

The Study of the Educational Decision-Making: Based on the Hall for Workshop of Metasynthetic Engineering: A Case Study on the Additional Sports Test in the College Entrance Examination

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Abstract

We make a first attempt to introduce the Hall for Workshop of Metasynthetic Engineering (HWME) which is an important method applied in the field of the decision-making of complex system with Chinese characteristics, and illustrate the framework about HWME's application in educational decision-making. Taking the policy decision-making of additional sports college entrance examination as the simulation object, we elaborate on the use of technology HWME's rules and processes. This research also simulates HWME in practical application of educational decision-making in three aspects—the knowledge system, machine system and expert system. Therefore, the application of operational educational decision-making HWME will be conducive to the improvement of educational decision-making system and promote the institutionalization and scientization of educational decision-making.

Key words: Educational decision-making; Hall for workshop of metasynthetic engineering; College entrance examination; Sports

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INTRODUCTION

Education is a complex social activity. The diversity and complexity of educational policy decision-making of

the decision-makers facing determines that educational policy decision-making (hereinafter referred to as educational decision-making) is very difficult and involves a wide variety of subjects. Therefore, decision-makers usually encounter various dilemmas and problems in actual educational decision-making process. That's exactly why decision-makers have to get an insight into decision-making phenomena and behaviors of educational activities, and to be constantly familiar with various features of educational decision-making under complex conditions. Only by striving to understand and grasp general laws of educational decision-making, can be scientific and rational decision-making model be formed and can the healthy development of education cause be ensured.

Whether sports examination should be added into the college entrance examination or not? This is a long-standing decision-making dispute. Although having been debated at different levels and in different regions for a long time, it still hasn't been implemented as an educational policy. *The Several Opinions on Further Strengthening the School Physical Education*" (hereinafter referred to as the *Opinions*) was issued by four Ministries including the Ministry of Education, and re-issued by General Office of the State Council of People's Republic of China in October, 2012. It has been pointed out that decision maker should actively explore to add sports test in the college entrance examine and facilitate the construction of comprehensive evaluation system for the college entrance examine, in order to take its guide role in strengthening students' physics to full play. With the introduction of the *Opinions*, the policy of college entrance examination plus sports examination stirred heated discussion in all circles. Is it appropriate to plus a sports examination in the college entrance examination? Does it really help to enhance physical fitness of middle school students? Or will it just cause a new examination-oriented phenomenon? If the policy of

the college entrance examination plus sports examination will finally be implemented, then decision-makers will face new questions, such as what the contents will be tested? How to test? When will the test be implemented? Who will be tested?

As to the additional examination, which is of great importance and involves a wide variety of subjects, how to adequately assess follow-up issues it may bring? What kind of argumentation channel, procedure and decision tools, in line with the spirit of democracy and science, will be applied to solve such macro educational decision-making matter related with the interest of the country's as well as the nation's education cause? These questions are worth our serious study and thinking. Inspired by such questions and doubts, this paper attempts to introduce the Hall for Workshop of Metasynthetic Engineering (hereinafter referred to as HWME) technology and methodology which had ever been successfully applied in other fields. And this paper takes the policy decision-making of college entrance examination plus sports examination as an example, to explore and elaborate on educational decision-making path and mode in complex systems through simulating its entire decision-making process.

1. METASYNTHETIC ENGINEERING: EFFECTIVE WAY TO EDUCATIONAL DECISION-MAKING IN COMPLEX SYSTEMS

The policy of the college entrance examination plus sports examination is an important public educational policy influencing middle school students' family and social life as well as their healthy long-term growth in the future. The implementation of this public policy is of great significance. Although college entrance examination directly caters to high school students, the involved external conditions are complex and changeable, coupled with the uncertainty of future expectation. Therefore, decision-makers will face a great deal of difficulty.

We measure the question from all above mentioned aspects and find that this question is for educational decision-making in a complex system. As for decision-making of a complex educational system, there are many limitations on traditional qualitative thinking and argumentation method which fail to solve this issue properly. Therefore, we should be open-minded, making full use of the latest research results of modern scientific decision-making. And with the aid of the latest theory and technology of complexity science, we would develop and deepen educational decision-making theory and practice study.

The qualitative-to-quantitative metasynthetic engineering proposed by Chinese famous scientist Qian

Xuesen provides a new thinking mode to solve this problem. As to the policy decision-making in complex system, Qian proposed and developed the HWME system combining qualitative and quantitative research method at the end of 20th century (Dai & Li, 2004), in which the HWME technology is an application form putting theory of the decision-making in complex system into practice and provides specific technical method to achieve metasynthetic engineering.

At present, HWME has become an important methodology for the decision-making in complex system. The methodology had ever been successfully applied in military and economic departments, etc., which enriched and improved the metasynthetic engineering theoretical ideas proposed by Qian and developed relatively mature and operational methods and technologies (Hu, 2002). All these achievements will provide important research ideas and approaches to decision-making research in education system. Therefore, we think that the establishment of "educational decision-making HWME" will integrate latest research results of information technology to form highly intelligent man-machine integration system with expert group, which will be an effective way to solve educational decision-making in complex systems (Han, 2005).

2. THE CONSTRUCTION OF "EDUCATIONAL DECISION-MAKING HWME"

We can define educational decision-making HWME as a cooperative work platform based on modern information technology, using a variety of information resources, getting together experts from different fields and collaborating working platforms. The so called "Hall" here refers to the computer technical support network system, not the commonly known living place. It's intelligent man-machine integration system, so the HWME is a virtual hall. From the point view of "hardware condition", the HWME is intelligent man-machine integration system, based on qualitative-to-quantitative metasynthetic engineering, containing database, model base, knowledge base, multi-sensor information-fusion technology, network technology and so on. The "Hall" demonstrates such external functions and features as "man-machine", "qualitative-to-quantitative", "metasynthetic engineering", and "expert workshop" (Wei & Zhou, 2004). Nowadays, network has penetrated into every aspect of people's work and life, and has made participants out of time and geographical constraints. People can study, explore and communicate issues of concern anytime and anywhere, and are free to take advantage of network for local or remote wealth of information resources. Therefore, it's safe to say that rapid development of information technology provides

solid foundation for the construction of educational HWME system, and that the network's time-saving connection makes it possible to put the HWME system into practice and establish virtual workshop (Dai & Li, 2004).

The working model of educational decision-making HWME is, in line with the development needs and future planning of education cause, to involve experts from relevant fields in group discussion and collaborative work, to discuss all contents of educational decision-making and to fully take advantage of modern information technology to compare various programs and select feasible suggestion in order to provide service and advise for educational administrative department decision-making. The difference from previous educational decision-making working model is that educational decision-making HWME is a working platform supporting collaborative work of experts from different fields. Experts participating HWME collaboratively work in distributed network environment, which is very different from previous experts' workshop and assessment. Based on computer network technology, the HWME attempts to get together software and hardware facilities scattered in different locations as well as experts from educational field through information technology to discuss educational issues, forming in man-made electronic platform a supportive environment of instant sharing out of time and space constraints, metasynthetic engineering, discussion and analysis. In this supportive environment, educational experts can give full play to their strengths, discuss issues and express their views, taking advantage of data and analysis tools provided in the network, based on their accumulated experience and knowledge. The distributed network environment can combine experts group, knowledge and information through network, so that participants can stay at home to communicate with experts in different locations, to issue personal ideas and complete verification with the aid of auxiliary tools (Wei & Zhou, 2004). Therefore, the HWME system has capabilities of collection, storage, transmission, relocation, analysis and integration of educational knowledge and information. What's more, it makes it possible that sparks of wisdom collide to produce new knowledge, new ideas and new methods. The culmination of wisdom contributes to theoretical research and practical problems (Li, 2011). In short, system engineering theory and method are the theoretical basis for educational decision HWME. The HWME focuses functions of system management, database management, model base management and experts' workshop in one, in which experts' workshop is method of achieving man-machine combination, experts' workshop on network is a means of usage and computer network is carrier, to integrate various information, knowledge, analysis methods and expert wisdom through

the electronic platform and function as meta-synthesis (Yu, 2012).

With the above analysis, we believe that the HWME can provide methodological foundation for educational decision-making in complex systems. Therefore, this paper will take the policy of college entrance examination plus sports examination as a policy decision-making example to simulate and analyze the application matter of educational decision-making HWME.

3. THE SIMULATION ANALYSIS OF COLLEGE ENTRANCE EXAMINATION PLUS SPORTS EXAMINATION BASED ON THE HWME

The policy of college entrance examination plus sports examination needs to fully consider the interests of students, parents and society in all aspects and make comprehensive comparison of experts' ideas in related fields. The targeted decision-making suggestions should be proposed based on comprehensive analysis with the aid of statistical data and related mathematical models. The HWME is essentially to organize experts from various domains to form experts group, and provide the integration environment of man-machine interaction and human-human integration for experts group to study issues through discussion, both qualitative analysis and quantitative analysis with the aid of related statistical models (Hu, 2002). Therefore, as to the educational decision-making of college entrance examination in complex systems, we will take the HWME, which has been proved by past application in other fields as effective way to solve such complex decision-making matter, as study technical method and decision-making supportive system. This paper expects to comprehensively integrate resources as much as possible to solve such like policy decision-making issues in complex system through establishing the HWME to simulate the decision-making of college entrance examination policy, in order to provide cases and experience that can be referred for similar decision-making, and provide necessary methodology supports for complex educational decision-making in the future (Liu, 2007).

3.1 Fundamental Framework

The proposal that sports examination will be added into college entrance examination is due to concern about decline in students' physical condition in recent years. Various factors affect physical fitness, so there is long-standing dispute on whether the baton of college entrance examination plays an important role in enhancing student's physical fitness to realize the purpose of quality education. The development and implementation of educational policies play an important role in macro regulation and control of promoting students'

comprehensive development and education cause's reform and innovation as a whole.

The HWME needs to complete following argument tasks:

(a) What's the purpose of college entrance examination plus sports examination?

(b) Is the policy of college entrance examination plus sports examination feasible?

(c) Is college entrance examination plus sports examination a new kind of examination-oriented education?

(d) How to implement the policy of college entrance examination plus sports examination?

(e) What are the contents of the examination?

(f) How to guarantee just and fair sports examination?

(g) Does the implementation of college entrance examination plus sports examination really helps to enhance students' physical fitness?

(h) What are expectation and future judgment of student physical and mental development with the implementation of college entrance examination plus sports examination?

(i) Policy suggestions

Policy suggestions are proposed based on reasonable decision-making suggestions and references by relevant experts participating workshop, considering pros and cons of college entrance examination plus sports examination. The principle to follow is that experts participating workshop need to compare the expected policy effects and desired objective to judge the feasibility of policy. If policy could achieve the desired objective, policy suggestion will be accepted; otherwise, relevant experts need to modify policy options, then stimulate and analyze the revised policy again until it meets the requirements of achieving the desired objective.

The architecture of college entrance examination plus sports examination HWME is constituted by knowledge system, machine system and expert system, and the like. Database of student physical fitness is mainly applied to system's quantitative analysis, providing appropriate model, data and policy simulation service. Workshop environment mainly provides policy decision-making support for all roles participating workshop, as well as provide man-machine integration environment and workshop environment for people participating workshop.

3.2 The Architecture of the Educational Decision-Making HWME of College Entrance Examination Plus Sports Examination

3.2.1 Knowledge System

3.2.1.1 Relevant National Policies

In order to ensure the smooth development of sports education in school at all levels and ensure that every student enjoys receiving sports education and the rights

to participate in physical exercise, China issued a series of rules, measures, regulations and implementation details. These provisions play an important role in the development of sports education in school (Wang & Li, 2008; Li & Shao, 2006)

3.2.1.2 University Admission Policies of Other Countries

In addition to domestic regulations and policies, the policy of college entrance examination plus sports examination can be proposed by referring to other major countries' university admission policies which can be referred to in establishing the knowledge system of college entrance examination plus sports examination as well (Zhou, 2009).

3.2.1.3 Database

National Students' Physical Health Standard Database is large national student physical health test data information system established by Ministry of Education in 2004, in accordance with the promotion of the "National Students' Physical Health Standards". The data comes from student physical health standard test results reported each year by schools at all levels to Ministry of Education. When National Students' Physical Health Standard Database is completed, it will accommodate physical health test results and assessment indicators of more than nationwide 200 million students, according to the "National Students' Physical Health Standards". In addition, National Students' Physical Health Standard Database has functions of data statistics, analysis and retrieval to meet various requirements. National Students' Physical Health Standard Database is composed of summary statistics based on test data of "National Students' Physical Health Standards" reported by schools throughout the country each year. Specifically, it consists of school's basic information, student's basic information, student's test scores, school statistics and regional statistics.

3.2.2 Machine System

The HWME system is a multi-layer architecture consisting of client layer (workshop terminal), business logic layer (workshop environment, a variety of support services, etc.) and data layer (including database server and public data). Workshop system server is composed of multiple computers located on local area network. Workshop system admin user access via web server and users can access to the HWME via network or special line

As previously mentioned, the prototype system of the HWME consists of three centers: Workshop center, management center and data center, which are further composed of different modules, such as the HWME website, workshop terminal, user access service (including WEB and EMAIL server), system management module, basic information platform, educational decision-making supportive system, system supporting tools, and the like (Han, 2005).

3.2.3 Expert System

(a) Role analysis of educational administration

Educational authorities play a dual role, participating in workshop and acting as moderator of workshop at the same time. Educational authorities need to consider the overall situation, collate related opinions and make statistical analysis to make overall judgment on whether sports examination should be added into college entrance examination or not. Educational authorities could choose one of the following three strategies:

i) Sports examination is added into the college entrance examination, scoring at 20-50 credits to fully embody the command function of college entrance examination.

ii) Sports examination is temporarily not added into the college entrance examination, schools at all levels implement sports test respectively.

iii) Maintaining original policy unchanged.

(b) Education experts' comments

The first category, favor,

The second category, oppose,

The third category, cautious favor.

(c) Opinions from PE teachers and front-line educators.

(d) Role analysis of parents and students.

(e) Related data calculation and simulation of sports examination.

3.3 Workshop Procedure

First of all, educational authorities, the moderator of workshop, start workshop process, and pose first-stage workshop subject, that's whether sports examination should be added into college entrance examination or not, and recommend database, model base, statistical data, and related knowledge or materials for reference, etc.. In the course of workshop, as to the policy decision-making of college entrance examination plus sports examination, experts can fully express their opinions combining their study fields, can discuss through words or voice, to engage in idea confrontation and inspiration burst. When all parties have fully expressed personal opinions and views based on one's own position and experience knowledge, workshop moderator expects to form unified opinion. When all parties choose the strategy to their own advantage, it's temporarily impossible to reach consensus. Workshop moderator will suggest all parties to use decision-making related supportive system, in addition to personal preference and experience knowledge, for example, experts could take advantage of relevant student physical fitness database to make quantitative process, such as statistical analysis of changes to student physical fitness after adding sports examination into college entrance examination and simulation model, etc., as well as models, data and templates and such like resources provided by related system to verify their own opinions and assumptions,

to help them to understand their opinion's feasibility and support their proposals. The management personnel of educational decision-making HWME could take advantage of opinion integration tools, such as Delphi model, electronic voting model, and AHP model, to conclude and induce opinions issued by experts to extract same or tendentious opinions. When obvious divergence occurred among workshop experts, moderator can suggest experts to avail of electronic voting machine to vote, based on which conclusion is produced. The procedure or certain parts of the procedure could be repeated until all participants are satisfied with the conclusion.

If the ultimate conclusion is that the college entrance examination plus sports examination isn't necessarily to be conducive to enhancing student physical fitness, but to cause some unexpected side effects, then it demonstrates that educational decision-making HWME system has denied the policy decision-making. The workshop temporarily ends. If the ultimate conclusion is that the implementation of college entrance examination plus sports examination does enhance students' physical fitness and the policy has positive effect on strengthening quality education and training talents of comprehensive qualities in new era, which demonstrates that educational decision-making system gets positive result of the first subject. Then educational authorities will continue to start the second phase of workshop, to discuss how to implement the policy of college entrance examination plus sports examination, and select examination planning. If unified opinion still can't be reached after several rounds of workshop, educational authorities could comprehensively assess opinions issued by all parties to form alternative policy decisions and make quantitative analysis. If the chosen policy decision is proved feasible, then the policy of college entrance examination plus sports examination does help to measure and analyze student physical fitness and encourage students to participate in physical exercise. The educational authorities will start the third phase of workshop, which will discuss the operability of the policy and how to avoid unfairness in sports examination to ensure fair and just college entrance examination, and the like.

After several rounds of workshop, moderator will summarize workshop conclusions, collect proposals put forward by all parties, to sort out and assess results and write reports which will be finally submitted to educational authorities.

According to previous arguments, and drawing study achievements from scholars as Wei and Zhou (2004) in other fields, this paper draws complete frame diagram of educational decision-making HWME as below in Diagram 1.

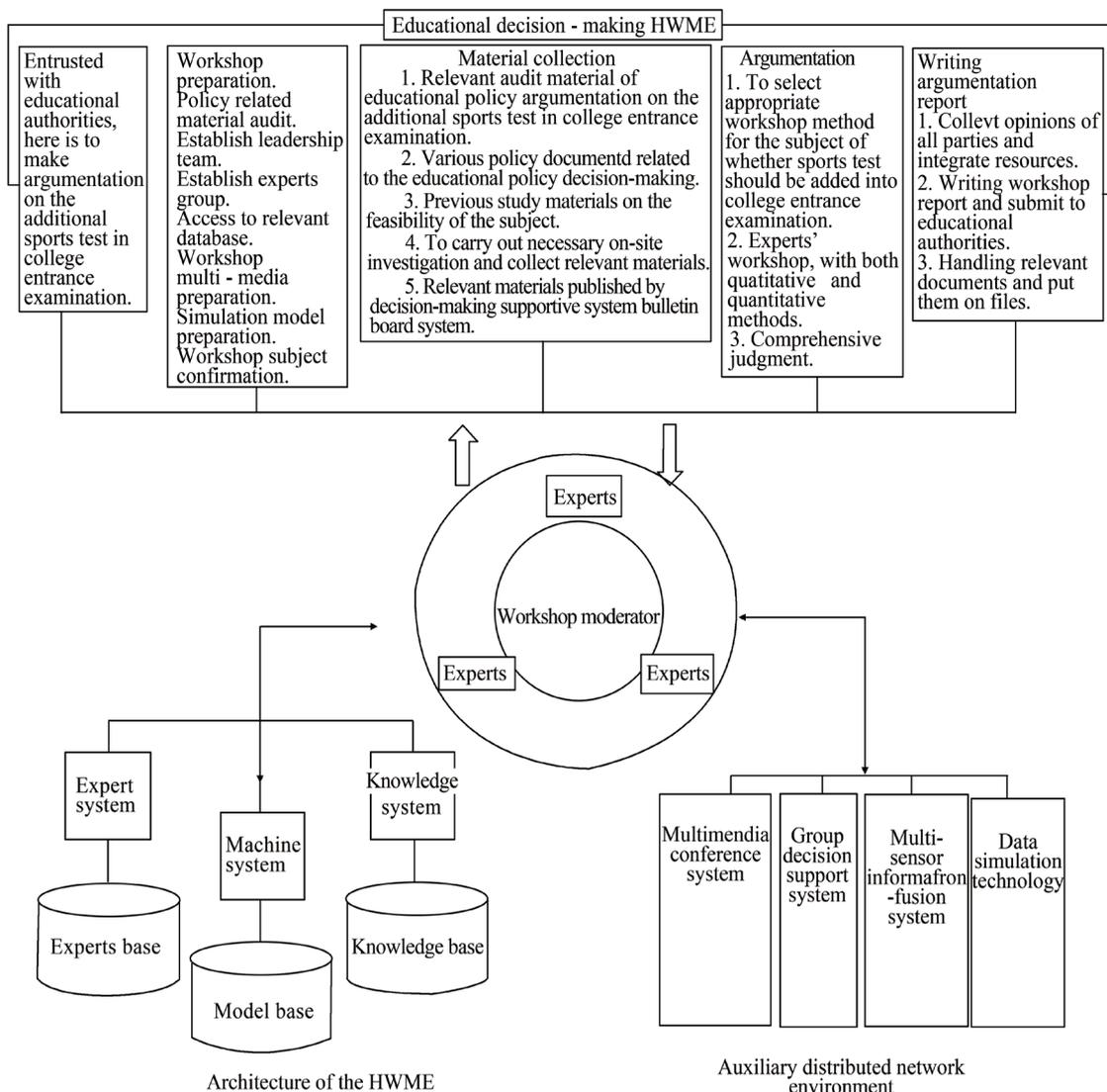


Figure 1
Complete Frame Diagram of Educational Decision-Making HWME of College Entrance Examination Plus Sports Examination (Wei & Zhou, 2004)

CONCLUSION

After collection and conclusion of opinions issued by experts, there are maybe three results. The first one is that sports examination will be added into the college entrance examination, scoring at 20-50 credits to fully embody the function of the college entrance examination baton. The second one is that sports examination is temporarily not added into the college entrance examination, schools at all levels implement sports test respectively. The third one is to maintain the original policy unchanged.

If with support and management of educational authorities, such an educational decision-making HWME is established. According to relevant requirements and

scientific standards, and after adequate argumentation, it is necessary to add sports examination into college entrance examination, which will be implemented and taken as an important educational policy. Then there are two alternative plans of domestic college entrance examination plus sports examination as below can be referred to. The first one is Tsinghua University model. Combined with the “National Students’ Physical Health Standards”, the physical fitness model in reexamination of independent recruitment by Tsinghua University can be used as reference. It’s only necessary to make some adjustments on the test contents and scoring criteria, etc.. The second one is Shandong model. Shandong province originally planned to plus physical quality examination in college

entrance examination since 2012, taking existing sports examination model of the senior entrance examination as reference. However, it failed to be implemented. Each region can refer to some comparatively mature sports examination of the senior entrance exam, and make some adjustments according to concrete situation, to explore feasible sports examination of college entrance examination.

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