



Creating the aspired intelligent assessment systems for teaching materials

Cheng-Hsiung Chen^a, Gwo-Hshiung Tzeng^{b,c,*}

^a Department of Information Management, Kainan University, No. 1, Kainan Road, Shinshing Tsuen, Luchu Shiang, Taoyuan 338, Taiwan

^b Distinguished Chair Professor, Kainan University, No. 1, Kainan Road, Shinshing Tsuen, Luchu Shiang, Taoyuan 338, Taiwan

^c Institute of Management of Technology, National Chiao-Tung University, 1001, Ta-Hsueh Road, Hsin-Chu 300, Taiwan

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ABSTRACT

The core objective of the Nine-Year Integrated Curriculum for primary schools is to “enable students to demonstrate their talents instead of just scoring high on exams” around the world. The determining factor in education reform is to declare the competence indicators of necessary educational behavior in primary and junior high school. In the reform process, for all domains, the enriched rate of competence indicators for educational materials and methods is very meaningful. Because educational materials and methods in different domains have their own style, we should evaluate these teaching materials separately. Thus, in this research we propose a novel MCDM (Multiple Criteria Decision Making) framework for evaluating, comparing, and improving the effectiveness of competence indicators in the various publications for teaching materials in primary school based on different viewpoints. The ANP (Analysis Network Process) weights are based on the DEMATEL technique with the MCDM method for resolving the problems of dependence and feedback among criteria. Then, a VIKOR technique with ANP weights is proposed for addressing and reducing the performance gaps for each criterion, thus hopefully improving, re-configuring and selecting the aspired Intelligent Assessment Systems (IAS) for teaching materials. An empirical study of Mandarin Chinese based on this system design of three publishers is illustrated to verify the effectiveness of the proposed method. The results can improve the efficiency and quality of the authored Mandarin Chinese teaching materials and may extend to other Learning Areas.

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1. Introduction

Every country has made the cultivation of human talent a priority in the 21st century. As other advanced countries propose education reform in different forms throughout the world, Taiwan also recognizes education as the bedrock of national development, implementing various education reforms such as pre-school education reform, grade 1–9 curriculum reform, the restructuring of secondary education, the enhancement of higher education, and lifelong learning projects (MOE, 2008). Therefore, the purpose of this research is to propose a novel technique and evaluation method that can improve, re-configure and select the aspired Intelligent Assessment Systems (IAS) for teaching materials to promote education levels.

Since 1990, the four British educational reform contexts have been: (a) the right to national centralization reform; (b) the priority of compulsory education; (c) vocational education mainstreaming; and (d) the ability to pursue educational evaluation (Dfe, 1991).

* Corresponding author at: Distinguished Chair Professor, Kainan University, No. 1, Kainan Road, Shinshing Tsuen, Luchu Shiang, Taoyuan 338, Taiwan. Tel.: +886 937 541 184.

E-mail addresses: hsiong.chen@msa.hinet.net (C.-H. Chen), ghtzeng@cc.nctu.edu.tw, ghtzeng@mail.knu.edu.tw, arthur@mail.knu.edu.tw (G.-H. Tzeng).

The report of the Mayer Committee proposed to advise the Australian Education Council (AEC) and the Ministers for Vocational Education, Employment and Training (MOVEET) on employment-related key competencies for post-compulsory education and training (Mayer, 1992). The Education Commission of Hong Kong proposed the following: “Learning is the key to one’s future, and education is the gateway to our society’s tomorrow”. Education enables individuals to develop their potential, construct knowledge and enhance the quality of their personal lives (EC, 2000).

In general, no matter what style of education reform is used, the key competencies are the major concern for national education reform at the beginning of the 21st century.

The core objective of Nine-Year Integrated Curriculum for primary schools in Taiwan is to “enable students to demonstrate their talents instead of just scoring high on exams”. The determining factor in education reform is to declare the competence indicators for necessary educational behavior in primary school (MOE, 2002). In the reform process, for all domains, the enriched rate of competence indicators for educational materials and methods is very meaningful. Because educational materials and methods in different domains have their own style, we should evaluate these teaching materials separately.

Thus, in this research we propose a novel MCDM (Multiple Criteria Decision Making) framework based on the DEMATEL

(Decision Making Trial and Evaluation Laboratory) technique for evaluating, comparing, and improving the effectiveness of competence indicators in the various publications for teaching materials in primary school based on different viewpoints. The ANP (Analysis Network Process) weights are based on the DEMATEL technique with the novel MCDM method for resolving the problems of dependence and feedback among criteria. Then, a VIKOR technique with ANP weights is proposed for addressing and reducing the performance gaps for each criterion, thus hopefully improving, re-configuring and selecting the aspired Intelligent Assessment Systems for teaching materials. An empirical study of Mandarin Chinese teaching materials in Grade 1 of primary school based on this system design of three publishers is illustrated to verify the effectiveness of the proposed method. The results can improve the efficiency and quality of the authored Mandarin Chinese teaching materials and may extend to other Learning Areas.

The remainder of this paper is organized as follows. In Section 2, the aspired intelligent assessment systems for teaching materials with MCDM are introduced. In Section 3, a novel MCDM method based on the DEMATEL technique is proposed. In Section 4, an empirical study for the aspired IAS for Mandarin Chinese teaching materials is presented to show the process that our proposed method entails, and discussions are conducted. Finally, in Section 5, concluding remarks are presented.

2. Intelligent assessment systems for teaching materials with MCDM method

In recent decades, competence-based education has become the mega trend impacting the education reform strategies of the majority number of governments throughout the world. In the following section, the literatures related to core competence (CC), the intertwined effects of an assessment system for teaching materials, will be reviewed as a foundation for the development of the theoretical framework of this paper. We also give an example of Taiwan to explain the basic concepts of Educational Reform for teaching materials.

2.1. Educational reform of Taiwan (MOE, 2002)

In keeping with the progress of the 21st century and the global trends of educational reform, Taiwan must engage in educational reform in order to foster national competitiveness and boost the overall quality of our citizen's lives.

The Ministry of Education (MOE) of Taiwan, therefore, has initiated curricular and instructional reforms in primary and junior high school education. These reforms have been based on the

Action Plan for Educational Reform approved by the Executive Yuan of Taiwan. Because the curriculum is not only the core of schooling but also the foundation on which teachers plan learning activities, the MOE places top priority on the development and implementation of the Grade 1–9 Curriculum. Curricular reforms are necessary and will be timely for the following reasons: (a) meeting national development needs; and (b) meeting public expectations.

2.2. Assessment system for mandarin chinese teaching materials

Mandarin Chinese is one of the curricula included in the Language Arts. It is divided into 3 stages: Grades 1–3, Grades 4–6, and Grades 7–9.

2.2.1. Mandarin Chinese's curriculum goal

Based on the Curriculum Goals and CCs of the Grade 1–9 Curriculum, a more detailed description is given in sub Sections 4.1.2 and 4.1.3, with the Mandarin Chinese Curriculum Goal defined as follows: (1) to utilize language to inspire individual potential and to cultivate learning; (2) to cultivate interest in writing and enhance ability to appreciate literature; (3) to equip with the self-learning ability for language learning and lay the foundation for lifelong learning; (4) to utilize language and words for expressions of emotion, experience-sharing and communications; (5) to utilize language expression to adapt to one's environment and to demonstrate appropriate behavior; (6) to understand and recognize the Chinese, Taiwanese and foreign cultures and rituals through language learning; (7) to utilize the power of language to develop and implement plans effectively; (8) to combine the information of language and technology to enhance learning and to expand fields of study; (9) to cultivate an interest in language exploration and a proactive attitude towards language-learning; (10) to utilize language for independent thinking and problem-solving.

2.2.2. Competence indicators of Mandarin Chinese's curriculum of grade 1–9 curriculum

Based on the requirements for children's intellectual development, the numbers for the competence indicators of the Mandarin Chinese Curriculum for each stage are defined (see Table 1).

In general, this includes listening, speaking, reading and writing of languages, and developing basic communication competencies. From the academic point of view, six terms were developed as follows: (1) phonetic symbol applications; (2) listening skills; (3) the ability to speak; (4) literacy and writing ability; (5) reading skills; and (6) writing skills.

Table 1
Numbers for competence indicators for the mandarin Chinese curriculum for each stage.

Criterion of CC	Stage1	Stage2	Stage3	Sum
D₁ : Physical, mental, and spiritual mold				
C₁ : Self-understanding and exploration of potential	24	19	18	61
C₂ : Appreciation, representation, and creativity	20	17	17	54
C₃ : Career planning and lifelong learning	9	13	10	32
D₂ : Interpersonal and social relations				
C₄ : Expression, communication, and sharing	8	9	12	29
C₅ : Respect, care and teamwork	9	9	13	31
C₆ : Cultural learning and international understanding	6	8	6	20
C₇ : Planning, organizing and putting plans into practice	7	7	6	20
D₃ : The use of Life Science and Technology				
C₈ : Utilization of technology and information	4	11	8	23
D₄ : Logical thinking and reasoning				
C₉ : Active exploration and study	8	7	9	24
C₁₀ : Independent thinking and problem-solving	9	8	7	24
Sum	104	108	106	318

Sources: (MOE, 2002)

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