

# **School Management Ideas of Primary Principals: Application of fuzzy statistics**

Mei-Hui Chou<sup>1</sup>, Fwu-Yuan Weng<sup>2</sup>, Tsung-Kuo Tien-Liu<sup>3</sup> Wen-Tsung, Lai<sup>4</sup>

<sup>1</sup> Department of Educational Policy and Administration/ Dr student  
National Chi Nan University, Taiwan  
jmay4258@ms27.hinet.net

<sup>2</sup> Department of Educational Policy and Administration/Professor  
National Chi Nan University, Taiwan  
fyweng@ncnu.edu.tw

<sup>3</sup> Center for General Education / Lecturer & Dr student  
National Chi Nan University, Taiwan  
tkliu@ncnu.edu.tw

<sup>4</sup> Department of Educational Policy and Administration/ Dr student  
National Chi Nan University, Taiwan  
s100407904@mail1.ncnu.edu.tw

## **Abstract**

The reasons for principals managing their schools are primarily to encourage students to realize their potential, be suitable for development and achieve education goals, "The type of school relies on the type of principal" A principal is the school leader. The principals' management ideas for their schools relate to school quality and performance. In addition, data analyses were collected from 12 units selected by group measurements with purposive sampling. The main statistical methods applied are fuzzy modes and fuzzy expected values. These two methods are used to investigate school management ideas of primary principals. Finally, based on our results, the analysis of the dimensions show that school management philosophies, comply with student requirements, development of school characteristics, administrative leadership, teaching professionals, parents, community interactions, and human resources management. The primary concern is to comply with students' requirements. School management has the most difficulties in their interactions with the parents and community.

**Keyword: School management, Leadership style, Fuzzy statistics**

## 1. Introduction

Because of the factors of success cause school education to be complex, one of the principals operating educational concept of the most important indicator. Modern school principals' leadership and management focus on the "administration," "leadership," "public relations," and "professional responsibilities" so that the school management can understand the advantages of school development situations, weaknesses, opportunities, aims, and threats (SWOT analysis), and have a clear vision of education, educational goals, and school management ideas.

We used a fuzzy questionnaire and fuzzy modes to analyze the membership function status of a principal's school management for participants' demands, future trends, and management strategies. The purposes of this study are to (a) establish a goal value system for the management philosophies of the principals of schools; (b) analyze the requirements of principal school management; (c) analyze the future direction of principal school management from five dimensions, including complying with student requirements, development of school characteristics, administrative leadership, teachers, parents, community interactions, and human resources management; (d) and to understand the main strategies of principals in school management.

## 2. Literature review

### 2.1. The concept of the principals managing school

A substantial portion of theory in educational management derives from business management (Walker & Dimmock, 2002) Taylor (1911) stated, "The principal objective of management should be to secure the maximum potential for employers coupled with the maximum potential for each employee," so that the principals of school operations is promoting student learning outcomes and enhancing the quality of education that advances that goal.

Principals involve all stakeholders, such as students, teachers, parents, and community members in setting the directions and building visions for change (Walker & Dimmock, 2002).

Principals are in an educational reform environment fraught with uncertainty and contradictions. For leadership and cross-cultural understanding, discovering important insights in cultural differences in learning is necessary (Marion, 2002).

Principal leadership, a culturally and contextually bounded process, is inextricably intertwined with its larger environment, at levels ranging from the organizational, to local community though to larger society (Dimmock & Walker, 2005). Therefore, principal school management must be multicultural. Through internal and external public relations, schools, families, and social mutual understanding, and build each other's good relationship (West, 1985). Setting the operation goals and strategies of school leaders is important.

### 2.2 The fuzzy theory

There are two types of human thinking that one formal thinking another fuzzy thinking, The former is a logical and sequential thinking, latter is the entire and integrated thinking (Zadeh, 1965; Wu, 2010). When faced with the decision-making judgment and thinking, based on the binary logic of formal thinking, and often difficult to show the multiple logistic characteristics of human thinking.

The fuzzy theory based on fuzzy logic based that will the traditional concept of mathematical logic to do an expansion. Elements and the relationship of the collection, a collection of classical elements and a collection of relations to the characteristic function of recognition that  $I(x) = 1, \text{ if } x \in A; I(x) = 0, \text{ if } x \notin A$ . The fuzzy theory by Zadeh (1965), suggesting "Fuzzy Sets" concept began to develop at Information and Control ". Fuzzy theory to fuzzy sets, it is crisp sets of mathematical concepts,

correction and expansion. To understand the fuzzy meaning, that is the opposite word from the “fuzzy” to “crisp” to do reverse thinking. However, in the real world, this “belong or not belong” it seems we can have many examples to support, but is not necessarily a contradiction.

Manski (1990) reminded of the risk of too much demand for digital data and over-interpretation. Using fuzzy data may avoid such risks. However, ambiguous data are consistent with human logic during the computing process. Human thoughts and feelings that are ambiguous and uncertain, and on the satisfaction scale, happiness, sadness, strength, weakness, optimism, pessimism, and so on are not easy to assess. Language and concepts are limited for analysis by traditional logic technology. The fuzzy sets concept, first proposed by Zadeh, uses the principle of fuzzy measure and classification to deal with the dynamic environment, to give a more reasonable description (Zadeh, 1965; Wu, 2010).

Fuzzy theory development since 1965 has gradually from the mathematical theory and engineering applications, extended to the statistical methodology of the social science community. From the study early, Verma (1997) suggesting fuzzy logic to construct offender profiles since the police officers received descriptions of suspects that were fuzzy in nature. In addition, Wu and Tseng (2002) applied fuzzy regression models to business cycle analysis. Besides, Ohdar and Ray (2002) proposed the fuzzy-based approach to measure and evaluate the performance of suppliers in the supply chain. Furthermore, Wu and Chang (2007) proposed new approaches on market research with fuzzy statistical analysis. Further, Metaxiotis, Psarras and Sanouilidis (2003) integrated fuzzy logic into a decision support system. In addition, Ordoobadi (2008) used fuzzy logic to evaluate advanced technologies for decision makers and provided a model based on fuzzy logic for decision makers to help them with selection of appropriate suppliers in 2009. Furthermore, Yeh (2011) Fuzzy relative weights of the analysis of fuzzy numbers, these studies are to obtain good results. There are more and more researches focus on the fuzzy statistical analysis and applications in the social science fields.

### **2.3 Applications of fuzzy theory on principal management concepts**

Since Zadeh (1965) first proposed fuzzy theory, this thinking could explain numerous practical phenomena, fuzzy theory elements, and the relationships among these. The degree of membership (membership) is in the range of [0, 1]. Fuzzy theory is used to understand principals' management ideas and principals' school improvement strategies to promote a quality environment for student learning, and enhances competing forces in children's future talents.

For evaluation of the principals' management, their ideas are divided into “good” and “not good” categories. This division is obviously unreasonable because management ideas excellent is not a binary phenomenon, but the continuity of the features of a variety of different management idea.

## **3. Method**

This study is adopted fuzzy method of quantitative research. We selected a purposive sample of 12 primary school principals for the sample.

### **3.1. Sample and Measures**

#### **3.1.1 Sample**

The study participants were 12 principals from primary schools in Taichung City and Nantou County in Taiwan. The 12 principals included 6 men and 6 women. These principals ranged in their experience from 1 to 15 years. The 11 participants ranged in age from 41 to 50 years, and two were over 50 years old. Four participants are from rural schools and 8 participants are from urban schools. The participants are all from

public primary schools.

### 3.1.2 Measures

The measurements consisted of two parts. The first is demographics examination, such as gender, age, principals' years of service, degrees, school type, school location, and school nature. The second portion is the fuzzy assessment of the management ideas of the principals.

It is a structure of multi-components, including compliance with students' requirements, the development of school characteristics, administrative leadership, teaching professionals, parents, community interactions, and human resources management.

### 3.1.3. Fuzzy Methods

Traditional statistics derive single answers or a certain range of answers by using a sampling survey, and are unable to sufficiently reflect on the complex thoughts of people. If people can use the membership function to express the degree of their feelings based on their own choices, the answer presented is closer to actual thinking. Therefore, collecting information based on the fuzzy mode should be the first step, and fuzzy statistics, such as fuzzy mode and fuzzy median, fit modern requirements. We show the definitions for fuzzy mode and fuzzy median generalized from traditional statistics below. Discrete cases are simpler than continuous ones.

### 3.1.4 Fuzzy sample mode

#### Definition 1 fuzzy mode (the sample is continuous and uniform allocation)

To set up  $U$  for a domain,  $S = [a_i, b_i], a_i, b_i \in R, i = 1, 2, \dots, n$  is the domain of  $U$ . If there is one point  $x (x \in U)$  a sample is covered. Cover  $x$  is the sample of a community, and is the collection of the largest community for  $MS$ , we define the fuzzy mode (Fuzzy Mode;  $FM$ ) for  $FM = [a, b] = \{ \cap [a_i, b_i] \mid [a_i, b_i] \subset MS \}$ . If  $[a, b]$  does not exist (as  $[a, b]$  is empty), we can say this set of data is without blurring mode or has no consensus (common agreement); if there are more than two groups the same as the frequency of coverage (as  $[a, b]$  not only). We state this set of data has multiple fuzzy modes or a variety of consensus.

#### Definition 2 fuzzy mode (discrete sample)

Set up  $U$  for a domain, order  $\{L_j\}_{j=1}^k$  distributed in the domain of  $U$  on  $k$  language variables,  $\{P_i\}_{i=1}^n$  a set of fuzzy samples, and for each sample  $P_i$  the corresponding linguistic variables  $L_j$  give a standardized membership  $m_{ij} (\sum_{j=1}^k m_{ij} = 1)$  ° significant membership standards. Order  $I_{ij} = \begin{cases} 1, & \text{if } m_{ij} \geq \alpha \\ 0, & \text{if } m_{ij} < \alpha \end{cases}$ ,  $S_j = \sum_{i=1}^n I_{ij}, j = 1, \dots, k$ .  $L_j$  has the largest value of  $S_j$  fuzzy mode, such as  $FM = \{L_j \mid \forall i \neq j, S_j > S_i\}$  °.

If the existence of more than two groups of  $L_j$  maximize the  $S_j$  value, we call state this set of data has multiple fuzzy modes or a variety of consensus.

### 3.2 Research Process.

This research establishes the value of the management ideas of the principals in schools systems. The management strategies of principals should be adjustable and inclusive. The differences among principal management strategies of schools require types of activities for value subjects that reflect on visions toward value cognition.

### 3.3 Data Collection Procedure

The collection of research analysis and fuzzy questionnaire content is divided into two parts: a questionnaire of basic information and management ideas from the principals'

perspectives. The questionnaire contained questions on teacher background characteristics, and on grading practices and strategies to understand the principals' backgrounds, levels of education, and management strategies.

Twelve participants were asked to answer the questionnaire. They were the principals of Taichung City and Nantou County schools in Taiwan. The participants anonymously finished the questionnaires one time. Finally, the data was analyzed using fuzzy statistics.

#### 4. Research results and discussion

##### 4.1. Research results

Using Definition 2, The discrete fuzzy sample plural seeking fuzzy mode of the 12 principals in the School management idea, Calculated for all samples of the project to the business philosophy of Tianda membership requirements sum, For example Needs of students item, Individual answer the sum of the membership of the 12 principals for  $0.3+0.1+0.2+0.1+0.3+0.2+0.8+0.6+0.4+0.05+0.6+0.3=3.95$ . Other items Using the same calculation method, After sort based on the sum of low membership. The analyses are summarized and shown in Tables 1, 2, 3, 4, 5, 6.

##### 4.1.1 School management strategies that summarize the most important types of memberships and sort

School management strategies that summarize the most important types of membership agree that the first important aspect is student requirements. The final aspect is administrative leadership, as shown in Table 1.

**TABLE 1. Sum of the most important of memberships and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
memberships (Total )	3.95	1.5	1.2	2.4	1.55	1.4
sort	1	4	6	2	3	5

##### 4.1.2 School management idea that the sum of the most difficult membership and sort

School management ideas that summarize the most difficult aspect types show that the most difficult aspect is community interaction. The lease difficult is needs of the students, as shown in Table 2

**TABLE 2. Sum of the most difficult of membership and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
Membership (Total )	1.3	2	1.4	2.5	2.6	1.9
sort	6	3	5	2	1	4

##### 4.1.3 School management idea that the sum of the to spend most time membership and sort

School management ideas that sum the time spent on types of aspects show that spend most time is spent on school characteristics, and the least is spent on administrative leadership, as shown in Table 3.

**TABLE 3. Sum of the to spend most time membership and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
Membership (Total )	2.3	2.5	1.3	1.8	1.9	1.7
sort	2	1	6	5	3	4

#### 4.1.4 School management idea that the Sum of the most effective way of membership and sort

School management ideas that summarize the most effective membership and type. The most effective of Needs of students which the final sort is Resources Management as Table 4.

**TABLE 4. Sum of the most effective way of membership and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
Membership (Total)	3.25	2.2	1.3	2.1	1.95	1.2
<b>sort</b>	1	2	5	3	4	6

#### 4.1.5 School management idea that the Sum of colleagues agree way of membership and sort

School management idea that the sum of colleagues agrees way of membership and sort, most of needs of students which the final sort is Administrative of Leadership as Table 5.

**TABLE 5. Sum of colleagues agree way of membership and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
Membership (Total)	2.9	2.1	1.3	1.9	2.2	1.6
<b>sort</b>	1	3	6	4	2	5

#### 4.1.6 School management idea that the Sum of Parents agree way of membership and sort

School management idea that the sum of parents agrees way of membership and sort, of Needs of students, The final sort is Resources Management as Table 6.

**TABLE 6. Sum of Parents agree membership and sort**

Item	Needs of students	School Characteristics	Administrative of Leadership	Teaching Professionals	Community Interaction	Resources Management
Membership (Total)	3.4	2.1	1.8	2.4	1.9	0.4
<b>sort</b>	1	3	5	2	4	6

## 4.2. Discussion

Our results show the school management ideas of primary principals in our study.

Analysis of the level of school management shows that principals think that school management is most important in complying with student requirements. School management has the most difficulties with interactions with parents, and the community, and spends the most time in complying with student requirements. In effective school management, colleagues and parents agree with the aspect that complying with the needs of students is important.

All the principals had good management qualities; however, their degrees and personal qualities are two important factors.

## 5. Conclusion

The principals are at the forefront of school education. Principals must have clear ideas and educational concepts to enhance the effectiveness of learning and to create an environment, in which each student can fulfill their self-potential, and their potential to learn in an educational environment.

Based on these findings, we have four recommendations.

#### **5.1 The establishment of balanced school management indicators**

We found that the principal of the schools are accountable for the needs of the students; however they do not attach importance to the development of school characteristics. Therefore, the establishment of balanced school management indicators and the pursuit of excellence is recommended. We show that to establish the characteristics of the school can sustain the developmental qualities of schools.

#### **5.2 Use of community resources that establish partnerships and augment student learning resources.**

The principals understand the tremendous importance of communication in organization, and advocated free and open interaction as the solution to numerous organization problems.

In this study, principals' greatest challenge is the interaction of parents and community; therefore, the use of strategic alliances and community resources is to establish partnerships to augment student learning resources.

#### **5.3 In a globalization era the principal should foster the concepts of leadership and management with global vision goals.**

In the globalization trend of modern education, principals should continue studying, absorbing new information in education, and should understand new education policies. A good attitude toward life-long learning and toward meeting the standards of professional requirements is currently required.

#### **5.4 Principals should be multi-cultural to ensure the care of the education of disadvantaged groups, and should have a concept of justice to promote the spirit of "social justice."**

This is a multicultural society. The principals should have clear school operating values and multicultural leadership concepts, such as empathy, caring leadership, and taking care of every student. Principals should not permit the students to fall behind; furthermore, they should enable them to have access to learning achievements. Therefore, principals require further education, particularly in promoting the ideas and skills of school management. We must enact measures to encourage principals to own their roles as senior professionals, and to improve their knowledge of psychological health, which can promote the quality of the principals, and promote the school's teaching performance.

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