

KPIs (Key Performance Indicators) in Taiwan Basic Education

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Abstract: The study adopted Fuzzy Delphi method to set up KPIs (key performance indicators) in Taiwan basic education by collecting 12 expert scholars opinions on a questionnaire developed from various literature review. Among the 37 indicators constructed in this study, the top five perceived by the experts as most important had Gi values > 8.75. From the highest to the lowest, these indicators were “Learning achievement performance: Student learning performance in various learning domains”, “Parental satisfaction: Parent satisfaction toward school”, “Physical fitness performance: Degree of student performance beyond standard criteria for physical fitness tests”, “3-3-2 School reputation: Degree of high regard of community (society) for the school”, and “School culture: Degree of warmth and care exhibited by school personnel”.

Key words: KPIs, basic education, governance

1. Introduction and Background to the Study

In recent years, students in Taiwan have performed well in international academic achievement tests such as PISA or TIMMS, and the quality of basic education in Taiwan is among the best. However, to further and better the effectiveness of basic education governance through scientific means remains an issue of concern. This research explored the construct of key performance indicators (KPI) and its application in basic education.

Educational policies in advanced nations emphasize performance accountability, educational quality of schools and student achievement, and improvements were made in assessment policies to effectively evaluate educational performance. In the United States, educational reforms from grade K to 12 include the No Child Left Behind Act, improvements in assessment policies and accountability systems, and supporting excellent schools while shutting down poorly performing schools. In December 2007, UK government launched The Children’s Plan: Building Brighter Futures report, which describes a new blueprint for basic education in Britain. The report delineated developmental goals for children’s education for 2020, such as increasing attention to the physical and psychological development of children, and preparing each child to succeed in school, and according to the Early Years Foundation Stage Profile, more than 90% of 5-year old children have achieved this expectation. As can be seen, countries such as the United States and United Kingdom value the learning performance of students and improvements in overall educational quality as well as continuing to promote performance accountability and forwarding many important indicators for evaluating educational performance.

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In Taiwan, a motion was proposed to administer a formal competence test for learning achievement for primary and secondary in 2007, to be used as a major teaching outcome evaluation for both teachers and students and as a timely intervention to increase the learning outcome of students. The implementation of such a competence test conveyed the message of performance accountability in the basic educational system, and is useful to the current formulation of an effective educational accountability system.

Hence according to the stated research background and motivation, the two primary goals of this study were:

- (1) Develop the content and dimensions of key performance indicators for basic education.
- (2) Construct appropriate key performance indicators for basic education.

2. Literature Review

2.1 Content of Indicators of Educational Accountability

Educational performance accountability developed from western countries emphasizes fair and effective multi indicators as the first tools toward better educational efficiency and effectiveness. However, scholars differ in their definitions of indicators. Some believe that indicators are statistical measurements (Johnstone, 1981) while others assert that indicators represent signals that manifest the performance of organizations (Spee & Bormans, 1992). In addition, indicators are also viewed as guidelines for the qualitative and quantitative measurement of organizations (Cuttance, 1990). Through symbols, indicators can also represent a single or multiple input, process or outcome for comparison or evaluation. These indicators could be in the form of numbers, percentages, test scores, levels of participation or perceptions of student achievement (McEwen, 1995).

From a management perspective, indicators are tools for measuring performance. Through a complete system of indicators, a manager can evaluate the operational performance of an educational organization, and hence the term performance indicators, though educational indicators are generally combined with the term performance indicators (Scheerens, 1991).

In education, indicators are referred to as educational indicators. According to Wu (2002), educational indicators have dual meanings. First, they are concrete items predicting the outcome of educational operations; second, they are concrete items describing the important features of an educational system. Wang (1996) pointed out that educational indicators refer to the statistical assessment of performance in major levels of an educational system. Others such as Richard, McDonnell and Oaks (1991) indicated that both field practitioners and academia believe that a single indicator cannot provide information that could be useful to a complex and varied educational domain. Rather, a system of indicators must usually be constructed from a combination of statistical data to provide an accurate picture of education.

In response to the call for an educational accountability that values performance, the province of Alberta in Canada forwarded The Educational Quality in Indicators (EQI), which comprised four levels of educational models. The partnership level includes school, family and society; the condition level includes background, input and management; the student performance level includes cognition, friendship and behavior; and the time level includes 3rd, 6th, 9th and 12th grades (McEwen, 1995).

According to Suen (2000), review of domestic and overseas literature on education show five types of conceptual models for educational indicators, namely systems educational indicators, deductive educational indicators, inductive educational indicators, goal oriented educational indicators and problem-based educational indicators. Since current education emphasizes educational performance accountability, multi indicators should be

used for guidelines and verification to achieve a fair and effective accountability system.

Scholars differ in their views of educational indicator constructs. Some believe that educational indicators need only be based on schools while others recommend indicators measuring school network information. According to Chen (2007), the educational performance indicators constructed by different schools can be classified into five models. Of these, the most representative basic model is based on the integrative educational system proposed by Murnane (1987) and Shavelson (1987). In the model, educational indicators are divided into input, process and output educational indicators (Porter, 1991).

(1) Input indicators: Include finances and other resources, teacher knowledge, student background, parental/social regulations.

(2) Process indicators: Can be divided into two major types, including characteristic of the school's educational organization and characteristics of the school's teaching. The former includes school quality and school district, and state and country indicators; the latter includes course quality and teaching quality.

(3) Output indicators: Includes student learning achievement, graduation performance, efficacy of school operation, teaching and research performance.

2.2 Meaning of Key Performance Indicators

Key performance indicators, also known as primary performance indicators, critical performance indicators and performance assessment indicators, are important indicators for assessing the outcome of management. KPI are tools for datalizing management and therefore must be objective and measurable. This term is often used in assessing financial management and general administration by quantifying and qualifying the performance of companies, employees and tasks over a given period. It is useful for improving performance and planning, and is comparable to the gauges in an airplane cockpit. Flying is a complex task requiring indicators for fuel, airspeed, altitude, learning and destination. Like a pilot, managerial personnel must remain attuned to environmental and performance factors, and therefore need gauges to safely guide the company into the future. Management guru of the generation, Drucker, stated that KPI is the indispensable dashboard that guides the development of a company.

Many scholars offered different interpretations of KPI. Kerr (2000) regarded KPI as an important feature of a management control system that obtains valuable feedback for planning and evaluation purposes. KPI is also viewed as a method for policy administration by helping decide policy formulation and implementation. Wang (2004) believes that in the Planning-Implementation-Assessment of management, KPI is an inseparable component of assessment that represents the basis for evaluating key individual and organizational performance and contribution. Li (2004) pointed out that KPI is simply an indicator, not a goal; however, it can be used to determine goals or behavioral standard. KPI is a performance indicator, not an indicator of ability or attitude; it is a key performance indicator, not a general indicator; KPI is a quantified indicator that can reflect the critical success factors of an organization. Therefore KPI is selected according to the design of the organization. However, regardless of the type of KPI chosen, it must concur with organizational goals and be quantifiable.

Wu and Lin (2008) define KPI as the analysis, summarization and selection of factors that are critical to the successful operation of organizations or departments. In addition, by breaking down organizational or departmental goals into quantifiable targets, the degree to which these goals are achieved can be reviewed and determined. Furthermore, KPI must include two important contents: key indicator and performance indicator. The former is defined as important and influential; the latter is an important tool for determining the goal achievement or performance accountability of an organization or group, and should reflect the performance standard of

organizations, departments or individuals in order to form guidelines, diagnosis or policies. Through his field experience, Yang (2009) defined KPI according to SMART, that is, specific, measurable, attainable, relevant and time-bounded.

In summary, KPI can be defined as an evaluation basis and target that can concretely reflect important and influential factors in the operations of an organization or department. It is measurable, attainable, relevant and time-bounded, and can adequately reflect critical success factors in organizational performance.

2.3 Preliminary Construct for Educational Key Performance Indicators

2.3.1 Construct for Indicators Primarily Based on Achievement of Basic Educational Performance

The educational performance indicators used in this research were primarily based on KPI used in management, and the study was based on institutes of higher education using KPI. In other words, by integrating past studies on Taiwan's school efficacy, quality and administrative requirements toward basic education, the study approximated Taiwan's societal perspective toward basic education, and is consistent with the research goal of determining performance.

2.3.2 Importance of Input, Process and Outcome Indicators

Few domestic and overseas research on school efficacy focused exclusively on student learning outcome. Most studies were multi-dimensional analysis of education system organization and operation to determine performance from dimensions such as input, process and outcome. In Taiwan junior high schools and grades schools, parents and society expect students to enter the next grade up, especially in junior high school. Therefore schools must satisfy the expectations of different parties toward student performance, and the outcome of school performances frequently determines the outcome of educational accountability during educational administrative evaluation of the school. To determine educational accountability in basic education, this research underscored the importance of input, process and outcome dimensions to verify whether schools were able to implement different levels of detailed indicators, especially key indicators. Figure 1 shows the preliminary framework of the indicators.

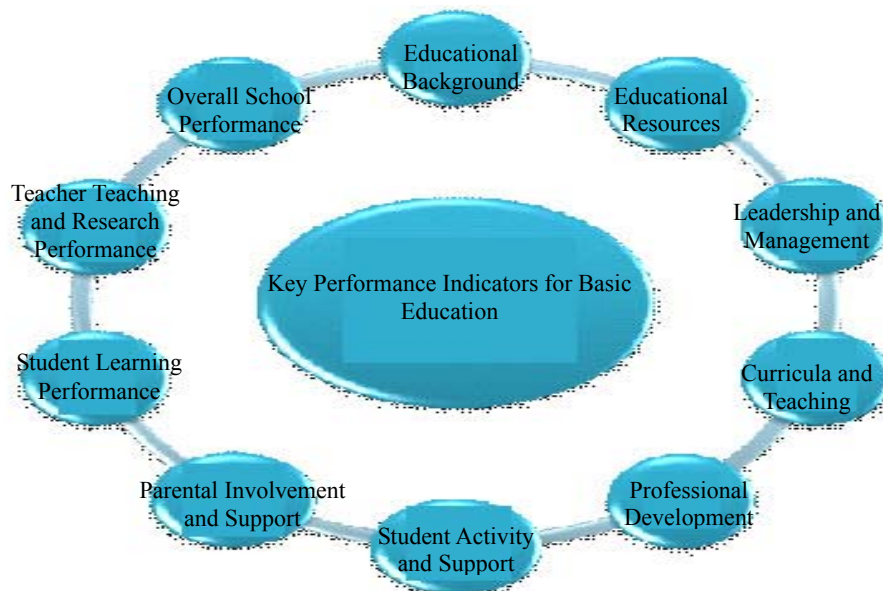


Figure 1 Preliminary Framework for Dimensions of KPI in Basic Education

3. Research Method

In this study, the validity of the research tool was confirmed by content validity. 12 expert scholars were invited to review the questionnaire content, and based on their assessment, inappropriate items were eliminated. Phrases were also modified to make the content more subjective and realistic. The questionnaire reviewed by the experts was a preliminary questionnaire designed according to literature review, and the 61 items evaluated by the experts were classified as appropriate, appropriate after modification, and inappropriate. Each item had a single correct answer.

Reliability in the research tool was analyzed using Cronbach α to test for internal consistency among the questionnaire items. The higher the Cronbach α , the greater the reliability of the research tool. The Fuzzy Delphi Method was used to obtain the most promising value in the questionnaire as basis for calculating the Cronbach α .

After the elimination process, the questionnaire was statistically analyzed using the Fuzzy Delphi Method. The Triangular Fuzzy Number (TFN) was then calculated using Excel 2003 version Visual Basic Application Edition (VBA) software. The basic education key indicators were then selected against this threshold value.

4. Research Findings and Discussion

Using the data collected from the Basic Education Key Performance Indicator Construct Questionnaire Survey, this research obtained the maximum, minimum and geometric mean values of the TFN. The gray zone was then tested to verify whether expert opinions achieved convergence. Last, the degree of expert consensus on the importance of each indicator was calculated. The higher the degree of consensus value, G^i , the greater and more important the degree of consensus among the representative experts. In this study, $G^i > 7.00$ was used as the preliminary threshold value for selecting the most appropriate and most consensual assessment indicators. Then, as recommended by the experts, $G^i > 8.00$ was used as the criteria for selecting the most critical KPI to form the basic education KPI for this research.

4.1 Expert Opinions on Key Performance Indicators for Basic Education

4.1.1 Content of Key Performance Indicators

Using Input, Process and Output as dimensions, the different measures of basic education KPI in this research were as follow:

(1) Input Dimension

(a) Educational Background

Indicators should include: student attendance rate, number of students in each grade level, student transfer rate, student drop-out rate, student-teacher ratio, ratio of students in special education, ratio of immigrant students, ratio of students from single-parent families, ratio of aboriginal students, ratio of students raised by grandparents, ratio of students from low income families, ratio of qualified teachers, ratio of substitute teachers, and teacher turnover rate.

(b) Educational Resources

Indicators should include: Total budget, cost per student, staff wages, number of computers, ratio of overhead projector per school, ratio of information and communications teacher, and ratio of guidance teacher.

(2) Process Dimension

(a) Leadership and Management

Indicators should include: Educational background of principal, continuing education for principal and administrative staff, e-formalization of school affairs, standard operating procedure for business operation, and self-assessment.

(b) Curricula and Teaching

Indicators should include: School curricula development, ratio of materials compiled by teachers, teacher incorporation of information and communications in teaching, innovative teaching, diversified evaluation, teacher educational background.

(c) School Culture and Features

Indicators should include: Teacher organization of social activities, public award ceremony for teachers and staff, teacher organization of professional groups, teacher participation or development in professional growth, teacher participation in research, and school image or reputation.

(d) Parental Involvement and Support

Indicators should include: Number of parent volunteer, frequency of parental involvement in various committee, parent donation toward school funds, routine involvement in parent-teacher conference and parent association meetings, parental involvement in school activities.

(3) Output Dimension

(a) Student Learning Performance

Indicators should include: Learning achievement, behavioral performance, school and off-campus awards.

(b) Teacher Instruction and Research Performance

Indicators should include: Teaching achievement exhibition, teaching performance records, school and off-campus awards, teacher research achievement.

(c) Overall School Performance

Indicators should include: parental satisfaction, reputation in the community, school assessment outcome.

4.2 Value and Limitations of Using Key Performance Indicators in School Operations

Summary of expert opinions of this research validates the importance of this study, and recommendations were given for avoiding possible limitations in future applications.

4.2.1 Value

- Provides guidelines for development and operation of school affairs.
- Provides society and parents with indicators for assessing and selecting schools.
- Enables unit and individual performance evaluation, and providing a mean for school review and feedback.
- Moves away from teacher centered “teaching” to student centered “learning”.
- Underscores fairness and impartiality, and drawing attention to integration and reasonable distribution of resources.
- Provides comprehensive quality management and encourages effective and systematic thinking for grade and junior high school performances.

4.2.2 Possible Limitations

- Difficulty in quantifying school performance.
- Easily influenced by external constructs, rendering it impossible to reflect qualitative performance of the school.
- Unfamiliarity of school personnel toward KPI and inadequate skills in quantification.

- Role of principal affects the entire school, and this critical influence was neglected.
- Performance oriented operation and management of schools has replaced humanistic leadership.
- Though appropriate for cities and towns, the same indicators were not appropriate for rural areas.

4.3 Selection and Analysis of the Input Dimension of the Basic Education Key Performance Indicators

The selection process for the educational background and educational resource measures of the input dimension of the basic education KPI, the outcome and indicator characteristics are analyzed and described as below:

Table 1 Selection Result of the Input Dimension of the Basic Education KPI

Indicator	The TFN of the Most Conservative Perceived Value (C_L^i, C_M^i, C_U^i)	The TFN of the Most Optimistic Value (O_L^i, O_M^i, O_U^i)	The TFN of the Most Promising Value (A_L^i, A_M^i, A_U^i)	Z^i	M^i	$M^i - Z^i$	G^i
1-1-1	(3, 6.47, 9)	(7.8.79,10)	(5,7.80,9)	2	2.32	0.32	7.63
1-1-2	(4, 6.23, 9)	(7.9.00,10)	(5,7.70,10)	2	2.76	0.76	7.62
1-1-3	(3,6.12,8)	(7.8.07,10)	(4,7.31,9)	1	1.95	0.95	7.09
1-1-4	(6,7.35,8)	(8,9.43,10)	(7,7.93,9)	0	2.08	2.08	8.39
1-1-5	(3,6.53,10)	(7.8.69,10)	(4,7.35,10)	3	2.16	-0.84	7.61
1-1-6	(3,7.12,10)	(8,9.43,10)	(5,7.94,10)	2	2.31	0.31	8.27
1-1-7	(4,6.69,9)	(7.8.77,10)	(4,7.17,9)	2	2.08	0.08	7.73
1-1-8	(4,6.41,9)	(7.8.71,10)	(5,7.23,9)	2	2.30	0.3	7.56
1-2-1	(5,6.94,9)	(7.8.75,10)	(7,7.93,9)	2	1.81	-0.19	7.85
1-2-2	(4,7.00,10)	(8,9.27,10)	(8,8.60,10)	2	2.27	0.27	8.13
1-2-3	(3,6.94,10)	(8,9.15,10)	(7,8.00,10)	2	2.21	0.21	8.05
1-2-4	(6,7.25,9)	(8,9.07,10)	(7,8.25,9)	1	1.82	0.82	8.16
1-2-5	(4,6.63,9)	(7.8.43,10)	(5,7.37,9)	2	1.80	-0.2	7.53
1-2-6	(4,6.69,9)	(7.8.87,10)	(6,7.75,9)	2	2.18	0.18	7.78
1-2-7	(6,7.59,10)	(8,9.31,10)	(7,8.41,10)	3	1.72	-1.28	8.45

The above statistical analysis shows that in the selection process of the 8 indicators of educational background, 6 indicators were eliminated; and of the 7 indicators of educational resource, 3 indicators were eliminated. Therefore, as shown in Table 2, following selection and elimination based on expert opinions, the Input Dimension of the Basic Education KPI construct included measures of Educational Background and Educational Resource, totaling 6 indicators.

Table 2 Selected Input Dimension of the Basic Education KPI

Dimension	Measure	Indicator
Input Dimension of Basic Education KPI	1-1 Educational Background	1-1-1 Student drop-out rate (junior high school): Number of student drop-out per year/Total number of students
		1-1-2 Ratio of qualified teachers: Number of qualified teachers per year/Total number of full-time teachers
	1-2 Educational Resources	1-2-1 Cost per student: Total budget per year/Total number of students
		1-2-2 Ratio of number of computers: Total number of computers used for teaching/Number of classes
		1-2-3 Student activity space: Available area of floor space per student
		1-2-4 Available number of library books per student: Total number of library books/Total number of students

4.4 Selection and Analysis of the Process Dimension of the Basic Education Key Performance Indicators

Table 3 Selection Result of the Process Dimension of the Basic Education KPI

Indicator	TFN of the Most Conservative Perceived Value (C_L^i, C_M^i, C_U^i)	TFN of the Most Optimistic Perceived Value (O_L^i, O_M^i, O_U^i)	TFN of the Most Promising Value (A_L^i, A_M^i, A_U^i)	Z^i	M^i	$M^i - Z^i$	G^i
2-1-1	(7,7.53,10)	(9,9.75,10)	(8,8.88,10)	1	2.22	1.22	8.64
2-1-2	(5,7.56,10)	(9,9.71,10)	(7,8.64,10)	1	2.15	1.15	8.64
2-1-3	(5,7.59,10)	(9,9.57,10)	(6,8.35,10)	1	1.98	0.98	8.58
2-1-4	(5,7.47,10)	(8,9.57,10)	(6,8.29,10)	2	2.10	0.1	8.52
2-1-5	(4,7.29,9)	(8,8.53,10)	(7,8.17,9)	1	1.24	0.24	7.91
2-1-6	(4,7.11,9)	(8,9.62,10)	(6,8.43,10)	1	2.50	1.5	8.37
2-1-7	(6,7.24,10)	(7,8.94,10)	(7,8.17,9)	3	1.71	-1.29	8.09
2-1-8	(5,6.71,9)	(7,8.63,10)	(6,7.76,9)	2	1.92	-0.08	7.67
2-2-1	(5,7.47,9)	(7,9.2,10)	(7,8.23,9)	2	1.73	-0.27	8.34
2-2-2	(6,7.93,9)	(9,9.33,10)	(6,8.23,9)	0	1.40	1.4	8.64
2-2-3	(5,6.94,9)	(8,8.44,10)	(6,7.88,9)	1	1.50	0.5	7.69
2-2-4	(4,6.52,9)	(8,8.53,10)	(6,7.52,9)	1	2.00	1	7.53
2-2-5	(6,7.64,10)	(9,9.5,10)	(7,8.64,10)	1	1.85	0.85	8.57
2-2-6	(4,6.76,9)	(7,8.73,10)	(5,7.64,9)	2	1.97	-0.03	7.75
2-2-7	(4,6.71,9)	(7,8.44,10)	(5,7.52,9)	2	1.73	-0.27	7.57
2-2-8	(4,6.88,10)	(7,8.8,10)	(6,7.76,10)	3	1.92	-1.08	7.84
2-2-9	(4,7.12,9)	(8,9.00,10)	(6,8.12,9)	1	1.88	0.88	8.06
2-3-1	(5,6.94,9)	(8,9.07,10)	(6,8.00,9)	1	2.13	1.13	8.01
2-3-2	(5,7.69,9)	(8,9.27,10)	(7,8.43,9)	1	1.58	0.58	8.48
2-3-3	(5,7.35,10)	(8,9.27,10)	(6,8.17,10)	2	1.91	-0.09	8.31
2-3-4	(5,7.29,9)	(8,9.07,10)	(6,8.18,9)	1	1.77	0.77	8.18
2-4-1	(5,7.12,10)	(8,9.07,10)	(6,7.88,10)	2	1.95	-0.05	8.09
2-4-2	(6,6.76,9)	(8,8.92,10)	(6,7.58,9)	1	2.16	1.16	7.84
2-4-3	(5,7.59,10)	(8,9.43,10)	(6,8.29,10)	2	1.84	-0.16	8.51
2-4-4	(5,6.35,9)	(8,8.57,9)	(5,7.37,9)	1	2.22	1.22	7.46
2-4-5	(5,6.94,9)	(7,8.73,10)	(6,7.64,9)	2	1.79	-0.21	7.84
2-4-6	(5,7.06,9)	(8,8.87,10)	(6,7.76,9)	1	1.81	0.81	7.96
2-4-7	(5,7.19,9)	(8,8.87,10)	(6,8.00,9)	1	1.68	0.68	8.03
2-4-8	(6,7.35,9)	(8,9.07,10)	(7,8.11,9)	1	1.71	0.71	8.21
2-5-1	(5,7.12,9)	(8,8.81,10)	(7,7.94,9)	1	1.69	0.69	7.97
2-5-2	(3,6.65,9)	(8,8.79,10)	(7,7.75,9)	1	2.14	1.14	7.72
2-5-3	(3,6,9)	(7,8,9)	(6,7.06,9)	2	2.00	0	7.00
2-5-4	(3,6.35,9)	(7,8.79,10)	(5,7.41,9)	2	2.43	0.43	7.57
2-5-5	(5,6.65,9)	(8,8.87,10)	(6,7.64,9)	1	2.22	1.22	7.76
2-5-6	(5,7.24,9)	(9,9.33,10)	(6,8.05,9)	0	2.10	2.1	8.28

The above statistical analysis shows that in the selection of the 8 indicators of Leadership and Management, 2 indicators were eliminated; of the 9 indicators of Curricula and Teaching, 5 indicators were eliminated; of the 4 indicators of Professional Development, all were preserved; of the 8 indicators of Student Activity and Support, 4 indicators were eliminated; and, of the 6 indicators of Parental Involvement and Support, 5 indicators were eliminated. Therefore, as shown in Table 4, following selection and elimination based on expert opinions, the Process Dimension of the Basic Education KPI construct included Leadership and Management, Curricula and Teaching, Professional Development, Student Activity and Support, and Parental Involvement and Support, totaling 19 indicators.

Table 4 Selected Process Dimension of the Basic Education KPI

Process Dimension of Basic Education KPI	
2-1 Leadership and Management	2-1-1 Principal's knowledge of current educational policy: Principal's level of understanding and implementation of educational policies. 2-1-2 Development plan for school affairs: Comprehensiveness and implementation of development plans for school affairs. 2-1-3 Quality control: Degree of establishing and implementing standard operating procedure for school affairs, discipline (student affairs), general affairs, guidance, accounting and personnel. 2-1-4 E-formalization of school affairs: Degree of computerization in administration and teaching. 2-1-5 Campus safety: Number of student accident and number of reported bullying. 2-1-6 Public relations: Degree of positive relationship between school and community.
2-2 Curricula and Teaching	2-2-1 Curricula organization and operation: Formation of groups and group operations for various learning domains in the curricula. 2-2-2 Curricula planning and implementation: Degree of overall curricula planning and implementation in the school. 2-2-3 Teaching innovation: Degree of diversified and active teaching methods employed by teachers. 2-2-4 Ratio of remedial teaching: Number of students receiving remedial teaching/Total number of students in school.
2-3 Professional Development	2-3-1 Continuing education for principal: Number of hours of continuing education for principal per year. 2-3-2 Ratio of hours of continuing education for teachers: Total hours of continuing education for teachers/Total number of teachers. 2-3-3 Teacher's professional groups for learning: Number of teachers in school forming professional groups. 2-3-4 Ratio of teachers evaluated for professional development: Number of teachers evaluated for professional development/Total number of teachers.
2-4 Student Activity and Support	2-4-1 Campus club activity: Degree of student participation in campus club activities. 2-4-2 Reading activity: Number of students borrowing library books/Total number of students. 2-4-3 Activity award: Number of students publicly receiving awards/ Total number of students. 2-4-4 Student activity support: School funding for student activities/Total number of students.
2-5 Parental Involvement and Support	2-5-1 Parental participation in school activities: Number of parents participating in school activities per year.

4.5 Selection and Analysis of the Output Dimension of the Basic Education Key Performance Indicators

The statistical analysis in Table 5 shows that in the selection process of the 10 indicators of Student Learning Performance, 4 indicators were eliminated; of the 4 indicators of Teacher Teaching and Research Performance, 3 indicators were eliminated; and, of the four indicators of Overall School Performance, all were retained. Therefore, as shown in Table 6, following selection and elimination based on expert opinions, the Output Dimension of the Basic Education KPI construct included measures of Student Learning Performance, Teacher Teaching and Research Performance and Overall School Performance, totaling twelve indicators.

Table 5 Selection Result of the Output Dimension of the Basic Education KPI

Indicator	TFN of the Most Conservative Perceived Value (C_L^i, C_M^i, C_U^i)	TFN of the Most Optimistic Perceived Value (O_L^i, O_M^i, O_U^i)	TFN of the Most Promising Value (A_L^i, A_M^i, A_U^i)	Z^i	M^i	$M^i - Z^i$	G^i
3-1-1	(6,8.24,10)	(10,10,10)	(7,8.71,9)	0	1.76	1.76	9.12
3-1-2	(5,7.5,10)	(7,9.43,10)	(7,8.35,10)	3	1.84	-1.16	8.51
3-1-3	(4,6.88,10)	(7,9.06,10)	(5,7.88,10)	3	2.19	-0.81	7.97
3-1-4	(5,7.29,9)	(9,9.41,10)	(7,8.17,9)	0	2.12	2.12	8.36
3-1-5	(4,6.17,10)	(7,8.46,10)	(5,7.17,10)	3	2.29	-0.71	7.32
3-1-6	(3,6.12,9)	(7,8.54,10)	(5,7.25,9)	2	2.42	0.42	7.33
3-1-7	(6,6.94,10)	(9,9.07,10)	(6,7.88,10)	1	2.13	1.13	8.00
3-1-8	(6,6.29,10)	(8,9.40,10)	(6,8.35,10)	2	3.11	1.11	7.85
3-1-9	(5,8.88,9)	(9,9.33,10)	(7,8.47,10)	0	0.45	0.45	9.11
3-1-10	(5,7.18,9)	(8,8.88,10)	(6,8.05,9)	1	1.70	0.7	8.03
3-2-1	(6,7.8,9)	(8,9.13,10)	(7,8.29,9)	1	1.33	0.33	8.46
3-2-2	(5,6.56,10)	(8,8.93,10)	(6,7.62,9)	2	2.37	0.37	7.75
3-2-3	(5,6.65,9)	(8,8.86,10)	(6,7.62,9)	1	2.21	1.21	7.75
3-2-4	(4,6.71,10)	(8,8.86,10)	(5,7.58,10)	2	2.15	0.15	7.78
3-3-1	(7,8.24,10)	(10,10,10)	(8,8.94,10)	0	1.76	1.76	9.12
3-3-2	(6,7.94,10)	(9,9.75,10)	(7,8.76,10)	1	1.81	0.81	8.85
3-3-3	(6,7.75,10)	(9,9.54,10)	(7,8.35,10)	1	1.79	0.79	8.64
3-3-4	(5,7,10)	(8,9.13,10)	(7,8.18,10)	2	2.13	0.13	8.07
3-3-5	(5,7.93,10)	(9,9.56,10)	(7,8.81,10)	1	1.63	0.63	1

Table 6 Selected Output Dimension of the Basic Education KPI

Output Dimension of the Basic Education KPI	
3-1 Student Learning Performance	<p>3-1-1 Learning achievement performance: Student learning performance in various learning domains.</p> <p>3-1-2 Student scholastic test performance: Student performance in various county and city level scholastic tests.</p> <p>3-1-3 Student specialty: Number of students with specialty in arts or sports/Total number of students in school.</p> <p>3-1-4 Excellent behavioral performance (grade school): Number of students winning awards under award system/Total number of students in school.</p> <p>3-1-5 Physical fitness performance: Degree of student performance beyond standard criteria for physical fitness tests.</p> <p>3-1-6 School and off-campus awards: Number of students winning awards in school and off-campus competitions or activities per year/ Total number of students in school.</p>
3-2 Teacher Teaching and Research Performance	<p>3-2-1 Ratio of keeping teaching records: Number of teachers keeping teaching records/Total number of teachers.</p>
3-3 Overall School Performance	<p>3-3-1 Parental satisfaction: Parent satisfaction toward school.</p> <p>3-3-2 School reputation: Degree of high regard of community (society) for the school.</p> <p>3-3-3 Evaluation performance of school affairs: Passed assessment criteria or ranking in school affairs assessment.</p> <p>3-3-4 Awards conferred to school: School won awards from county or above level organizations, such as Top Schools award, Excellent Schools award, and Exemplary Schools award.</p> <p>3-3-5 School culture: Degree of warmth and care exhibited by school personnel.</p>

4.6 Analysis of the Importance of Basic Education Key Performance Indicators

4.6.1 Importance Ranking of the Various Dimensions of Basic Education Key Performance Indicators

In this research, the basic education KPI were classified into the input dimension of the basic education KPI, the process dimension of the basic education KPI, and the output dimension of the basic education KPI. Table 7 ranks the G^i value of the experts' perceived importance of the indicators in the three dimensions.

Table 7 Importance Ranking of G^i Values among the Basic Education KPI in the Various Dimensions

Dimension	Mean G^i value	Ranking
Input dimension of basic education KPI.	8.24	3
Process dimension of basic education KPI.	8.34	2
Output dimension of basic education KPI.	8.59	1

Table 7 shows that of the three dimensions of basic education KPI, the mean G^i of the Output Dimension of Basic Education KPI ranked first; the mean G^i of the Process Dimension of Basic Education KPI ranked second; and, the mean G^i of the Input Dimension of Basic Education KPI ranked third.

Evidently, the Fuzzy Delphi experts believed that among the basic education KPI dimensions, the Output Dimension of Basic Education KPI was the most important dimension.

4.6.2 Importance Ranking of the Various Measures of Basic Education Key Performance Indicators

In this research, the basic education KPI was classified into 10 measures. Table 8 ranks the G^i value of the experts' perceived importance of the indicators in the various measures according to their dimensions.

Table 8 Mean G^i Values and Ranking among the Measures of the Basic Education KPI

Dimension	Measures	Mean G^i value	Ranking Within the Dimension	Ranking Among the Measures
Input Dimension	1-1 Educational Background	8.33	1	6
	1-2 Educational Resource	8.20	2	10
Process Dimension	2-1 Leadership and Management	8.47	1	3
	2-2 Curricula and Teaching	8.40	2	5
	2-3 Professional Development	8.25	4	8
	2-4 Student Activity and Support	8.21	5	9
	2-5 Parental Involvement and Support	8.28	3	7
Output Dimension	3-1 Student Learning Performance	8.52	2	2
	3-2 Teacher Teaching and Research Performance	8.46	3	4
	3-3 Overall School Performance	8.69	1	1

Evidently, the Fuzzy Delphi experts believed that in the output dimension of the basic education KPI, Overall School Performance was the most important measure.

4.7 Ranking of the Importance of Various Indicators among the Basic Education Key Performance Indicators

In this research, there were a total of 37 indicators in the basic education KPI. Table 9 shows the G^i value of experts' perceived importance, and ranks the various dimensions of indicators and overall ranking.

KPIs (Key Performance Indicators) in Taiwan Basic Education

Table 9 Mean Gⁱ Value and Rankings among the Indicators of Basic Education KPI

Dimension	Measure	Indicators	G ⁱ Value	Ranking Within the Measures	Ranking Within the Dimension	Overall Ranking
Input Dimension of Basic Education KPI	1-1 Educational Background	1-1-1 Student dropout rate (Junior high): Number of student dropout per year/Total number of students	8.39	1	2	18
		1-1-2 Ratio of qualified teachers: Number of qualified teachers per year/Total number of full-time teachers.	8.27	2	3	24
	1-2 Educational Resource	1-2-1 Cost per student: Total funding per year/Total number of students.	8.13	3	5	28
		1-2-2 Ratio of number of computers: Total number of computers used for teaching/Number of classes.	8.05	4	6	33
		1-2-3 Student activity space: Available area of floor space per student	8.16	2	4	27
		1-2-4 Available number of library books per student: Total number of library books/Total number of students	8.45	1	1	17
Process Dimension of Basic Education KPI	2-1 Leadership and Management	2-1-1 Principal's knowledge of current educational policy: Principal's level of understanding and implementation of educational policies.	8.64	1	1	6
		2-1-2 Development plan for school affairs: Comprehensiveness and implementation of development plans for school affairs.	8.64	1	1	6
		2-1-3 Quality control: Degree of establishing and implementing standard operating procedure for school affairs, discipline (student affairs), general affairs, guidance, accounting and personnel.	8.58	3	4	10
		2-1-4 E-formalization of school affairs: Degree of computerization in administration and teaching.	8.52	4	6	12
		2-1-5 Campus safety: Number of student accident and number of reported bullying.	8.37	5	9	19
		2-1-6 Public relations: Degree of positive relationship between school and community.	8.09	6	15	29
	2-2 Curricula and Teaching	2-2-1 Curricula organization and operation: Formation of groups and group operations for various learning domains in the curricula.	8.34	3	10	21
		2-2-2 Curricula planning and implementation: Degree of overall curricula planning and implementation in the school.	8.64	1	1	6
		2-2-3 Teaching innovation: Degree of diversified and active teaching methods employed by teachers.	8.57	2	5	11
		2-2-4 Ratio of remedial teaching: Number of students receiving remedial teaching/Total number of students in school.	8.06	4	17	32
	2-3 Professional Development	2-3-1 Continuing education for principal: Number of hours of continuing education for principal per year	8.01	4	19	36
		2-3-2 Ratio of hours of continuing education for teachers: Total hours of continuing education for teachers/Total number of teachers.	8.48	1	8	15
		2-3-3 Teacher's professional groups for learning: Number of teachers in school forming professional groups.	8.31	2	11	22
		2-3-4 Ratio of teachers participating professional development evaluation: Number of teachers participating in professional development evaluation/Total number of teachers.	8.18	3	14	26
	2-4 Student Activity Support\	2-4-1 Campus club activity: Degree of student participation in campus club activities.	8.09	3	15	29
		2-4-2 Reading activity: Number of students borrowing library books/Total number of students.	8.51	1	7	13
		2-4-3 Activity awards: Number of students publicly receiving awards/Total number of students.	8.03	4	18	34
		2-4-4 Student activity support: School funding for student activities/Total number of students.	8.21	2	13	25
	2-5 Parental Involvement and Support	2-5-1 Parental participation in school activities: Number of parents participating in school activities per year.	8.28	1	12	23
Output Dimension of the Basic Education KPI	3-1 Student Learning Performance	3-1-1 Learning achievement performance: Student learning performance in various learning domains.	9.12	1	1	1
		3-1-2 Student scholastic test performance: Student performance in various county and city level scholastic tests.	8.51	4	7	13
		3-1-3 Student specialty: Number of students with specialty in arts or sports/Total number of students in school.	8.36	3	9	20
		3-1-4 Excellent behavioral performance (grade school): Number of students winning awards under award system/Total number of students in school.	8.00	6	12	37
		3-1-5 Physical fitness performance: Degree of student performance beyond standard criteria for physical fitness tests.	9.11	2	3	3
		3-1-6 School and off-campus awards: Number of students winning awards in school and off-campus competitions or activities per year/Total number of students in school.	8.03	5	11	34
	3-2 Teacher Teaching and Research Performance	3-2-1 Ratio of keeping teaching records: Number of teachers keeping teaching records/Total number of teachers.	8.46	1	8	16
	3-3 Overall School Performance	3-3-1 Parental satisfaction: Parent satisfaction toward school.	9.12	1	1	1
		3-3-2 School reputation: Degree of high regard of community (society) for the school.	8.85	2	4	4
		3-3-3 Evaluation performance of school affairs: Passed assessment criteria or ranking in school affairs assessment.	8.64	4	6	6
		3-3-4 Awards conferred to school: School won awards from county or above level organizations, such as Top Schools award, Excellent Schools award, and Exemplary Schools award.	8.07	5	10	31
		3-3-5 School culture: Degree of warmth and care exhibited by school personnel.	8.75	3	5	5

5. Conclusion

Following the recommendations provided by the Fuzzy Delphi Method experts, the basic education KPI constructed in this research comprised 3 major dimensions, 10 measures and 37 indicators.

5.1 Input Dimension of Basic Education Key Performance Indicators

Following the recommendations provided by the Fuzzy Delphi Method experts, 9 indicators in this dimension were eliminated from the original 15 indicators, resulting in 6 remaining indicators. Due to their G^i value and A^i_M value not achieving the 8.00 threshold, the following indicators were eliminated: “Student attendance rate: School’s student attendance per year”, “Student registration rate: School’s new student registration per year”, “Rate of students transferring out: Number of student transferring out per year/Total number of students”, “Student-Teacher ratio: Number of students per year/Total number of full-time teachers”, “Educational background of principal: Whether principal has master’s degree or above”, “Educational background of teachers: Number of full-time teachers with master’s degree or above per school/Total number of full-time teachers”, “Total funding: Total school funding per year (including supplementary funding for special projects)”, “Ratio of overhead projectors in school: Total number of overhead projectors in school/Number of classes”, and “Ratio of specialized classroom: Specialized classroom/Total number of classrooms in school”.

5.2 Process Dimension of Basic Education Key Performance Indicators

Following the recommendations provided by the Fuzzy Delphi Method experts, 16 indicators in this dimension were eliminated from the original 35 indicators, resulting in 19 remaining indicators. Due to their G^i value and A^i_M value not achieving the 8.00 threshold, the following indicators were eliminated: “Ratio of budget implementation: Ratio of budget implementation for school funds per year”, “Self-assessment: Number of yearly self-assessment organized by school”, “Curricula improvement: Number of self-assessment for curricula each semester”, “Ratio of supplementary teaching materials compiled by teachers: Number of teachers compiling supplementary teaching materials/Total number of teachers”, “Teaching observations: Number of teaching observations organized by teachers/Total number of teachers”, “Ratio of information and communications integrated into teaching: Number of teachers integrating information and communications into teaching per year/Total number of teachers”, “Diversified assessment: Number of diversified assessments adopted by each teach per year/Total number of teachers”, “Off-campus learning activity: Degree of student participation in off-campus learning activities”, “Guidance activity: Number of students receiving guidance/Total number of students”, “Arts activity: Number of arts activity organized by school each year”, “Physical education activity: Number of physical education activity organized by school each year”, “Ratio of school parent volunteer: Number of parents volunteering in school per year/Total number of students”, “Parent participation in various committee operations: Frequency of parents participating in various committee operations per year”, and “Classroom parent associations meetings: Organization of classroom parent associations and degree of operations”.

5.3 Output Dimension of Basic Education Key Performance Indicators

Following the recommendations provided by the Fuzzy Delphi Method experts, 7 indicators in this dimension were eliminated from the original 19 indicators, resulting in 12 remaining indicators. Due to their G^i value and A^i_M value not achieving the 8.00 threshold, the following indicators were eliminated: “Student standardized test performance (junior high school): Ratio of students with standardized test score > 80 ”, “Excellent behavioral performance (junior high school): Number of students given merits per year/Total number

of students in school”, “Rule violations (junior high school): Number of students given demerits or warnings per year/Total number of students in school”, “Character performance: Number of students receiving awards for excellent character performance/Total number of students in school”, “Ratio of teachers engaging in research: Number of research that teachers participated in/Total number of teachers”, “School and off-campus awards: Frequency of awards won by teachers per year in school and off-campus competitions or activities/Total number of teachers”, and “Ratio of excellent teachers: Number of teachers receiving local government or national excellent teacher awards in last five years/Total number of teachers”.

Among the 37 indicators constructed in this research, the top five perceived by the experts as most important had G^i values > 8.75 . From the highest to the lowest, these indicators were “3-1-1 Learning achievement performance: Student learning performance in various learning domains” and “3-3-1 Parental satisfaction: Parent satisfaction toward school” ($G^i = 9.12$), “3-1-5 Physical fitness performance: Degree of student performance beyond standard criteria for physical fitness tests” ($G^i = 9.11$), “3-3-2 School reputation: Degree of high regard of community (society) for the school” ($G^i = 8.85$) and “3-3-5 School culture: Degree of warmth and care exhibited by school personnel” ($G^i = 8.75$). The above ranking showed that when comparing the importance of the basic education KPI with other indicators, members of the expert team viewed the above five indicators as more important.

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