021), economic stability and educational dependency are intertwined, suggesting that robust educational models can contribute to economic resilience (Benz, 2021). This relationship is further supported by Mpumuje (2024), who demonstrated that ICT integration in education enhances learning outcomes and, by extension, economic development in rural settings (Mpumuje, 2024).

The significant path coefficient between economic factors and the actions of managers, policymakers, and educational planners highlights the critical role of governance in education. Effective management and policy-making can drive educational success, as evidenced by the

work of Hegre et al. (2012), who identified the socio-political determinants of educational stability in conflict-prone areas (Hegre et al., 2012). The proactive involvement of educational leaders is essential for fostering environments conducive to learning and development.

Individual factors and foundation-building reflect the need for personalized learning experiences and the creation of supportive learning environments. This aligns with the findings of Strapasson et al. (2022), who advocated for the use of system dynamics to understand and manage complex educational ecosystems. Their work emphasizes the importance of creating adaptable educational frameworks that can respond to changing individual and societal needs (Strapasson et al., 2022).

The inclusion of social, physical, and technological factors further highlights the comprehensive nature of the proposed model. The integration of bioenergy and climate management into education, as discussed by Rose et al. (2013), is an example of how environmental considerations can be incorporated into educational planning (Rose et al., 2013). This approach ensures that future generations are equipped to address global challenges such as climate change and sustainability.

Despite the comprehensive approach, this study has several limitations. Firstly, the sample size, while adequate, may not fully represent the diversity of opinions and experiences across different regions and educational systems. The study primarily relied on expert opinions, which, although valuable, may introduce bias due to the subjective nature of qualitative data collection and analysis.

Secondly, the study's focus on the year 2050 presents inherent challenges in forecasting long-term trends and developments. The rapidly changing technological, economic, and socio-political landscape means that some of the identified components may evolve or become obsolete over time. Thus, while the proposed model is robust, it requires periodic review and adjustment to remain relevant.

Lastly, the reliance on self-reported data and expert consensus through the Delphi method can introduce issues related to reliability and validity. Although measures were taken to ensure data quality, such as validating the questionnaire and using a mixed-method approach, these limitations must be acknowledged.

Future research should aim to address these limitations by expanding the scope and scale of the study. A larger and more diverse sample size, including participants from different geographical regions and educational backgrounds,

would provide a more comprehensive understanding of the factors influencing future education.

Longitudinal studies could also be conducted to track changes over time and assess the long-term applicability of the proposed model. By periodically revisiting and updating the model, researchers can ensure that it remains aligned with emerging trends and developments in education.

Additionally, future research should explore the integration of emerging technologies, such as artificial intelligence and machine learning, into educational models. These technologies have the potential to revolutionize education by providing personalized learning experiences and data-driven insights. Investigating their impact on education could yield valuable insights and further refine the proposed model.

Finally, more quantitative studies are needed to validate the qualitative findings of this study. By employing advanced statistical techniques and data analytics, researchers can test the relationships between components and assess the overall effectiveness of the proposed model. This approach would provide a more rigorous and evidence-based foundation for future educational planning.

Educational practitioners and policymakers can use the findings of this study to inform the design and implementation of future educational programs. The identified components should be integrated into educational planning to ensure that curricula are comprehensive, adaptable, and aligned with future needs.

Professional development programs should emphasize the acquisition of professional competencies and effective planning. By providing educators with the necessary skills and knowledge, educational institutions can enhance the quality of teaching and learning. Additionally, the integration of ICT and other technological tools should be prioritized to create engaging and interactive learning environments.

Policymakers should also focus on creating supportive policies and frameworks that facilitate the implementation of the proposed model. This includes investing in educational infrastructure, fostering collaboration between stakeholders, and promoting innovative teaching practices. By taking a proactive approach, policymakers can ensure that education systems are resilient and capable of adapting to future challenges.

Moreover, the emphasis on environmental sustainability and economic factors highlights the need for interdisciplinary approaches in education. Educational programs should incorporate elements of environmental

science, economics, and social studies to provide students with a holistic understanding of global issues. This approach will prepare future generations to address complex challenges and contribute to sustainable development.

In conclusion, the findings of this study provide a comprehensive framework for future education, emphasizing the importance of adaptability, technological integration, and holistic planning. By addressing the identified components, educational practitioners and policymakers can create robust and resilient education systems that meet the needs of future generations.

Authors' Contributions

The first author was responsible for conducting the interview and collecting data, and the other authors were responsible for analyzing the data and writing the article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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