Research on the design and development of the basic information database platform for art education

Qing Zhu
School of Education and science, Xinxiang University, Xinxiang 453002, China

Abstract

With the storm of information sweeping through the whole world, more and more investments are increasingly put in e-education by our nation. In order to improve the interactive and efficiency of art education, the design and development of the basic database platform for art education is proposed in this paper. In this stage, this paper presents the systemic design proposal, functional design proposal and database’s structure design. The logic diagrams of business process is showed in systemic design proposal, the corresponding function meeting different users’ demand will be designed in functional design proposal, and each related datasheet will be described and analysed in database’s structure design. The last place is the development of basic database platform. In this part, this paper introduces the B/S three-tier architecture and working principles used in this system. The introduction on key technologies refers to site configuration and operates class. Then, parts of functions and some key implementation procedure in platform will be showed. In the end of paper, software testing and testing results will be given.

Keywords: Database’s structure design, Basic information database platform, Art education, Big data

1. INTRODUCTION

With the storm of informationization sweeping through the whole world, more and more investments are increasingly put in e-education by our nation. After nearly twenty year’s development, e-education has been fruitful. The Ministry of Education officially approved that strategic study base of Central China for e-education will be prepared and built by Huazhong Normal University in March 17 this year, and the formal opening ceremony has been hold in April 13(Liao and Chen, 2014; Artman and Jacobs, 1929). As the first official research institutions in the field of e-education in our country, the establishment of "Strategic Study Base of e-education (Central China)" means that our nation’s e-education is stepping into a higher platform and the development of e-education is entering a stage of institutionalization, standardization and specialization. The purpose of this base is to build a "Think Tank" for e-education and its main duty includes the construction of index system, the acquisition and monitoring of data, trend forecasting and strategy inaction, etc., so that it could provide policy support and continued guidance for the full range of study and development in the field of e-education. Against this background, this paper focuses on the design and analysis of basic database system, aims to provide a set of key indicators for measuring the level of e-education’s development, and builds an integrated e-education platform supporting public information, study and decision to meet different users’ demand(Poppe et al., 2006).

Digital art learning management system is based on the increase in digital art professional development and employment needs while growing up. Art and design talent will be growing demand; digital art learning management system based on interactive virtual technology helps to better train digital art talent. Digital art information technology and the perfect combination of art, fully demonstrated the expressive arts. At present, domestic and foreign research and application of digital art education system does not reach the potential expected in the current situation and effects, there is a great development.

Through the existing process reengineering, the introduction of digital art learning management system based on interactive virtual technology, and can do a lot of work through the system. In functional analysis, including user information management, independent learning management, management, teaching quality management and
platform management five functional modules. The user information management module mainly includes parameters setting, teacher registration, face basic data and student information registration, students learning management mainly includes online learning, online learning, online testing, information exchange, resource download, and teaching management, including online teaching, online teaching, test, teaching, training, virtual, questionnaire, etc.

Due to the poor interaction of traditional art teaching method, the efficiency of the usage of art teaching resources is low. In order to solve the problem, interactive visual thinking should be used to reform the traditional art teaching method (Yang, 2000).

Because of interactive virtual roaming in simulation scene based on virtual reality technology, has characteristics of multi-sensory, interactive, immersive and autonomy etc., it is widely used in structure exhibition, personnel operation training, product structure design verification.

2. MATERIALS AND METHODS

2.1 Overview

Art education is a new educational philosophy, in which we need have a new understanding and orientation on the essence and function of education. Art education is driven by a personalization process rather than subject content and as such is cross-curricula. At the same time, the purpose of Art education is to achieve the comprehensive and structural educational Personalization and development. In the process of implementing Art education, it is needed to claim personalized philosophy in each section, and its goals are to achieve the fostering and development of personalized talents. In natural, Art education belongs to the field of quality education, and the latter is the specific form of the former in modern education views. The Art education puts emphasis on fostering personalization of the students from three dimensions of spirit, ability and personality (Art-In, 2015). The personalized personality, as an interim goal of the Art education, also which is an important part in modern educational system.

For the concept of personality, different scholars have different definitions of personality, and there are some deviations for defining it in different sphere of science. In psychology, personality is a combination of relatively stable psychological tendencies and characteristic of individual. The scholars in china summarized that personality is a relatively stable, unique psychological behaviour pattern hang on genetic quality, but which is influenced by the interaction between the person and the society. Personalized personality, as a new terminology, is emerged following the Art education, and which is composed of the individual integrated Personalization and personalized ability, is an aggregation of some more stable and unique psychological characteristic. Also, it is an inner dynamic mechanism of the Personalization, a mental accumulation of personalized spirit and sense of individual, and is the critical key to achieve the success of Personalization activities. Though personalized personality belongs to non-intellectual factors, it is more important than the intellectual quality in personalized qualities (Suzuki, 2015).

As for data mining (DM), there are two themes of agent and DM interaction and integration in the literature: DM for agents, referred to as mining-driven agents; and agents for DM, referred to as agent-driven DM, commonly known as Multi-Agent Data Mining (MADM). The former concerns issues of transforming the discovered knowledge extracted by DM, into the inference mechanisms or simply the behaviours of agents and multi-agent systems; as well as the arguable challenge of generating intelligence from data while transferring it to a separate, possibly autonomous, software entity. A FIPA-compliant multi-agent platform is based on mining-driven agents (Agent Academy) that offer facilities for design, implementation and deployment of MAS. That is the agent academy as an attempt to develop a framework through which users can create an agent community having the ability to train and retrain its own agents using DM techniques.

Mining-driven agent system is concerned with the use of agent and MAS to perform DM activities, which provide a broad review of prominent MADM approaches that benefit to gain the individual agent-based DM architectures. DM techniques concerned with the collaborative work of distributed software in the design of MAS directed at DM, which involves various systems that have been developed for MADM. These systems can be categorized according to their strategy of learning, into central-learning, meta-learning and hybrid-learning. Most data warehouse projects
strive to deliver integrated data, which supports decision makers throughout the organization. Data’s integration is a fundamental but challenging in the design of DW and DSS that involves combining data residing in different sources and providing users with a unified view of these data (Zhao, 2014). This process becomes significant in an integrating for DM and MAS with BI applications. It appears with increasing frequency as the volume and the need to share existing data explodes and the focus of extensive theoretical work, and numerous open problems remain unsolved in the process of BI. When data passes from the sources of the application oriented operational environment to the Data Warehouse, possible inconsistencies and redundancies should be resolved, so that the warehouse can provide an integrated and reconciled view of data of the organization. In the design of a data integration system, an important aspect is the way in which the global schema is specified, i.e., which data model is adopted and what kind of constraints on the data can be expressed. Figure 1 shows the architecture of agents’ components in the mining process.

![Figure 1. The architecture of agents’ components in the mining process](image)

The significant of data integration towards DM and BI is the key concept of DW that reflects the informational needs of an organization, which define in terms of a global, corporate view of data. Integrating for DM and BI is the roadmap to integrate the available information about the solution to queries posed by the user in terms of the data combination schema (i.e. from general to independent and called Global-as-View (GAV) and vice versa. These views should be provided in terms of conceptual representation mechanism that can be abstract from the physical and logical organization of data in the sources, which follows the need and requirements for maintaining an integrated, conceptual view of the corporate data in the organization are stronger with respect to other contexts, i.e. the query processing depends on the form of the data integration system that the GAV or LAV approach is adopted and on the form of constraints allowed on the global schema, which is an application of the DW.

2.2 Model and algorithm for database implementation

Big data and Internet, is not only the field of the information technology revolution, accelerate innovation, leading the social change and start the development of transparent government in the world. This new concept of big data not only refers to the data object size, also includes the processing and application of data, is the unity of technology and application of data object, the three. Data can be such as the government or enterprise master database this limited data set, can also be as micro-blog, Micro message, social network unlimited data virtual collection. Big data technology includes data acquisition, storage, management, analysis, visualization technology and its integration. Big data is of application data technology to obtain valuable information on various types of big data sets. The full realizable value of big data adheres to the application object, technology, development of three-in-one synchronization. Big data is the area of information technology and the close integration of industry field, with strong demand and broad prospects. The need to seize the opportunities continue to track the research data and continuously enhance the awareness and understanding of big data, insist on technological innovation and the application of collaborative innovation to accelerate at the same time data in all areas of economic and social development and utilization, promote the country, industry, enterprise for the data application requirements and the
level of development in the new stage. Big data is of application data technology to obtain valuable information on various types of big data sets. The full realization of the value of big data only adheres to the application object, technology, development of three-in-one synchronization. Big data is typical areas of information technology and the close integration of industry field, with strong demand and broad prospects. The need to seize the opportunities continue to track the research data and continuously enhance the awareness and understanding of big data, insist on technological innovation and the application of collaborative innovation to accelerate at the same time data in all areas of economic and social development and utilization, promote the country, industry, enterprise for the data application requirements and the level of development in the new stage.

The evolution model is implemented in two phases. The first phase takes place before learning a course, when the personalized course is generated from the knowledge base according to the teaching outline from teachers. The second phase takes place during the learning process. The learning content is dynamic updated and evolved based on genetic algorithms, while the learning states are changed. In detail, this thesis makes the following contributions: 1. the paper presents a personalized course generation and evolution model for normal learning in the context of large scale learning. Combined with the theory of knowledge maps, this paper describes the concept model of course generation and its formal description, and presents a personalized course generation and evolution model for normal learning with large numbers of online learners. It realizes personalized learning through a series of personalized generated courses. This model provides a good general-purpose and scalable framework model for personalized learning in large-scale online learning environment.

Personalization is a difficult, lengthy and complex process which requires perseverance, hard work and enthusiasm. For the successors, the common features of them are possessing perseverance. So, if the university students would like to be personalized talents, they should have a strong willpower and make progress toward the goal of Personalization constantly. Furthermore, they should dare to face setbacks and failures correctly. Figure 2 shows the conceptual model of data mining blessing and disambiguates framework.

Formula is as follows (Cheng and Jiang, 2015; Barros et al., 2014):

\[ \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{-\langle k, x \rangle} \, dx = \delta(k) \]  

Equation (1) can be converted into the following form:

\[ f(y, \omega) = f^0(y, \omega) + \int_{\mathcal{S}} S(y - y', \omega) L' F(y', \omega) dy' + \rho \omega^2 \int_{\mathcal{S}} g(y - y', \omega) \mathcal{J} f(y', \omega) dy' \]

\[ a \overset{f(b)}{\underset{a}{\int}} f(t) = \frac{1}{\Gamma(1 + \alpha)} \int_{a}^{b} f(t)(dt)^{\alpha} \]

\[ = \frac{1}{\Gamma(1 + \alpha)} \lim_{\Delta \to 0} \sum_{j=0}^{j=N-1} f(t_j)(\Delta t_j)^{\alpha} \]

With \( \Delta t = t_{i+1} - t_i \) and \( \Delta t = \text{max}\{\Delta t_1, \Delta t_2, ..., \Delta t_j, ..., \} \), where for \( j = 1, 2, ..., N-1, \{t_0, t_1, ..., t_N\} \), and \( t_0 = a, t_N = b \). Active set methods (ASM) are considered as one of the most effective techniques for solving small to medium scale nonlinear problems. In this work we will focus on ASM for solving convex QP problems depicted in (3) in which case the Hessian \( G \) is at least positive semi definite and therefore any local solution of the QP is also a global minimizer.

ASM solves system (3) by reducing it into the following equality constrained QP. If \( f(x) \) is defined on the real line \(-\infty < x < \infty\), its local fractional Hilbert transform, denoted by \( f^H_{\alpha}(x) \) is defined by
\[ H_\alpha \{ f(t) \} = \hat{f}_H^\alpha (x) = \frac{1}{\Gamma(1+\alpha)} \int_R^x \frac{f(t)}{(t-x)^\alpha} (dt)^\alpha \quad (4) \]

Where \( x \) is real and the integral is treated as a Cauchy principal value. An active set method starts by making an initial guess of the optimal active set \( f_\alpha^*(x) \), usually, if this guess turns out to be incorrect, it repeatedly uses gradient and Lagrange multiplier information to swap indices in and out of the current estimate of \( A(x^*) \). Although the simplex method is principally considered as active set approach for solving LP problems, active set methods for QP differ from the simplex method in that the search may not always progress from one vertex of the feasible region to another. Some iterates (and, indeed, the solution of the problem) may lie at other points on the boundary or interior of the feasible region, that is:

\[ \lim_{\varepsilon \to 0} \frac{1}{\Gamma(1+\alpha)} \int_{x-\varepsilon}^{x+\varepsilon} \frac{f(t)}{(t-x)^\alpha} (dt)^\alpha = \frac{1}{\Gamma(1+\alpha)} \int_{x-\varepsilon}^{x+\varepsilon} \frac{f(t)}{(t-x)^\alpha} (dt)^\alpha \]

To obtain the inverse local fractional Hilbert transform, write again Eq. (4) as

\[ \hat{f}_H^\alpha (x) = \frac{1}{\Gamma(1+\alpha)} \int_{-\infty}^{\infty} \frac{f(t)}{(t-x)^\alpha} (dt)^\alpha \]

\[ = \frac{1}{\Gamma(1+\alpha)} \int_{-\infty}^{\infty} f(t) g(x-t) (dt)^\alpha = f(x) * g(x) \quad (6) \]

The equation of motion is as follows:

\[ \partial_j (C_{ijkl} \partial_k u_i + e_{ijkl} \partial_k \varphi) - \rho \partial_{tt} u_i = 0 \quad (7) \]

Under the linear theory, that is:

\[ \partial_j (e_{ijkl} \partial_k u_i - \eta_{ijkl} \partial_k \varphi) = 0 \quad (8) \]

The linear equation can be expressed into the following simplified forms:

\[ L(\nabla, \omega) f(x, \omega) = 0 \quad \text{L} \quad (\nabla, \omega) = T(\nabla) + \omega^2 \varphi J \quad (9) \]

Curiosity is the base of interest which can breed thought and exploration. The university students should be filled with curiosity and doubts to prompt them generate inspiration and driving force of Personalization.
3. RESULTS AND DISCUSSION

There are generally two ways for digital art design teaching: 1) design based on biological system functions through physical, chemical, engineering science and technology study to learn from nature, e.g. the design of bionic ploughs or bulldozers X51 or walking machines; 2) design based on biological geometric features. In this paper, the focus is placed on the second one—design based on biological geometric features. There are two methods for capturing geometric information for bio-inspiration. Method 1 is Art Design Method. In this method, the direct observation of a natural object is undertaken by art design professionals with their special knowledge and experiences and Method 2 is Engineering Method. In this method, the measurement of a natural object is carried out by engineers with engineering methods such as reverse engineering. Both methods have their advantages and disadvantages. To combine the advantages of both methods and overcome the disadvantages, a methodology for PDN is proposed as shown in Fig. 2. The procedure of the proposed methods is as follows:

Stage 1 Capturing surface geometrical information

As discussed above, there are two methods for capturing surface geometrical information. Method 1: by art design professionals and Method 2: by engineering professionals. In Method 1, art design professionals directly observe a biological object such as an apple, a lotus leave and a bird etc. to get bio-inspirations. Then with their expert knowledge, experiences and creation talent, they use their imaginary power to design either a pre-defined kind of product or any kind of product freely The outputs of the design are normally 2D sketch (free hand drawing). This 2D sketch can then be scanned using a normal 2D scanner to get digitized geometrical information in the data format that is suitable for the late processing to generate the required geometrical information such as 3D models using various algorithms in Step 2.

For Method 2, engineering professionals employs advanced surface information capturing equipment to obtain geometrical and color data directly from a natural object. The outputs are normally various sets of points in x-, y- and z-coordinates for geometrical data and r, g and b for color information. They are together called point clouds which can be used for the late processing to generate useful information for geometrical design (such as 3D models) and aesthetics design using various algorithms in Step 2.

Stage 2 3D model build

This stage is consists of the following main work: Filtering, segmentation, edge detection, and initial 3D modeling and aesthetics analysis/optimization for the final 3D models. Here, there should be sufficient collaboration between art design professionals and engineering design and 3D modeling professionals. The inputs from art design professionals should be effectively integrated into 3D modeling process to obtain aesthetical beauty product design. The inputs from engineering design and 3D modeling professional are used to build 3D models that are suitable for the production in Stage 3. In this stage, various algorithms have to be applied.
Stage 3 Prototype Manufacturing

The aim of any product design including PDN is to provide product description for manufacturing a physical product. This is equally important for Bionic Engineering to survive and to prosper. So the natural stage of the proposed methodology should be the prototype manufacturing to build some prototypes of the design for test, quality control and production plan for late manufacture of the products for market. Here various rapid prototype techniques/methods are commercial available on market. The typical methods include Rapid Prototype, high-speed machining and laser cutting and processing etc.

Figure 3 shows the comparison of the traditional method and the proposed method. The research on the experiment and study of personalized education shows that the development of human is distinctive and colorful in terms of its intellectual type. Thus, the manager of higher education should strive to build a corresponding evaluation system, which is diverse and flexible in accordance with individual development of students with full freedom. For the items of evaluation, we should design them by combining the grasp of teaching knowledge with the ability and performance displayed in extracurricular activities and social practice. The scholars in china summarized that personality is a relatively stable, unique psychological behaviour pattern hang on genetic quality, but which is influenced by the interaction between the person and the society. Personalized personality, as a new terminology, is emerged following the personalized education, and which is composed of the individual integrated Personalization and personalized ability, is an aggregation of some more stable and unique psychological characteristic. Also it is an inner dynamic mechanism of the Personalization, a mental accumulation of personalized spirit and sense of individual, and is the critical key to achieve the success of Personalization activities.

For the evaluation entity, we should pay more attention to the positive initiative of the students and urge students to participate in the evaluation with self-assessment and peer assessments, so that they can learn to get along well with others. In short, we should improve the current educational evaluation system, such that the evaluation could not only reflect the basic requirements for students, but also concerned about the individual differences of students. Figure 4 shows the data storage flow process. The evaluation can also identify and help students develop their multifaceted potential. Only in this way, we can promote the formation of personalized personality of students and enhance their personalized ability.
Figure 4. The data storage flow process

The understanding consists of (1) description of natural system behaviours and functions; (2) mechanisms of how natural systems perform their functions, physical, chemical and biological properties of natural systems; (3) designer's observation from the PDN through the free hand sketch (4) geometrical characterization of natural systems including 2D and 3D models, a joint efforts of both engineering designers and art design, which leads to the final conceptual design based on functional requirements and form aesthetics and (5) the prototype design and development for the test. Among the above, the geometrical feature, designer sketch inspiration (DSI), and form aesthetics of natural systems are essential work for PDN. The proposed methodology is designed with intention of integrating all these aspects of research work with intention of provide a guide for innovative product design and development by learning from nature. A basic database platform for art education is shown in the figure 5.

Since civilization began, nature is a designer's sourcebook full of natural system behaviours, functions, colours and shapes etc., which have inspired visual invention. To learn from nature, one of the fundamental issues is to understand the natural systems such as animals, insect, plants and human beings etc. When design a product, besides the functional characteristics, designers also observe many form elements of a natural object from form aesthetics point of view to get bio-inspirations for product design with purpose of improving the marketability of manufactured products. The bio-inspiration can be triggered either by direct observation of an art design professional or captured by engineering designer using 3D digitizing techniques to obtain surficial information. An art design professional often create a conceptual design in the form of 2D sketch while engineering method leads to a point cloud in 3D. Both ways have limitation in that art design professional are lack of knowledge to build final physical product from 2D sketch and engineering designer's 3D point clouds are poor in aesthetic beauty [12]. This is an important point that should be paid attention to in the art design teaching. This paper also proposed a methodology for innovative product design from nature with the focus on realizing of a practical coupling of aesthetic intents and geometrical characteristics, exploring the interactions between designers and nature systems in product design from nature (PDN) in digital art design teaching. The discussions and investigations have been presented for the methods/technologies involved in the proposed methodology. It is believed that this methodology would considerably reduce the lead time of the innovative product design and development from nature at low cost and can also improve interactive and efficiency in the course of digital art design teaching.
4. CONCLUSION

With the development of computer technology and network communication technology in the field of education, the development and research of e-education are gradually being put on the agenda. China’s investment in e-education is doubling every year, with the development in the past decades, e-education in China have achieved fruitful results at all levels. However, the research about the level assessment of e-education and its future development prediction is so little. In order to assess e-education development level better, to master basic education, higher education and vocational e-education present development situation of every area in China generally, to forecast the development direction and trend of e-education in China with science, e-education development has been established as an important subject by the Ministry of education. The "E-education Strategic Research Base (Central China)" in the National Engineering Research Centre For e-Learning of Central China Normal University was formally agreed to establish by the Ministry of Education in March2011, which marks that the e-education in China has entered into a higher platform and the development of e-education is moving from the stage of "application" to the stage of "fusion" and "innovation", officially entering the stage of standardization, specialization, and institutionalization. Based on this background, the design and development of the e-education basic database platform is focused in this paper, aiming to establish an open platform combining a variety of functions including information dissemination about domestic and foreign e-education, documentation download, data visualization, automatic assessment and prediction of the level of e-education, meeting the needs of different users. In this paper, it introduces the B/S three-tier architecture and working principles used in this system. The introduction on key technologies refers to site configuration and operates class. Then, parts of functions and some key implementation procedure in platform will be showed. In the end of paper, software testing and testing results will be given.

REFERENCES


