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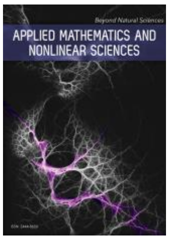

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Multimedia Delivery and Teaching Innovation of Civic Value in Art Education in the Digital Media Era

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Abstract

The rapid development of information technology and multimedia education in today's world has led to important changes in the delivery of ideological values in the process of art education. In this paper, according to the form of multimedia presentation of knowledge, a multimedia learning cognitive model is used to study the process of multimedia transmission of Civic and political values. A diverse and efficient recommendation algorithm is proposed, and a recommendation system for Civics and Politics courses is constructed based on the algorithm. The method mines the set of high-efficiency items related to the relationship between courses and categories through a conceptual hierarchical tree and introduces a diversity upper bound function to optimize the mining process. Thus, rules are efficiently generated in the efficiently used generalized itemsets. A collaborative filtering algorithm between users and course types is used to find the neighbors that best match the target users. The results show that the four indicators of this paper's recommender system are better than other recommender methods. The F-measure of this paper's system is 0.45, which indicates that this paper's method can produce the best recommendation effect of the Civics courses. The students in the process of art education can get the Civics course recommendation that is more suitable for them, which improves the efficiency of the Civics value transmission among students.

Keywords: Multimedia technology; Efficient Use Algorithm; Collaborative Filtering Algorithm; Civics Course Recommendation; Art Education.
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1 Introduction

Modern digital media art education includes many fields, such as computer, design aesthetics, network media, broadcasting, visual communication, and so on, which can be regarded as a composite discipline that integrates many specialties into one. In recent years, the development of digital media art has had a great impact on the computer, publishing, entertainment, service, and other industries and has also caused a great impact on the teaching and education mode of traditional college art and design talents [1-2]. The discipline of digital media art is a kind of comprehensive cross-art profession that contains technology and art. Not only has the characteristics of theoretical knowledge, but it also has the characteristics of practical knowledge, which needs to enhance the practical ability of the students in the learning of theoretical knowledge and strengthen the student's ability to solve difficulties and problems. The integration of digital technology and information and the change in technology media will also lead to a new teaching mode combining digital technology, art media, and art content to become the central idea and guiding principle of digital media art teaching. How to use it to stimulate students' thinking, innovation, and ability to think about problems in the process of teaching new media art is what the current teaching needs to think about [3-4].

The public art education courses in colleges and universities have universal demonstration and wide recognition, and the integration of course ideology and politics into the teaching of public art professional courses has positive practical significance for colleges and universities to adhere to the direction of socialist schooling, realize the teaching goal of establishing morality and enhancing the quality of talent cultivation [5]. The establishment of any discipline has its scientific and ideological as well as practical feasibility and needs to meet the needs of realistic development. The basis for the construction of the ideological and political collaboration and innovation system of public art education courses in colleges and universities is to ensure the scientific nature of the teaching of public art courses. Only by realizing the scientific nature of teaching can the ideological nature of teaching be further realized. If there is a lack of ideology, the teaching will be empty and lackluster. In the construction of the ideology of public art education courses in colleges and universities, ideology and scientificity are both equally important and mutually reinforcing, and they are two inseparable parts [6]. Only by integrating ideology into the teaching of public art education courses can we increase the added value of disciplinary education.

Tavin, K et al. reviewed the origins of digital arts education as well as the potential, strengths, and weaknesses of digital arts education in the present day, encouraging researchers to explore the future and development of the Internet's digital technologies combined with arts education [7]. Heydon, R et al. examined the practical manifestations of the introduction of digital media technology into intergenerational art classrooms and found that digital media technology integrates technological tools and resources in the art classroom, enhances the effectiveness of art teaching and learning, and popularizes and promotes art education by fostering a sense of achievement among students and integrating intergenerational identity measures [8]. Lemon, N et al. talked about the importance of art teachers' self-efficacy for teaching behaviors, instructional guidance, and perceptions of teaching in the context of digital media technology and discussed it in detail with real-life examples [9]. Hobbs, R et al. assessed teachers' digital media literacy and how to integrate the classroom with mass media and popular culture, concluding that targeted training and cognitive remediation are needed based on teachers' characteristics as well as beliefs [10]. Ma, H et al. conceptualized a hybrid digital media teaching framework with mobile Internet technology as the underlying logic, and based on the teaching feedback and comparative analysis, pointed out that the teaching model effectively improved students' learning and developed their key competencies, which was unanimously recognized by teachers and students [11]. Kucirkova, N. describes the uses of digitized books, clarifies that digitized books can enrich the teaching classroom with certain language arts to stimulate students' interest, and concludes with some recommendations for classroom digitized touchscreen practices based on a fivedimensional analytical framework [12]. Ulger, K explored the practice of PBL learning methods in higher education visual arts programs and concluded that PBL learning strategies enhance students' non-routine problem-solving skills by reinforcing their creative thinking as well as maintaining uncertainty [13]. Li, Q et al. describe the development of an online model for performing arts education in the context of the epidemic, noting that the model initiated both webinars and an innovative performance program to provide students with opportunities for cognitive engagement [14]. Wang, Y used a questionnaire survey method to examine how Civic Education affects the students' psychological performance, and through the analysis of the data information collected from the questionnaire survey, it was learned that Civic Education alleviates the students' psychological pressure and psychological problems to a certain extent, which emphasizes the importance for colleges and universities to pay attention to the role of the Civic Education in intervening in the hearts of the students [15]. Han, W attempted to introduce information technology into students' ideological education as well as students' management and formulated a detailed implementation plan through the comparison of teaching practice, verified the proposed information technology teaching program, which effectively improved students' IPE as well as the efficiency of students' management [16]. Kuttner, P. J reveals the role of arts education as not only fostering the basic knowledge and skills of artistic creation but also as beneficial to young people in setting positive goals for cultural participation, and argues that considering arts education as part of civic education facilitates the socio-political practice of the arts and promotes dialogues about arts participation in democratic social change [17]. Pais, A. et al. discuss the current state of development of global citizenship education and argue that it plays a role in helping critical democratic discourse and neoautonomist discourse to coexist [18].

Based on the multimedia learning theory, this paper proposes a cognitive model of multimedia learning that delivers the value of civics and politics in the form of text and pictures. An efficient diversity-based recommendation algorithm is used to construct a recommendation system for Civics courses. Local and global upper bound functions predict the highest diversity scores of the current prefix and its expanded set, and the DHUGR is generated by the method of high-efficiency use of itemset grids. A user-category score matrix is constructed in the recommendation system of CF to analyze the user's preference for different Civics course resource categories. In addition, a data cleaning operation was performed on the course dataset before loading it into the platform. The platform developed in this paper and the recommendation system use socket programming to realize data exchange through TCP protocol, and the platform calls the recommendation system through the service layer to realize the recommendation of the course Civics resources.

2 Multimedia to convey the value of civics

2.1 Multimedia classification

Media is the carrier of information. Information can only be expressed through one or more forms of media, such as books. The content of knowledge is expressed through text, graphics, tables, and other forms. These words, graphics, and tables are the carriers of knowledge content, which is media.

Regarding the classification of multimedia, different scholars from different perspectives have provided a variety of categorizations, which represent the following two main points.

The media for presenting knowledge in multimedia learning include two categories: words and pictures. Words can be printed and spoken, while pictures can be static and dynamic.

The multimedia field is a new field that stands out from the computer and television fields. In the field of multimedia, there are four major categories based on the form of media used to convey information and present knowledge content: diagrams, text, sound, and images. Diagram refers to still diagrams, including graphics and still images. Text refers to any text, including title text and explanatory text. Sound refers to sound, including narration, background music, and sound effects. Image refers to moving pictures, including animation and motion pictures.

In this paper, for the sake of research needs, according to the function of media presenting knowledge and the accuracy and artistic expression of presenting knowledge, the media are categorized into text, picture, sound, and animation from the perspective of multimedia pictures.

According to the presentation function of each media, this paper divides ten specific media forms into three categories: the first category is the media that transmit knowledge information, including text, pictures that transmit knowledge information, animation, and video that transmit knowledge information; the second category, the decorative media, including decorative elements, i.e., decorative pictures and decorative animation, and the background elements, i.e., pictures that act as the background and background music; the third category, the media that cooperate with other accessories to present knowledge content, including narration, sound, and animation; and the third category, the media that cooperate with other supporting bodies to present knowledge content. The third category is media that cooperate with other accessories to present knowledge content, including narration and audio.

2.2 Forms of Multimedia Presentation of Civic Values

From the perspective of multimedia pictures, according to the media combination, the form of multimedia presentation of knowledge can be divided into two kinds: the form of single media presentation of knowledge and the form of media with the presentation of knowledge. A single media presentation includes text, pictures, sound, animation, and video. The forms of media collocation include two media collocations, three media collocations, four media collocations, and five media collocations.

Art is a social philosophy that reflects social life and expresses the author's thoughts and feelings through image shaping and is a source of creativity and methods. As can be seen from the definition, art is the use of creative ways and methods of image reshaping and shaping, giving the image the sense of art; at the same time, it will change the original, inherent form, it will cause the image of the indistinguishable, unclear, and then cause a certain degree of fuzzy feeling. The strong artistic nature of things' shapes will cause ambiguity, but not all ambiguity will lead to a sense of art.

The accuracy and artistry of multimedia presentations of knowledge sometimes conflict. Accuracy includes correctness and standardization, while artistry involves reshaping the image through creative ways and means. Giving things artistic and technical processing breaks the original shape of things, resulting in new changes and sensory stimulation. By contrasting sensory stimuli, the audience can enjoy the beauty of things. However, at the same time as bringing audiences new feelings, breaking the norm and reducing the normality of the shape of things can even affect the correctness of the presentation of things. Therefore, the artistry of shaping things will affect the accuracy of the presentation of things, and different degrees of artistry will affect the accuracy of the presentation of things to different degrees, some of which will affect the identification of things and even cause scientific errors. However, the lack of accuracy in the presentation of the form of a thing may also be due to violations of scientific accuracy and have nothing to do with artistic shaping.

2.3 Cognitive Modeling of Multimedia Learning

Multimedia learning theory believes that "multimedia information designed in accordance with the way the human mind works is more likely to produce meaningful learning than multimedia information not designed in accordance with the way the human mind works." based on the multimedia learning theory, the cognitive theory of multimedia learning has three assumptions, five steps, the multimedia cognitive model, and the seven principles of multimedia design. The cognitive theory of multimedia learning includes three assumptions, five steps, a multimedia cognitive model, and seven principles of multimedia design.

The three assumptions of the cognitive theory of multimedia learning:

1) Dual-channel hypothesis, which means that the channels for human beings to process information include two independent channels for visual and auditory information.

2) Limited capacity assumption, meaning that human cognitive processing needs to consume cognitive resources, out of the human cognitive capacity (mainly working memory capacity) is limited, so processing too much information at the same time will be a shortage of cognitive resources, resulting in cognitive overload phenomenon.

3) The active processing hypothesis refers to the fact that human beings will actively participate in information processing when faced with materials that establish a consistent mental representation of their own experience, which is mainly manifested in the active formation of attention, active incorporation of new information into the cognitive structure, and active integration of new information with the cognitive structure.

The cognitive model of multimedia learning is shown in Figure 1. The cognitive model of multimedia learning graphically reflects the principle of information processing when human beings engage in multimedia learning. According to the cognitive model of multimedia learning, multimedia presents knowledge information in the form of text and pictures, and human beings first incorporate the text and pictures into the sensory memory center through the auditory channel ears and the visual channel eyes. Then, visual and auditory representations in the sensory memory center are selected.

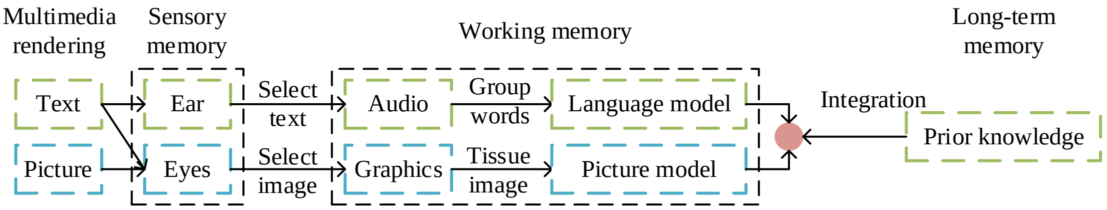

Figure 1. Mayer's cognitive theoretical model of multimedia learning

3 Diversity-based high-performance recommendation algorithms

3.1 Highly useful association rules for diversity across hierarchies

3.1.1 Description of the problem

1Despite the individual items in the set $u(GX) \geq min\_util$, their diversity is 0. To solve this problem, it is proposed to assign corresponding hierarchical weights to each generalized item node $(i \in GI)$. The specific hierarchical structure is shown in Fig. 2.

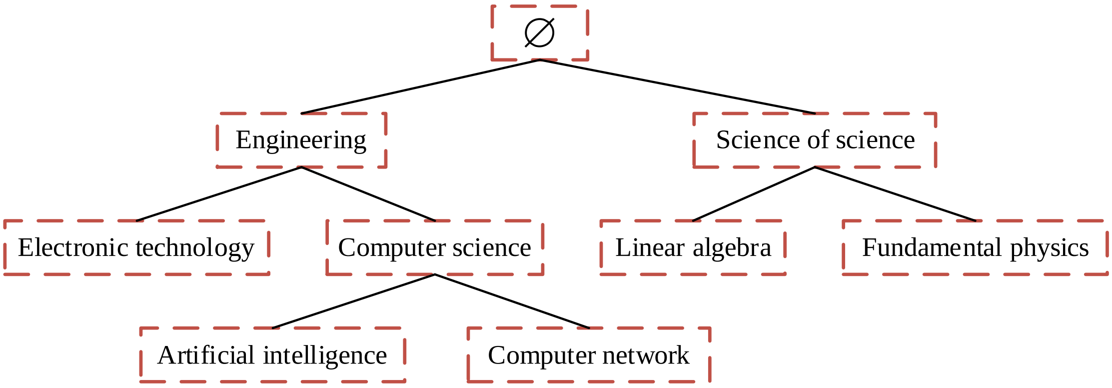

Figure 2. Curriculum concept hierarchy

Definition 1 (Node Hierarchical Weights) For a given conceptual hierarchy τ, assume h is the maximum height of τ and L is the hierarchical height of the current node n satisfying $1 \le L < (h-1)$, and $h \ne \{0,1\}$. The hierarchical weights of node n are defined as follows:

$$c(n) = \frac{2 \times (h - L(n))}{(h-1) \times h} \tag{1}$$

For leaf nodes, define their weights as the hierarchical weights of their direct parents. For generalized nodes, define their weights as the weights of their hierarchy:

$$c(n,\tau) = \begin{cases} c(pather(n))) & n \in I \\ c(n) & n \in GI \end{cases} \tag{2}$$

Definition 2 (Sum of itemset path weights) For itemset I, the sum of its itemset path weights is the sum of the weights of the paths on which all the elements i in the set are located. The itemset path weight sum is defined as:

$$TPW(I,\tau) = \sum_{i \in I} \sum_{n \in path(i)} c(n,\tau) \tag{3}$$

Definition 3 (Item Set Path Concatenation Weights) In Concept Level τ, the concatenation of item set paths is defined as:

$$UPW(I,\tau) = \sum_{n \in \bigcup_{i \in I} path(i)} c(n,\tau) \tag{4}$$

Definition 4 (Overall Weight of Conceptual Hierarchy τ) The sum of the hierarchical weights of all non-leaf nodes in Conceptual Hierarchy τ as they represent the diversity weight of the whole τ. The overall weight of the concept level τ is defined as:

$$OPW(\tau) = \sum_{n \in GI} c(n) \tag{5}$$

Definition 5 (Local diversity fraction) of the local diversity formula:

$$Ldiv(I,\tau)=\frac{\sum_{i\in I}w(i,\tau)}{\sum_{i\in I}\sum_{x\in \mathrm{Cov}(i,\tau)}w(x,\tau)} \tag{6}$$

To solve this problem, the local diversity score is redefined, and the modified local diversity score formula is as follows:

$$ILdiv(I,\tau)=\frac{\sum_{n=1}c(n,\tau)}{\sum_{i=1}\sum_{n=1}c(n,\tau)\times(1-\beta\times\Psi_{Siblingr(s)})} \tag{7}$$

Definition 6 (Global Diversity Score) The sum of the concatenation weights of the item paths covered in itemset I is defined as the diversity score for concept level τ:

$$IGdiv(I,\tau)=\frac{\sum_{n\in\bigcup_{n\in I}posh(i)}c(n,\tau)}{\sum_{n\in GI}c(n)} \tag{8}$$

Definition 7 (Diversity Reconciling Mean) Diversity Reconciling Mean DS is defined as:

$$DS(I,\tau)=2\times\frac{ILdiv(I,\tau)\times IGdiv(I,\tau)}{ILdiv(I,\tau)+IGdiv(I,\tau)} \tag{9}$$

3.1.2 Upper limit function

Local and global upper bound functions are proposed to predict the highest diversity score for the current prefix and its expanded set [19], with the aim of efficiently narrowing down the search. When the expanded set of a given itemset is less than the diversity threshold, then this item, as well as all its supersets, do not constitute DHUGIs.

Definition 8 (Local Diversity Upper Score) Let $E(I)$ be an expandable finite set of itemsets I. The upper score of local diversity is given here as follows.

$$LUB(I,\tau)=\frac{\sum_{n\in\bigcup_{a\in I}path(i)}c(n,\tau)+\sum_{n\in\bigcup_{a\in I,I,}path(c)}c(n)}{\sum_{i\in I}\sum_{n\in Path(i)}c(n,\tau)\times(1-\beta\times\Psi_{Sihlings(n)})+\sum_{n\in\bigcup_{a\in I,I,}path(c)}c(n)} \tag{10}$$

Where $\sum_{n\in\bigcup_{c_iL(t)}puh(e)}c(n)$ is the sum of the path concatenation weights of the expandable set of itemsets I, and $LUB(I,\tau)$ serves as an upper bound on local diversity.

d is the concatenated weight of the expandable e. Since the concatenated weight of paths in $(I\bigcup e)$ is a subset of all the expanded weights, the numerator of $ILdiv(I\bigcup e,\tau)$ must be smaller than the numerator of $LUB(I,\tau)$, leading to $d<c$. Next, by comparing their differences:

$$
\begin{aligned}
LUB(I,\tau)-ILdiv(I\bigcup e,\tau) &= \frac{a+c}{b+c}-\frac{a+d}{b+d} \\
&= \frac{(a+c)(b+d)-(b+c)(a+d)}{(b+c)(b+d)} \\
&= \frac{ad+bc-bd-ac}{(b+c)(b+d)} \\
&= \frac{(c-d)(b-a)}{(b+c)(b+d)}
\end{aligned} \tag{11}
$$

For each itemset I and its extended itemset E, since the weights of the set of concepts are all non-negative, the conclusion $ILdiv(I\cup e,\tau)\le LUB(I,\tau)$ can be drawn only if $(b-a)>0$. To make $b>a$, it is necessary to set the appropriate value of C β such that $LUB(I,\tau)$ becomes a diverse local upper bound function.

Definition 9 (Global Diversity Upper Score) the global diversity upper score is defined as follows:

$$
GUB(I,\tau)=\frac{\sum_{n\in\bigcup_{a\in I} path(i)} c(n,\tau)+\sum_{p\in\bigcup_{c\in K(J)} path(e)} c(p)}{\sum_{i\in GI} c(p)} \tag{12}
$$

Definition 10 (Diversity Upper Limit Reconciliation Function) is defined as follows:

$$
DUB(I,\tau)=2\times\frac{LUB(I,\tau)\times GUB(I,\tau)}{LUB(I,\tau)+GUB(I,\tau)} \tag{13}
$$

Let the minimum threshold of diversity be min_div, the DS-score of itemset I be $DS(I)$, $E(I)$ be the possible expansion of itemset 7, and $S\in Desc(E(I),\tau)$ denote the set of all subitems of $E(I)$. If $DS(I\bigcup E)<min_d iv$, then for any subset of itemsets S, $DS(I\bigcup S)$ also does not satisfy the minimum threshold.

3.1.3 DCHUPM Algorithm Implementation

Based on the previous discussion, a cross-level high-utility mining algorithm for diversity called DCHUPM is outlined.

Algorithm DCHUPM:

Input: sequence database SDB, concept hierarchy τ, itemset prefixes $prefix$, prefix utility table pUL, prefix expansion set utility list ULs, minimum utility threshold min_util, minimum diversity threshold 7

Output: diversity generalized high utility itemsets DHUGIs.

3.1.4 Efficient generation of DHUGR from itemsets grids

The DHUGR is generated by efficiently using the itemset lattice, and Fig. 3 shows the process of constructing a HUIL from which the HUGR is generated. Briefly, the main steps of the algorithm are as follows: first, construct an efficiently used generalized itemset lattice. Each node contains an itemset, and the utility of each item corresponds to each item in the itemset. When dealing with the child nodes of the root node, first check whether the node has been traversed or not and queue up its child nodes if it has not been traversed. When the queue is non-empty, the first node is out of the queue, and if conf(8→3)≤min_conf, the processing continues with the remaining nodes in the queue. If conf(8→3)≥min_conf, then it will be output as DHUGR. at this point, the queue is updated to Queue={{8, 7},{8, 3, 1},{8, 3, 6}}, and Marknode is updated to {{8, 3},{8, 7},{8, 3, 1},{8, 3, 6}}. Then queue out {8, 7} from Queue={{8, 3, 1},{8, 3, 6}} and calculate the value of conf({8→7}), at this point {8, 7} has no child nodes and continue to queue out the remaining nodes of the queue. When the queue is empty, call the recursive function to use {8, 3} as an entry point and continue to add the child nodes of {8, 3} to the queue. After completing the processing of root node 8, then recursively calculate the remaining child nodes of the root node.

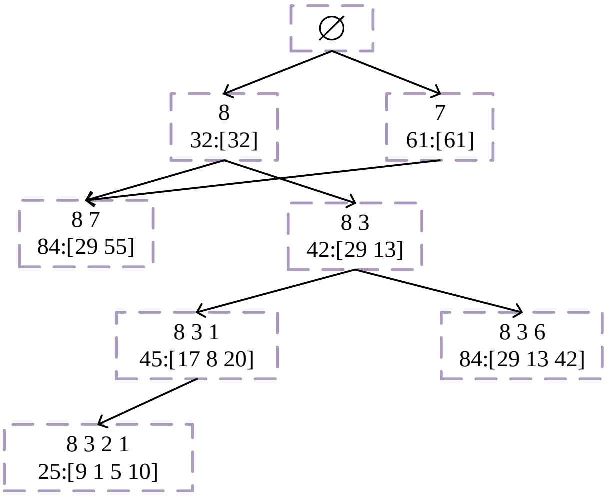

Figure 3. Efficient itemset lattice method

3.2 User-Category Collaborative Algorithm

Definition 11 (Category Score to which the course belongs) the weight $w_{a,r}$ of each category c on the path from the Civics course a to the root node r is defined as:

$$w_{a,r} = e^{(-\xi \times (h_{a,c}-1))} \tag{14}$$

Where $h_{a,c}$ represents the height of course a to category c, and $w_a, r=1$ is obtained when $h_{a,c}=1$. ξ is an adjustable parameter $0<\xi\le 1$ that controls the speed of the decay function. As the height, of course a increases, weight $w_{a,r}$ will decrease exponentially. Finally, the weights obtained are used to update the score of the category in which the user watches the course.

Definition 12 (User-Course Category Score Matrix) consists of a two-dimensional matrix that describes the relationship between users and categories. Where each row represents a user, and each column represents a course category.

Definition 13 (User Similarity) This definition is used to calculate the similarity of a target user to other users if they have taken a certain course category. In this paper, cosine similarity is used to calculate the similarity between two users [20]. Take user u as an example. For his neighbor v, the cosine similarity method is used to calculate the similarity:

$$W_{(u,c)(v,c)} = \frac{Q(u,c) \cdot Q(v,c)}{\sqrt{\sum_{i=1}^{c} Q(u_i,c)^2} \cdot \sqrt{\sum_{i=1}^{c} Q(v_i,c)^2}} \tag{15}$$

Existing association rule systems aim to identify rules with high confidence support [21] in the shape of $x \to Y$. Confidence reflects the degree of correlation between X and Y, while support reflects the prevalence of correlation between X and Y. Based on the satisfaction of the antecedent X, ARS calculates the probability of occurrence of the consequent Y, thus identifying the relevant rules based on the purchase history of the target user and generating a recommendation list based on the consequences of these rules. However, the DCHUPM-CF method proposed in this paper is different from the traditional ARS in that it not only mines the common itemsets but also recognizes the generalized items, thus mining the rules more comprehensively.

In this paper, the CF method is adopted. First, we construct the similarity score matrix between target students and ideological and political categories and calculate the similarity between target students and neighboring students who are interested in “ideological and political”. Then, the courses under the category of “ideology and politics” that these neighboring students like are recommended to the target students.

Based on the above, the DCHUPM-CF recommendation strategy is proposed.

Algorithm DCHUPM-CF:

Input: mapping relationship between types and items $ParentToChild$, target student sequence S_i, diversity generalized high utility rule DHUGR, generalized item GI.

Output: recommended Civics courses suitable for target users C_k.

4 Recommendation System for Civics Courses Based on Efficient Usage Algorithm

4.1 Platform Architecture Design

1) Logical Architecture

This platform is a combination of the curriculum ideology platform, resource recommendation system, and database system, and the overall logical architecture is divided into three layers: the representation layer, the business layer, and the data layer.

The representation layer is mainly the front-end page, which is responsible for providing platform users with an interface display and showing operable functions through a graphical interactive interface.

The business layer is responsible for performing the relevant business functions of the platform.

The data layer mainly provides data access operations for the business layer. When the data layer receives the data access request from the business layer, the data access object will access the database according to the parameters and access types and return the operation result to the business layer for the next step.

The view layer provides interactive functions, the business layer provides execution logic, and the data layer provides access to data. The three layers collaborate to complete various functions of the platform.

2) Technical architecture

Technical architecture is a technical subdivision based on logical architecture, which includes a view layer, scheduling layer, service layer, recommendation system, and persistence layer.

4.2 Functional Module Design

The Civics Platform module for this course mainly consists of registration and login, personal center, likes and comments, resource uploading, resource recommendation, and platform management module.

1) Registration and Login

The registration and login module provides users and administrators with the functions of registration and login and login keeping.

2) Likes and Comments

After perfecting their profile information, the logged-in users can act liking and comment when browsing the resources related to course ideology and politics on the platform and get a pop-up window prompt after the operation is successful.

3) Resource Upload

The user’s personal center page provides the function of resource uploading, and three functional entrances are designed according to the types of the platform’s Civics resources: uploading cases of course Civics, uploading Civics materials, and posting teaching topics.

4) Personal Center

The personal center page provides ordinary users with the functions of modifying personal data, viewing the records of likes and comments, publishing Civics course resources, notifying messages, and logging out.

5) Platform Management

The platform provides platform management functions for administrators. Administrators can log in with their administrator accounts to access the management center page, where they can manage user login, user profile, user notifications, resource content, likes and comments, and platform announcements.

6) Resource Recommendation

The platform provides users with a recommendation service for literature resources related to ideology and politics. Teacher users can use the recommendation function of the platform through the recommendation function entrance on the resource homepage, and the logical flow of the recommendation function is shown in Fig. 4.

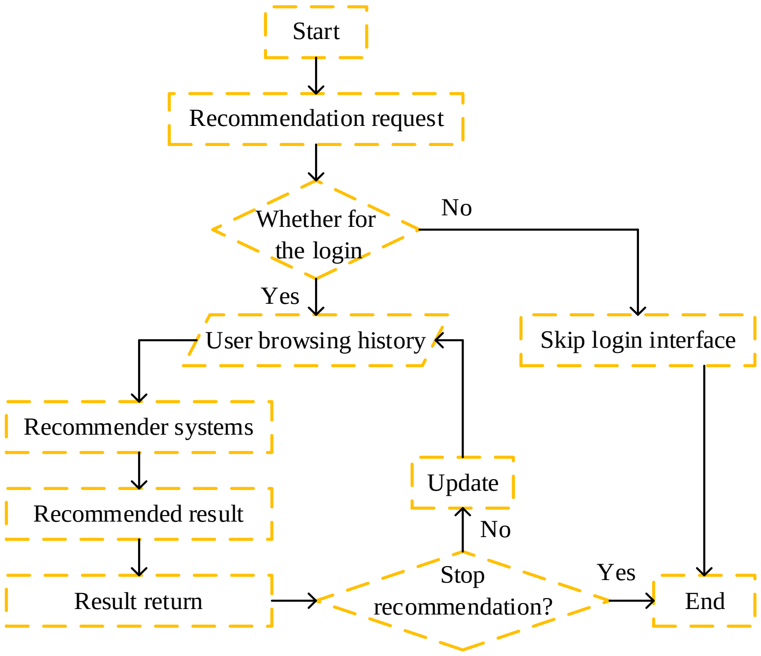

Figure 4. Logical flowchart of the recommendation function

4.3 Database design

After requirements analysis, architecture design, and functional design, the overall design of the platform is basically determined. The purpose of this subsection is to analyze the entity relationships in the platform and finish designing the platform database.

1) Database E-R Modeling

The key to database design is to consider the relationship between entities and attributes, entities and entities clearly. Combing the database entity-relationship model is the first step of database design, and the detailed design of the subsequent database needs the entity-relationship model as support.

According to the platform requirements analysis and functional module design, the main entities that can be abstracted are users, administrators, documents, cases, materials, and announcements.

2) Database table structure

This subsection will be based on the database E-R model design, the entities involved in its field name, field type, length, and description for detailed design.

4.4 Recommendation of Civics Courses Based on Highly Usable Algorithms

4.4.1 Data sets and data cleaning

The dataset used by the platform for recommendation is the course Civics resources dataset. In order to demonstrate the recommendation effect of the recommendation algorithm proposed in this paper in the platform, the course Civics literature information dataset in the laboratory server is used here, and the following data cleaning operations are carried out on the dataset before loading it into the platform.

1) Missing value processing: detecting and identifying samples with missing values in the dataset, deleting samples with missing key information, and interpolating and filling samples with missing non-key information.

2) Outlier processing: detect and process the outliers in the data set, delete the samples with abnormal key information, and replace the data with the samples with abnormal non-key information.

3) Duplicate value processing: detect and delete duplicate samples in the data set to ensure the uniqueness and consistency of the data.

4) Data type conversion: detect and identify the data type of each sample in the dataset and convert incorrect or inconsistent data types.

4.4.2 Recommended system integration

The platform system developed in this paper and the recommendation system use socket programming to realize data exchange through the TCP protocol, and the recommendation system can be deployed in the same server with the platform system or deployed to other servers in the local area network that have the CUDA computing capability, which not only retains the ecological advantages of each of the two programming languages, but also makes the platform more flexible in its deployment, and improves the platform’s overall Fault Tolerance

4.4.3 Civics Course Recommendation Implementation

In the actual application, the platform calls the recommendation system through the service layer to realize the recommendations for resources in courses and politics.

The recommender system follows the platform system to start, uses the data set of the curriculum resources in the platform to carry out pre-training, and the parameters of the trained model are saved locally on the server in the form of h5 files. After loading the deep reinforcement learning recommendation model into the memory, the recommendation system transfers to the listening state and waits for the recommendation request from the platform, and when it receives the recommendation request, the model loads the decision model parameters in the form of an h5 file and then performs the recommendation action. The recommendation function entrance is on the right side of the resource area of the platform, and users can click on it to use the recommendation service of the platform while logged in.

1) When the user initiates a recommendation request, the view layer first sends the user information, currently browsed resource information, and user evaluation package to the scheduling layer.

2) After the scheduling layer receives the recommendation request, it obtains the user information, resource information, and user rating from the request scope and submits this information as parameters to the recommendation business agent object in the service layer.

3) The recommendation business object is not responsible for the actual recommendation task but establishes a TCP link with the recommendation system in the server, sends the recommendation request and parameters to the recommendation system, and waits for the recommendation result.

4) The recommender system, after receiving the recommendation request, will call the high utility algorithm recommendation model to generate a single-item recommendation for the user based on the current recommendation strategy. The recommendation result will be returned in the form of the item code. The model will be slightly updated according to the interaction records of the recommendation strategy after the end of the single recommendation to adapt to the user's changing interests and preferences.

5) The service layer business object calls the persistence layer data access object according to the returned item code, queries the resource in the database, generates the recommendation result, returns the result to the scheduling layer, and then the scheduling layer sends the recommendation result to the view layer to present to the user.

5 Analysis of innovative recommender systems

In order to verify the effectiveness of the algorithm recommendation in this paper, tests are conducted on the whole Civics course dataset and Movielens 100K dataset, and the average of the accuracy, diversity, novelty, and the comprehensive evaluation index F-measure of the recommendation results of all target users are calculated. The relevant calculation formulas are as follows.

1) Accuracy rate:

$$Precision = \frac{\sum_{s\in U}\left|R_s \cap T_s\right|}{\sum_{s\in U}\left|R_s\right|} \tag{16}$$

Where U denotes the set of all users, $\left|R_u\right|$ denotes the length of the recommendation list recommended to user u, and T_u denotes the history of items that have been selected by user u.

2) Diversity:

$$Diversity = \frac{\sum_{i\in R, j\in R, j\neq j}(1-sim(i,j))}{|R_s|(|R_s|-1)} \tag{17}$$

Where $\left|R_u\right|$ denotes the length of the recommendation list recommended to user u, and $sim(i,j)$ is the similarity between items i and j in the recommendation list.

3) Novelty:

$$Novelty = \frac{\sum_{i \in R} \log_2 \left(\frac{n}{\lambda_i} \right)}{|R_u|} \tag{18}$$

Where $|R_u|$ indicates the length of the recommendation list recommended to user u, λ_i indicates the number of times item i in the list has been evaluated, and n is a custom parameter used to set a reasonable threshold for the number of evaluations.

In addition, in order to compare the recommendation effect more intuitively, set the comprehensive evaluation index $F-measure$, according to the recommendation requirements, the larger the value of $F-measure$ means that the recommendation effect is better:

$$F-measure = \frac{3 \times Precision \times Diversity \times Novelty}{Precision + Diversity + Novelty} \tag{19}$$

Figure 5 shows the comparison between the accuracy, diversity, novelty, and the comprehensive evaluation metric F-measure of different algorithms on the Movielens 100K dataset. As can be seen from Fig. 5, for the Movielens 100K dataset, in terms of the accuracy of recommendation results, the accuracy of this paper's algorithm is 0.33, which is slightly lower than that of MORS and TSPR but better than that of UserCF and MF. In terms of the diversity and novelty of the recommendation results, this paper's algorithm shows a better performance than the other comparative algorithms, and the diversity of recommendation results generated by User CF is better than that of MF, but in terms of novelty, this paper's algorithm is better than the other comparative algorithms. Recommendation results are better than MF in terms of diversity but worse than MF in terms of novelty.

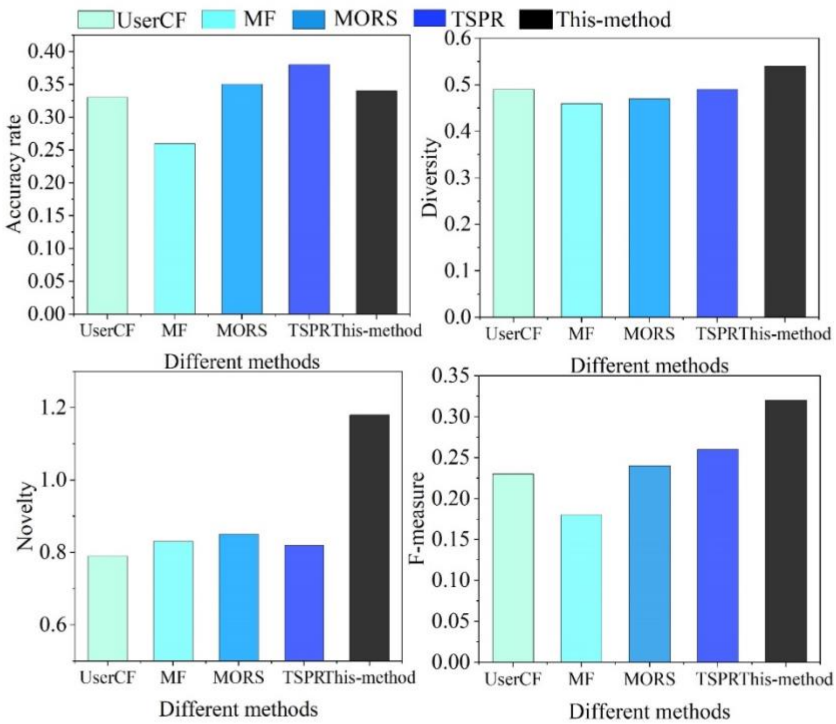

Figure 5. Different algorithms are compared in the movie lens 100k data set

To more intuitively measure the effectiveness of the recommendation effect of different algorithms, Fig. 6 shows the comparison between the accuracy, diversity, novelty, and the comprehensive evaluation index F-measure of different algorithms on the Civics course dataset. As can be seen in Fig. 6, for the course dataset, this paper's algorithm achieves the best performance in terms of the accuracy index, and the performance of UserCF is the worst. In terms of the diversity of recommendation lists, this paper's algorithm performs slightly better than UserCF, MF, and TSPR. In terms of novelty, this paper's algorithm achieves better results with a higher novelty value than other algorithms, which achieves an improvement of novelty without sacrificing accuracy. Finally, combined with the comprehensive evaluation index F-measure of recommendation, it can be seen that this paper's algorithm has the largest F-measure of 0.45, which is able to produce a recommendation list with better recommendation effect and optimize the three conflicting objectives of accuracy, diversity and novelty at the same time, so that the generated recommendation list can take a larger value in these three dimensions, and optimize the list of candidate recommendations, thereby Providing users with more personalized and diversified choices of ideological courses, which plays an irreplaceable role in the transmission of the ideological value of art education.

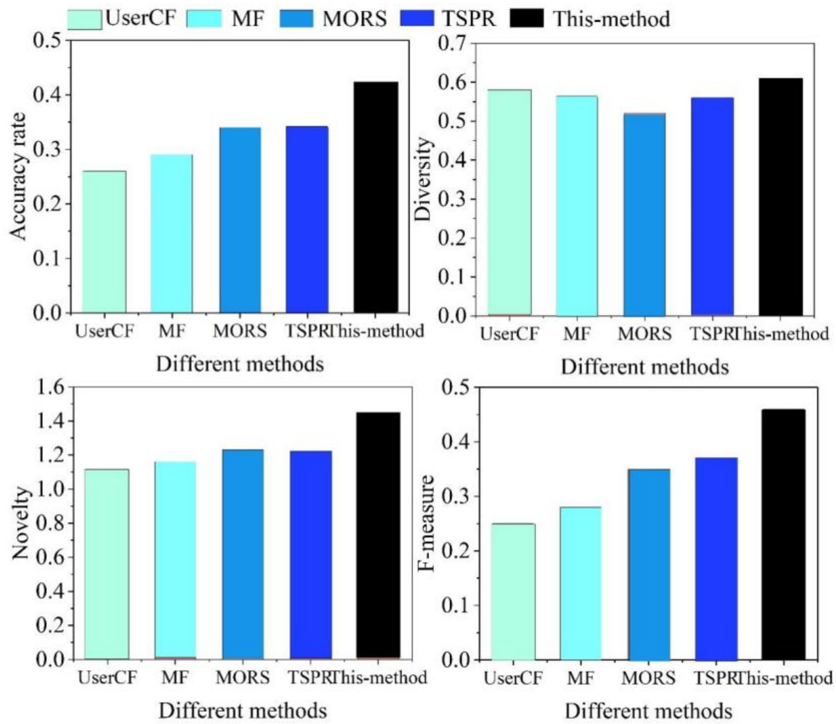

Figure 6. Different algorithms are compared in the course data set

6 Analysis of the effectiveness of the multimedia transmission of the value of art education and ideology

6.1 Survey objectives and instrument design

Research objective: to study the effectiveness of multimedia technology applied to ideological and political classroom teaching in art colleges, that is to say after the application of multimedia technology in the process of ideological and political teaching enhances the students' interest in the course and at the same time, the knowledge and ability are improved to a certain extent. Through the questionnaire survey and interviews, we find out the problems in the application of multimedia technology in the teaching of ideological and political classrooms in art colleges and reduce the problem of inefficient application of multimedia technology. Ensure that the effectiveness of teaching ideological and political courses in art colleges is improved after the application of multimedia technology. The instrument design divides the questionnaire into two parts. The target of the survey is teachers and students using the questionnaire.

6.2 Statistics and analysis of survey data

Understanding the current situation of the use of multimedia technology in the ideological and political classroom of art colleges and universities and sorting out the main problems of multimedia technology application by teachers in the classroom, the author conducted a questionnaire survey and a field survey interview. Among the questionnaire survey, a total of 300 questionnaires were issued, and 300 valid questionnaires were retrieved, with a valid questionnaire rate of 100%. After the questionnaires were returned, SPSS22.0 software was used to count and analyze the data.

The students' answers to the question, "What kind of way do you want the teacher to explain the key points of classroom knowledge?" The answer to this question. As shown in Table 1, 6.7% of the students hoped that the traditional teaching mode could still be used so that they could learn to understand the definition of ideological and political knowledge according to the teacher's lectures. The use of multimedia in ideological and political classes to learn abstract concepts through colorful and intuitive forms was hoped for by 93.3% of the students. This indicates that multimedia has some advantages in explaining abstract content, which most people recognize. A smaller number of students preferred the teacher's oral presentation and writing on the board.

Table 1. Students' hopes for the main teaching methods of the classroom

Select item	Selection number	Proportion/%
Mouth and board books	20	6.7
Multimedia courseware	140	46.7
Video and animation	108	36
Mind map	32	10.6

The students' answers to the question "What is the organization of the content of the multimedia courseware applied by your ideological and political science teacher?" were counted. The answers to this question. Teachers in the multimedia courseware content arrangement statistics as shown in Table 2, reflecting the ideological and political teachers in the classroom use of multimedia courseware content form, 71.7% of the teachers' multimedia courseware graphic and textual, detailed and appropriate, which indicates that teachers recognize the rich and varied multimedia teaching courseware can help students more efficiently grasp the knowledge, the total percentage of 28.3% of teachers think that multimedia courseware The total proportion of 28.3% of teachers think that the form of multimedia courseware is relatively single, the reason for this is its stereotypical impression of the traditional multimedia, for the modern application of multimedia technology cognition remains in the initial stage of understanding.

Table 2. Teachers apply the content form of multimedia courseware

Select item	Selection number	Proportion/%
Only content and title	11	3.7
Basically words	43	14.3
The text is equal and complementary	215	71.7
It is basically video and pictures	31	10.3

The students' answers to the question "In the ideological and political classroom of art colleges and universities where multimedia technology is used for teaching, what is the most attractive factor for you, and can the classroom with multimedia technology attract you?" were counted. The answers to this question. The students think that multimedia teaching has attractive factors of statistics, as shown in Table 3. From Table 3 can be seen that 31.4% of the students of multimedia teaching in the display of courseware and animation video of a variety of combinations expressed a liking and recognition, 25% of the students liked the courseware in the graphic and beautiful textual pictures, the total percentage of 20% of the students by the multimedia in the rich and colorful content of the attraction, 23.3% of the students 23.3% of the students think that the teachers' design ideas are more attractive, the above data show that multimedia technology enhances their interest in learning. Moreover, 96% of the students think that multimedia technology applied to the ideological and political classroom teaching in art colleges and universities can attract them to learn the subject of ideology and politics, which shows that multimedia technology enhances their interest in learning. For teachers, it is very important to collect suitable and rich multimedia materials in order to produce multimedia courses that attract students' interest. In addition, teachers' skillful design ideas for courseware and reasonable arrangement of materials can also enhance the effectiveness of multimedia applications. Moreover, finally, teachers should enhance the aesthetics of multimedia courseware so as to improve students' enthusiasm for learning.

Table 3. Attract students factor statistics

Question	Select item	Selection number	Proportion/%
The most attractive factor	The reasonable combination of courseware and flash	95	31.4
	Beautifully made	75	25
	The content is rich and colorful	60	20
	The way of explaining and designing ideas	70	23.3
Can you attract you	Can	288	96%
	Can't	12	4%

Art college curriculum civic politics to establish morality and nurture people as the fundamental goal, the highest level of education implicitly is to be able to let the value leadership with long-term development, the socialist core values into the students' outlook on life, social outlook, world outlook. This requires teachers, on the one hand, to be able to enrich the teaching source in professional curriculum education with strong political beliefs. On the other hand, they should be able to effectively combine teaching methods, clarify the curriculum arrangement, and awaken the souls of the students from their intrinsic needs. Generally speaking, the course of theoretical professional courses in art colleges and universities should be implemented from the four aspects of "guide", "reach", "pleasure," and "reason". Four aspects to implement. "Guide" is the mutual unity of professional theory courses and the elements of political thinking, the connotation and essence of the course of political thinking, requiring teachers to find the essence of the value of the theoretical course of the course of political thinking to lead, to explore the needs of the students, and to truly play the role of a guide. "Da" is the external extension of the course civic politics, using effective classroom methods and means to lead students' personal, professional, and patriotic spirit from the inside out. "Yi" is a process of exploring the effective unification of the professional theory course and the civic and political theory course, which really makes students feel the happy learning atmosphere of teaching and learning. "Reason" is to teach students to realize the way and discover the essential law of things, which is a comprehensive leap and effect of teaching and educating people. In order to explore the effect of transferring the value of Civics and Politics among students, we have counted the students' answers to the question: "In the Civics and Politics classroom where multimedia technology is used for teaching and in the Civics and Politics classroom where multimedia technology is not used for teaching, what is the rate of correctness of your classroom practice questions?" The answers to this question. The statistical results of the accuracy of the students' practice questions in the ideological and political classroom are shown in Table 4. From Table 4, it can be seen that before applying multimedia technology, the probability of students doing all the practice questions about the Civics and Politics course correctly is 7%, and after applying multimedia technology, the probability of students doing all the questions correctly is 15%, which is an increase of 8%. Moreover, the number of students who got only a small portion of the questions correct decreased by 41.3%. This shows that the transmission of the value of ideology in students is very effective, and the use of multimedia is an indispensable and colorful part of ideology education.

Table 4. Student Practice Rate Statistics

Select item	The number of people before the experiment	The previous number of experiments/%	The number of selected people after the experiment	The number of future generations/%
All right	21	7	45	15
Most of the right	88	29.3	148	49.3
Partly correct	45	15	85	28.3
There are only a few truths	146	48.7	22	7.4

7 Conclusion

With the development of information technology and multimedia technology, multimedia teaching has attracted widespread attention in the education sector, and this paper investigates the effect of multimedia in delivering the value of Civics and the innovation of teaching.

1) On the course dataset, the performance of this paper's algorithm is the best among several algorithms in terms of accuracy, diversity of recommendation lists, and novelty. Furthermore, this paper's algorithm has an F-measure of 0.45, making it the most effective among various methods. The algorithm successfully generates a list of the most effective Civics course recommendations, optimizes the list of candidate courses, and provides students in art colleges and universities with more personalized and diverse recommendations. This significantly contributes to the dissemination of Civics values in art education.

2) Multimedia has a certain advantage in the abstract content explanation, which is affirmed by 93.3% of the students. 71.7% of the teachers' multimedia courseware is rich in content, indicating their recognition that rich multimedia teaching materials can enhance students' understanding of civics and politics more effectively. 96% of students believe that the application of multimedia technology in the delivery of civics and politics values in art colleges and universities can stimulate their understanding and further study of the course, indicating the significant role that multimedia plays in delivering civics and politics values in art education. Learning this course shows that multimedia technology enhances their interest in the course. The probability of students getting all the practice questions in the Civics course correct is 7%, which is increased by 8% after using multimedia technology. The number of students who correctly answered a small portion of the questions decreased significantly. It shows that the transmission of civic values among students is excellent.

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