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FUZZY EVALUATING GOAL ORIENTED AND MARKETING STRATEGY IN COMMUNITY COLLEGES

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ABSTRACT. *This study evaluates community colleges' goal values and marketing strategies. Redefining the current community college vague goal, this work uses participant preference to investigate the college's needs, future trends, and marketing strategies. The results show that vocational training has become the top ranking course in community colleges. Life skill is one of the most popular courses to meet students' needs. Students expect to enhance vocational training in community colleges as part of their marketing strategy for future career development. It is suggested that design-related training with vocational values and special courses for life skills are important for community colleges to help students prepare for job expertise*.

Keywords: Fuzzy Goal Oriented; Marketing Strategy; Community Colleges

1. Introduction. The community college in Taiwan has become the new dimension for further extended higher education, and re-evaluating its goal value and efficiency has become an important topic. The founding of the National Association for the Promotion of Community Universities (NAPCU) in September 1999 has opened a new era of community colleges in Taiwan. The original intent was to inspire citizens' critical thinking and enhance the formation of civil society. However, the purpose and value of the community college was not well defined.

The traditional idea of community colleges generated from extending technical and vocational education, combined with adult education and lifelong education. The current situation in Taiwan for planning general courses in community college consists of three categories: exploring fundamental issues (academic programs), developing public areas (community programs), and enriching the meaning of life (life skills course).New ideas concerning the community college include building viewpoints through persistent reflection and discussion. This paper investigates the target values and marketing strategies for the future community college, based on participants' preference.

Fuzzy statistics are becoming more important in measuring ambiguous concepts in social sciences. Why is it that the traditional numerical model cannot explain complex human and social phenomena? 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 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).

This study uses a fuzzy questionnaire, fuzzy modes, a fuzzy mean, and a fuzzy Chi-square test to compare with each other to analyze the membership function status of community colleges in terms of participants' demand, future trends, and marketing strategy. The purposes of this study are as follows: 1. To establish a goal value system for community colleges. 2. To analyze the needs of community college students. 3. To analyze the future direction of community colleges from three dimensions-the value of life, the region, and the world. 4. To analyze the marketing strategy of community colleges.

2. Goal Orientation and Marketing Strategy.

2.1. Goal Orientation of the New Generation Community College. The first community college, Wen-Shan Community college, was established in Taipei in 1998, now totaling 87 in number. The current community college can be divided into "concept-based " and "market-based". By self-directed learning, students enter the community college and take courses through the market (Knowles, 1980). However, difficulties occurring in community college courses that include participants' low interest in academics, low attendance, and unclear core values and goal orientation t make it extremely difficult for community colleges to survive. According to difficulty values, the current values of community colleges can be divided into personal, regional, and world levels:

(1) Personal value dimensions. Participants believe that their individual needs are the major consideration, and take life skill courses to enhance their quality of life.. Hence, there are no differences between a community college and a cram class.

(2) Regional value dimensions. The community college complies with the public recreational demand to conduct classes, and modifies the developing direction for life skills learning. The community college offers educational opportunities, once available only to elite students, and channels for adults to better understand themselves, other people, and modern society.

(3) World value dimensions. The community college is the best place to nurture new ideas and disseminate knowledge. However, the lack of specific action and reflection cannot achieve the ideal of civil society. Although the number of community colleges has increased, the quality has not improved. Therefore, the Cram School Association has often questioned the value of the community college, causing the government to deny it funding.

The goal value might vary in different phases; different demands generate different levels

of values. Achieving the ultimate goal of civil society requires enhancing life quality at the basic individual level and moving up to the regional level, and finally, up to global civil society.

2.2. Assessing the Value of the New Generation Community College. The new community college has been established for 12 years in Taiwan, and has exceeded expectations in the fast "chaos market". As the former Director of the Department of Social Education indicated, “development of the community college in Taiwan is a miracle”. Community colleges resemble cram schools. However, the situation can be remedied as Tocqueville’ mentioned, “the electors trust their representative to be as eager in their private interests as in those of the country” (Tocqueville, 1840). The key point is to properly integrate private interests within the public good. Fukuyama (1995) pointed out that trust in the group creates high-performance. People join organizations out of an interest in cooperating with society, which adds meaning to life.

The purpose of community colleges is to promote liberal arts in society and re-orientate social values. The goal values of the community college lie in how to guide an individual’s philosophy of life concerning the value of the regional community, and to achieve global values, depending on the marketing strategy and internalized curriculum and teaching.

2.3. Marketing Strategy for the New Generation of Community Colleges. Westervelt (2006) suggested that the construction of a brand marketing plan ought to have the following steps: 1. Set the brand marketing objectives; 2. Brand commitment; 3. Brand attributes; 4. Brand type; 5. Brand positioning; 6. Brand positioning frame; 7. Customer; 8. Ads; 9. Budgets. Glatsten (2008) proposed establishing a strong brand and giving customers the best experience. Therefore, brand and marketing is a chain, brand image is a promise - a promise that must be kept. Each individual step in the community college process contains a number of touch points that participants encounter, for instance, how to meet participant’s course requests and the community college concept. The following presents an analysis of the three aspects of life value, regional value, and world value.

2.3.1. Response to the Marketing Strategies of Life Value. Harvard Business School recommends that office workers should have the ideal "π-type talent," which refers to professional depth and interdisciplinary breadth. According to Ohmae’s recommendation in 2002, “being a generalist will be even better if one possesses the two keys of professional “π-type talent”. Only if one enhances his or her own added value as the "π-type talent" with a second expertise can he or she stand firm against the wave of lay-off. The curriculum design of the community college should not only meet the needs for learners’ personal life, but also include training courses to develop their second expertise.

2.3.2. Response to Regional Value Marketing Strategies. Value management was developed after World War II, mainly due to wartime material shortages, in an effort to find quality and cost alternatives. Community colleges should use the values of creative thinking, local materials development, local characteristics, curriculum, and established marketing network.

2.3.3. Response to the Marketing Strategies of World Value. Inglehart (1977) pointed out that after the post-war economic boom; people began to change value orientation, similar to Maslow's needs theory, from basic economic security to higher satisfied emotional needs.

The "Universal Declaration of Human Rights," published by the United Nations in 1948, covers civil, political, economic, social, and cultural rights, such as personal protection of basic rights. Community college education and its marketing strategy should implement the protection of human rights and the value of civil society.

3. Fuzzy Methods.

3.1. Research Process. This research establishes the value of the community college system to find their marketing strategy.

Education policy should be adjustable and inclusive. The differences among educational needs, benefits pursuing, and types of activities for value subjects will reflect on the conflicts toward value cognition and value choice.

3.2. Fuzzy Statistics to Analysis. Traditional statistics deals with a single answer or a certain range of the answer through a sampling survey, and is unable to sufficiently reflect the complex thought of an individual. If people can use the membership function to express the degree of their feelings based on their own choices, the answer presented will be closer to real human 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 requirement. The current and next section demonstrates the definitions for fuzzy mode and fuzzy median generalized from traditional statistics. The discrete case is simpler than the continuous one.

Definition 3.1. Fuzzy sample mode (data with multiple values). Let U be the universal set (a discussion domain), $L = \{L_1, L_2, \ldots, L_k\}$ a set of k-linguistic variables on U, and $\{FS_i, i = 1, 2, \ldots, n\}$ a sequence of random fuzzy sample on U. For each sample FS_i, assign a linguistic variable L_j a normalized membership $m_{ij}(\sum_{j=1}^{k} m_{ij} = 1)$, let $S_j = \sum_{i=1}^{n} m_{ij}$, $j = 1, 2, \ldots, k$. Then, the maximum value of S_j (with respect to L_j) is called the fuzzy mode (FM) of this sample. That is $FM = \{L_j \mid S_j = \max_{1 \le i \le k} S_i\}$.

Note: A significant level α for fuzzy mode can be defined as follows: Let U be the universal set (a discussion domain), $L = \{L_1, L_2, \ldots, L_k\}$ a set of k-linguistic variables on U, and $\{FS_i, i = 1, 2, \ldots, n\}$ a sequence of random fuzzy sample on U. For each sample FS_i, assign a linguistic variable L_j a normalized membership $m_{ij}(\sum_{j=1}^{k} m_{ij} = 1)$, let $S_j = \sum_{i=1}^{n} I_{ij}$, $j = 1, 2, \ldots, k$ $I_{ij} = 1 \; if \; m_{ij} \ge \alpha$, $I_{ij} = 0 \; if \; m_{ij} < \alpha$, α is the significant level. Then, the maximum value of S_j (with respect to L_j) is called the fuzzy mode (FM) of this sample.

That is $FM = \{L_j \mid S_j = \max_{1 \le i \le k} S_i\}$. More than two sets of L_j that reach the conditions, assures that the fuzzy sample has multiple common agreement.

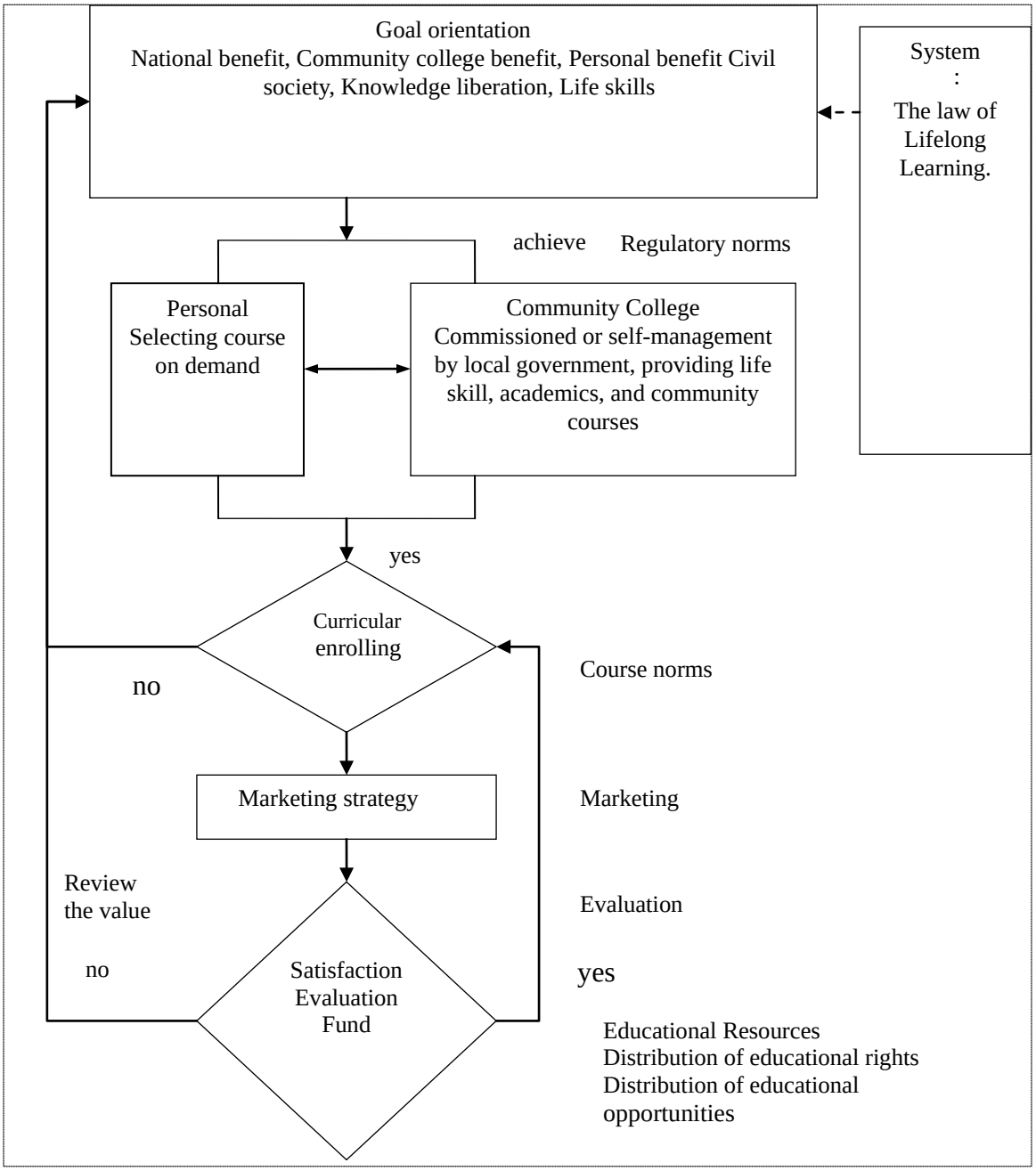

FIGURE 1. Dynamic process of community college structure

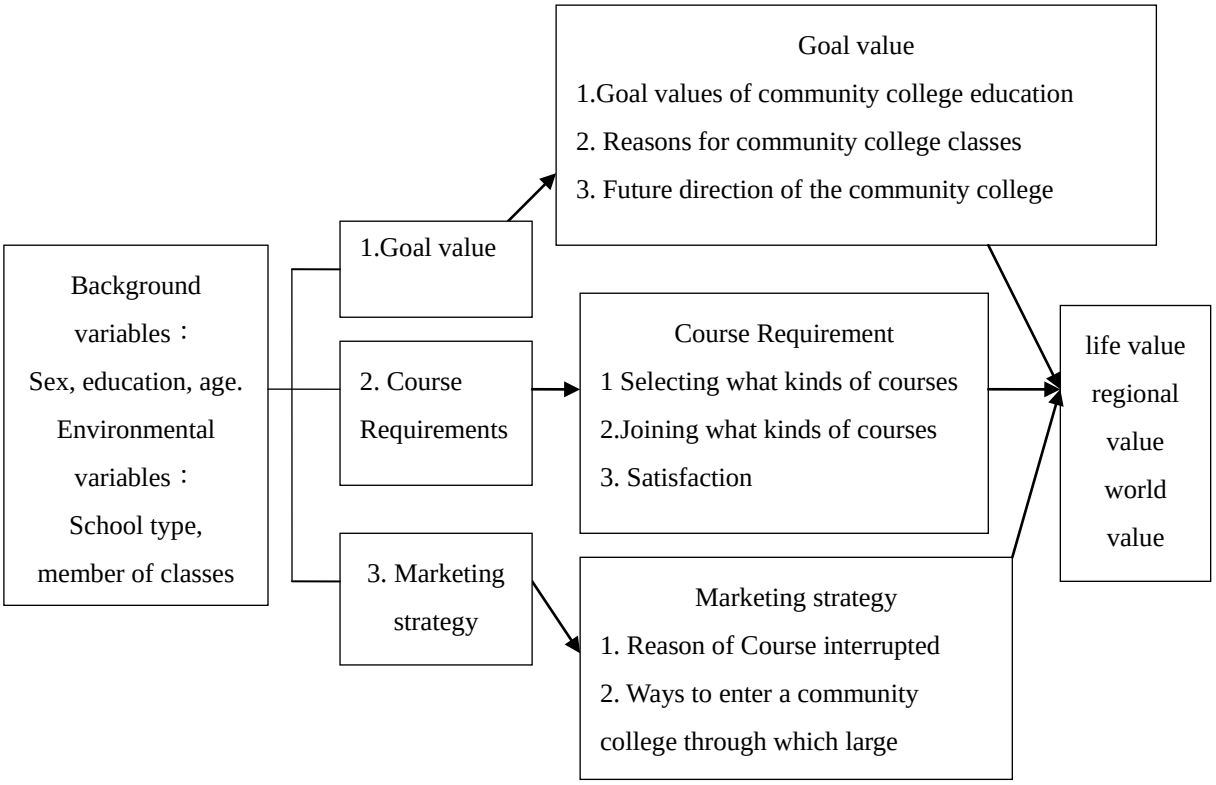

FIGURE 2. Research framework

Definition 3.2. Fuzzy sample mode (data with interval values). Let U be the universal set (a discussion domain), $L=\{L_1,L_2,\square,L_k\}$ a set of k-linguistic variables on U, and $\{FS_i=[a_i,b_i],a_i,b_i\in R,i=1,2,\mathrm{L},n\}$ be a sequence of random fuzzy sample on U.For each sample FS_i, if there is an interval [c, d] that is covered by certain samples, these samples are a cluster. Let MS be the set of clusters which contains the maximum number of sample, then the fuzzy mode FM is defined as

$$FM=[a,b]=\{\cap[a_i,b_i]\,|\,[a_i,b_i]\subset MS\}.$$

If $[a,b]$ does not exist (i.e. $[a,b]$ is an empty set), this fuzzy sample does not have a fuzzy mode.

Example 3.1 Suppose eight voters are asked to choose a chairperson from four candidates. Table 1 is the result from the votes with two different types of voting: traditional response versus fuzzy response.

From the traditional voting, three persons voted for *B*. Hence the mode of the vote is *B*. However, from fuzzy voting, *B* only gets a total membership of 2.1, while *C* gets 3.4. Based on traditional voting, *B* is elected the chairperson, while based on fuzzy voting or membership voting, *C* is the chairperson. The fuzzy vote more accurately reflects voters' preference; *C* deserves to be the chairperson more than *B* does.

TABLE 1. Response comparison for eight voters

Candidate	traditional response				fuzzy response			
Voter	A	B	C	D	A	B	C	D
1		∨				0.7	0.3	
2	∨				0.5		0.4	0.1
3				∨			0.3	0.7
4			∨		0.4		0.6	
5		∨				0.6	0.4	
6				∨	0.4		0.4	0.6
7		∨				0.8	0.2	
8			∨				0.8	0.2
Total	1	3	2	2	1.3	2.1	3.5	1.6

3.3. Fuzzy χ^2 -Test of Homogeneity. Consider a *K*-cell multinomial vector *n*= $\{n_1, n_2, ..., n_k\}$ with $\sum_i n_i = n$ .The *Pearson chi-squared test* ($\chi^2 = \sum_i \sum_j \frac{n_{ij} - e_{ij}}{e_{ij}}$) is a well known statistical test for investigating the significance of differences between observed data arranged in *K* classes and theoretically expected frequencies in *K* classes. The large discrepancies between the observed data and expected cell counts will result in larger values of χ^2

An ambiguous question is whether (quantitative) to consider discrete data categorical and use the traditional χ^2 *-test*. For example, suppose a child is asked the following question: "*how much do you love your sister*?" If the response is a fuzzy number (say, 70% of the time), it is certainly inappropriate to use the traditional χ^2 -test for analysis. The following presents a χ^2 -test for fuzzy data:

Procedures for testing hypothesis of homogeneity for discrete fuzzy samples. (1) Sample：Let Ω be a domain, $\{L_j, j = 1,...,k\}$ be ordered linguistic variables on Ω, and $\{a_1, a_2, \square, a_m\}$ and $\{b_1, b_2, \square, b_n\}$ be a random fuzzy sample from population A, B with standardized membership function mA_{ij}, mB_{ij} . (2) Hypothesis: Two populations A, B have the same distribution ratio.

$$H_0 : F\mu_A =_F F\mu_B \quad \text{Where} \quad F\mu_A = \frac{\frac{1}{m}MA_1}{L_1} + \frac{\frac{1}{m}MA_2}{L_2} + ... + \frac{\frac{1}{m}MA_k}{L_k}$$

$$F\mu_B = \frac{\frac{1}{n}MB_1}{L_1} + \frac{\frac{1}{n}MB_2}{L_2} + ... + \frac{\frac{1}{n}MB_k}{L_k}, MA_j = \sum_{i=1}^{m} mA_{ij}, MB_j = \sum_{i=1}^{n} mB_{ij}$$

(3) Statistics

$$\chi^2 = \sum_{i \in A,B} \sum_{j=1}^{c} \frac{([Mi_j] - e_{ij})^2}{e_{ij}}$$

To perform the Chi-square test for fuzzy data, we transfer the decimal fractions of M_{ij} in

each fuzzy category cell into the integer M_{ij} by counting 0.5 or higher fractions as 1 and discard the rest.

(4) Decision rule: Under significance level α, if $\chi^2 > \chi^2_\alpha(k-1)$, then we reject H_0.

Procedures for testing hypothesis of homogeneity for interval fuzzy samples

(1) Sample：Let Ω be a discussion domain, $\{L_j, j=1,...,k\}$ be ordered linguistic variables on the total range of Ω, and $\{a_i=[a_{li},a_{ui}], i=1,...,m\}\}$ and $\{b_i=[b_{li},b_{ui}], i=1,...,n\}$ and be a random fuzzy sample from population A, B with standardized membership function mA_{ij}, mB_{ij}.

(2) Hypothesis: Two populations A, B have the same distribution ratio. i.e

$$H_0: \ F\mu_A =_F F\mu_B, \text{ where } \ F\mu_A = \frac{\frac{1}{m}MA_1}{L_1} + \frac{\frac{1}{m}MA_2}{L_2} + ... + \frac{\frac{1}{m}MA_k}{L_k}$$

$$F\mu_B = \frac{\frac{1}{n}MB_1}{L_1} + \frac{\frac{1}{n}MB_2}{L_2} + ... + \frac{\frac{1}{n}MB_k}{L_k}, \ MA_j = \sum_{i=1}^{m} mA_{ij}, \ MB_j = \sum_{i=1}^{n} mB_{ij}.$$

(3) Statistics

$$\chi^2 = \sum_{i\in A,B}\sum_{j=1}^{c}\frac{([Mi_j]-e_{ij})^2}{e_{ij}}$$

To perform the Chi-square test for fuzzy data, we transfer the decimal fractions of M_{ij} in each fuzzy category cell into the integer M_{ij} by counting 0.5 or higher fractions as 1 and discard the rest.)

(4) Decision rule: Under significance level α, if $\chi^2 > \chi^2_\alpha(k-1)$, then we reject H_0.

4. An Empirical Study.

4.1. Research Objects. This study used a quantitative survey to collect data for Nantou County Community College. The questionnaire included eight items, answered by fuzzy form. The study distributed 100 questionnaires, with 75 returned, totaling 64 valid samples. The response rate was 75 %. Table 2 shows the descriptive statistics.

4.2. Fuzzy Statistical Analysis.

(1) The goal value of community college students: Students indicated that the core values of community college education for civil society fuzzy mode are 9.5.; Knowledge Liberate was 23; Life skills were 31.7. The current finding shows that community college students ranked life skill with the highest educational value.

(2) Reasons students join community college classes: The fuzzy mode for course need was 35.1, 6.2 for “Go with friends”, and “Idle” with more than 22.8. The finding shows that course demand is the main reason why students enroll in the community college.

(3) Future direction of the community college: The fuzzy mode for students preferring academic credits was 9.2. Professional course was 15.3, Diploma was 5.9, Vocational Training was 18.7, and Maintain the status was 14. The finding shows that the future direction of the community college is vocational training.

4.3. Course Requirement.

(1) Current enrolling situation: The academic course fuzzy mode was 19.69, Life skill class was 35.2, and Club class was 9.2. The finding shows that most students enroll in life skills classes.

(2) Course requirements of community college students. Participants wishing to join the academic course fuzzy mode were 19.9, Club Class was 4.9, Citizen Class was 1.2, Vocational Training was 12.9, Physical Health was 5.8, Life Skill Class was 22.4, and Local History, Ecology, and Industry were 5.7. The finding shows that life skills class is the most popular course.

(3) Overall Community college satisfaction. Community college participants were very satisfied overall. The fuzzy mode was 10.6, Fairly satisfied was 22.9, Satisfaction was 22.8, Not satisfied was 4.9, and Very dissatisfied was 0.8. The finding shows that the majority of community college participants are very satisfied, with a small number of people dissatisfied.

4.4. College Enrollment Marketing Strategy.

(1) The reason why participants stop classes. The fuzzy mode for participants who join community college classes, and continue was 19.69. The fuzzy mode for reasons for stopping class t because of no message was 35.2, Location is too far was 9.20, No one to go with was 1, Not interesting was 9.8, Too busy was 18.3, Forget to enroll was 8.4, and Have had bad experiences was 0.9. The finding shows that no message is the main cause of intermittent class.

(2) How participants enter community college. The fuzzy mode for participants using the internet to enter community college was 14.7, Notice by friends was 20.2, Notice by Chief Village was 0, Reading the newspaper was 3.4, Watching TV news as 0.9, Propaganda ads was 24.2, radio was 0, and Promotion car was 1.7. The finding shows that propaganda ads, recommended by friends and internet access are the three main sources of information.

4.5. Chi-square Test of Participants with Different Background Variables on Community Values and Future Direction. Applying the Chi-square test to examine the value of community college status reveals no significant difference between gender, education, and age.The finding for the future direction of the community college shows significant difference between different education levels. Persons with higher education wish to have more vocational training. The point of maintaining status reveals significant difference between genders, in that women want to maintain a far greater status than men do.

Some factors have higher Chi-square values: (1) Maintain status and ages: Students 41 ~ 60 yrs who hope to maintain their present situation. (2)Academic credits and ages: Students 41 ~ 60 yrs who hope to obtain academic credits. (3)Vocational training and ages: Students 41 ~ 60 yrs who hope to obtain vocational training.

TABLE 2. Descriptive statistics of nantou county community college

Sex	Female 41(64.1 %), Male 23(35.9 %)			
Age	20-40	41-60	61+	
	6(9.4 %)	49(76.6 %)	9(14.1 %)	
Education	Under high School		College	Graduated School
	27(42.2 %)		37(73 %)	0 %

TABLE 3. Goal value of the community college

					Fuzzy mode
	Fuzzy memberships				
The goal value of community college students :	Civil society	Knowledge Liberate	Life skills		Life skills (31.7)
	0.15	0.36	0.49		
Reasons for students join community college classes.	Courses demand	Go with friends	Idle time		Courses demand （35.1）
	0.55	0.10	0.35		
The future direction of the community colleges	Academic credits And Diploma	Maintain the status	Professional courses	Vocational training	Vocational training (18.7)
	0.23	0.21	0.24	0.29	

TABLE 4. Course requirement

				Fuzzy mode
	Fuzzy memberships			
Current enrolling situation	Academic course	Life skills class	Club class	Life skills class (35.2)
	0.31	0.55	0.14	
Course requirements of community college students.	Academic course, Club class, Citizen class, History, Health, Ecology, Industry ,etc	Vocational training	Life skills class	Life skills class (22.4)
	0.45	0.20	0.35	
Community college overall satisfaction	Not satisfied	Satisfied	Fairly satisfied	Fairly satisfied (33.8)
	0.09	0.35	0.52	

TABLE 5. Marketing strategy of community college's enrollment

	Fuzzy memberships				Fuzzy mode
The reason why participants stop classes	Never stop	Not interesting or no one to go with, too far, or have had bad experiences	No message	Too busy, or forget to enroll	No message (35.2)
	0.16	0.23	0.19	0.41	
How participants enter through community college	By friends	TV, Promotion car , Newspaper Radio 0r Village chief	Propaganda ads	Internet	Propaganda ads (24.2)
	0.32	0.09	0.38	0.23	

TABLE 6. Chi-square test of participants with different background variables on community values and future direction (α =0.05)

Factors	academic credits	Vocational training	Maintain status
Sex (male, female)	Accept H_0 χ^2 =8.58	Accept H_0 χ^2 =6.18	Reject H_0 χ^2 =17.65
Age (20-40, 41-60, 61~).	Accept H_0 χ^2 =20.03	Accept H_0 χ^2 =22.78	Accept H_0 χ^2 =21.75
Education (high school, college , graduate)	Accept H_0 χ^2 =3.73	Reject H_0 χ^2 =19.17	Accept H_0 χ^2 =1.99

5. **Conclusions.** This study examines the value of goals with respect to life, regions, and the world. Using a questionnaire approach and fuzzy statistical analysis, this research discusses the membership function of community colleges according to participants' demand, future trends, and marketing strategy. The results are as follows: there is a tendency to value r life skills in the community college. Providing vocational training courses has become a priority in community colleges. Students anticipate a new direction for community colleges in the future. The Life skills course is the most popular course and the 40-year-old student group were the main participants. The participants gave the higher degree of overall satisfaction to community colleges. "No message" is the main reason why participants stopped attending their courses. Advertisement is the largest source for participants to access community college related information. Most participants are not interested in civil society courses.

Analyzing marketing strategy, this study finds vocational training to be an important future direction for community colleges. The findings show that preparing students' second expertise for a better job, designing field-related vocational training, preparing special courses for the future are important.

Based on the findings, this study makes the following suggestions: (1) Life skill courses need to combine with civil society courses. (2) Enhancing local characteristics to show regional value. (3) For marketing strategy, attract new students to join community colleges by life skill courses. (4) Design special courses for students over the age of 40 years old. (5) Increase budgets for community colleges to subsidize more free courses and support the ideal of civil society in practice.

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