Chapter 60
Influencing Factor Analysis of College Students' Learning Interest in Specialized Courses by Rough Set Theory

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Abstract The learning interest plays an important role in college students' specialized course learning and teachers pay much attention to it in teaching activities. In this paper, first, a questionnaire survey is administered and related data collected; and then by using rough set theory the relationship between students' interest in specialized course and the influencing factors is analyzed; and when the data for importance degree of all the factors are known, theoretical foundation about how to improve students' interest in specialized course teaching activities is established. And with MyRS tool, it is concluded that teaching level of specialized courses is the most important to college students' learning interest.

Keywords Learning interest in specialized course · Teaching level of specialized courses · Rough set · MyRS tool

60.1 Introduction

Psychologists believe that interest is a favorable disposition towards acquiring knowledge. When the individual is learning in joy triggered by interest, this primary form of value concept, will generate a positive emotional experience, which plays significant role in promoting the individual's cognitive activities and gradually develops into an internal motivation of individual activity (Salas et al. 2009; Yang et al. 2006; Trimmel and Bachmann 2004). Physiologically, excitement aroused by interest can lead to excitement, which will increase amounts of

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glucagon in the blood and promote secretion of the thyroid. In this way, as a material basis for the improvement of the learning efficiency, the metabolism is accelerated, the mental power boosted and the learning stamina increased. Psychologically, it is generally thought that the generation of interest stems from cognitive surprise and emotional attraction. A surprise occurs when a concept similar to and associated with the past experience rises; but it cannot thoroughly assimilate the established cognitive structure; otherwise would trigger off conflict between curiosity and concept (Eisenberg et al. 2010).

From past to present, many world famous educators have noted the role of interest in teaching activities. Johann Amos Comenius, a Czech educationalist, pointed out in his *Didactica magna* that, "A good learning method should be motivating children to seek knowledge enjoyably and could encourage them to study with all possible ways. On the contrary, a way based on forcing children to learn would be greatly harmful to them" (Blair 2000). In light of the above, it is very important for senior college students to build up interest in learning specialized fundamental courses because interest is always contributing to an outstanding academic performance and a strengthening competence in engineering practice (Vaidyanathan 2011).

First, learning interest can improve the cognitive quality of specialized and professional knowledge. As interest is one of the important aspects of motive, learning is explicitly orientated. Second, this important source of motivation can generate awareness by internal driving force and its specific manifestation is the following: the broadened scope of attention, the increased persistence of attention, and the improved memory as well. As a matter of fact, learning interest in specialized course can bring about a positive emotional experience and to great extent, reduce fatigue. Third, once senior college students develop a passion for specialized knowledge whereby to form the positive knowledge-seeking desire, the desire will spark and ignite their learning interest in specialized courses. Inevitably, the delightful effect will make the students be in relaxed state and make them immerse in such contentment experience. Referring to the relevant literature in References (Shin t al. 2011; Peng et al. 2010; Shu and Chung 2009), by using Rough Set Theory and with the aid of MyRS tool, the importance degree indexes of various factors influencing college students' academic performance have been compared. As a result, it comes to a conclusion that the learning interest of the senior college students is the most active factor that influences their academic performance in specialized course learning.

60.2 The Rough Set Theory

The Rough Set Theory (RST) was proposed by Professor Pawlak in 1982. Owing to its multiple advantages, RST has been widely used in such fields like artificial intelligence, machine learning, knowledge acquisition, decision analysis, pattern recognition and so on. RST can be applied in handle the imprecise interclass

boundaries problems of "rough classification". The method philosophy is based on the assumption that an object must be affiliated with some information. And because of the very information, objects characterized by the same information are indiscernible. Correspondingly, the indiscernibility relation built in such way supplies a mathematic basis for the rough set theory. When a decision is made by using rough set theory, above all, the valuable information can be gathered from the given data set; and after data compression, reduction and analysis of attribute importance, a reasonable decision scheme is generated (Pawlak 1991).

Definition 1 (Cheng et al. 2011; Meng and Shi 2009) Assume that U is the universe of discourse, a nonempty finite set, and $R \subseteq U \times U$ is a binary equivalent relation on U, then $A = (U, R)$ is named approximation space, in which [x] is R equivalence class for the object. For any $X \subseteq U$, X is represented by $\underline{R}X$ and $\overline{R}X$. $\underline{R}X$ and $\overline{R}X$ are:

$$\begin{aligned} \underline{R}X &= \{x \in U | [x] \subseteq X\} \\ \overline{R}X &= \{x \in U | [x] \cap X \neq \varphi\} \end{aligned} \tag{60.1}$$

Here $\underline{R}X$ is Lower approximation and $\overline{R}X$ upper approximation. The elements in $\underline{R}X$ are classified as sure members of X by the knowledge in R; but the elements in $\overline{R}X$ are possible ones. The set X is referred to as a rough set which is approximated using information contained in R by constructing lower and upper approximation sets. Hence, positive field $pos_R(X)$, boundary region $bn_R(X)$, and negative field $neg_R(X)$ are defined as:

$$\begin{aligned} pos_R(X) &= \underline{R}X \\ bn_R(X) &= \overline{R}X - \underline{R}X \\ neg_R(X) &= U - \overline{R}X \end{aligned} \tag{60.2}$$

Definition 2 (Hong et al. 2000) The rough set method is a series of logical reasoning procedures to analyze an information system which is seen as a decision table; and the system can be denoted by $S = (U, A, F)$, where U is a limited object set represented by $U = \{x_1, x_2, \cdots, x_n\}$, A is a limited attribute set called $A = \{a_1, a_2, \cdots, a_n\}$, and a correlation set between U and A is F, i.e. $F = \{f_i | j \leq m\}$, where $f_i : U \rightarrow V_j, j \leq m$, V_j is called the domain of a_j, and the value of V_j can be either quantitative or qualitative. F(x) reflects complete information of object x in the system S, and F(x) is often called the information function. For this information system, each subset of attributes $B \subseteq A$ could define a binary equivalence relation R_B on the universe of discourse U as:

$$xR_By \Leftrightarrow f_j(x) = f_j(y), \forall a_j \in B \tag{60.3}$$

In the rough set, A is a set of primitive features, and C and D are two subsets of features; it is assumed that there is $C \cap D = \Phi$, where C is called the condition feature and D the decision feature. The information system A is called the decision

table often noted as $(U, C \cup D, F)$. R_c generated by U is defined as $U/R_c = \{C_1, C_2, \ldots, C_i\}$; R_D by U as $U/R_D = \{D_1, D_2, \ldots, D_J\}$. C positive field of D is expressed by $pos_C(D)$ denoted as $pos_C(D) = \bigcup_{j=1}^{J} \underline{R_C}(D_j)$ and $\gamma_C = |pos_C(D)/|U||$, where $|X|$ is the number of elements in the set X, and U is the universe of discourse.

Definition 3 (Kim et al. 2007) Assume that $(U, C \cup D, F)$ is a decision table, where C is called the condition attribute set, and D the decision attribute set, and then the importance of attribute subset $C' \subset C$ for D is

$$\sigma_{CD}(C') = \gamma_C(D) - \gamma_{C-C'}(D) \tag{60.4}$$

where $\gamma_C = |pos_C(D)|/|U|$, particularly, when $C' = a$, the importance of attribute $a \in C$ for D is

$$\sigma_{CD}(a) = \gamma_C(D) - \gamma_{C-a}(D) \tag{60.5}$$

60.3 Important Factor Analysis of Learning Interest

60.3.1 Collection of Raw Data

By questionnaire and with random sampling the third year undergraduates in Xijing University were investigated on the factors of interest influencing learning the specialized courses. With 110 questionnaires handed out and 104 valid questionnaires taken back, the recovery rate of the questionnaire is 95 % or so.

Firstly, the mapping relationship was established between interest in learning the specialized courses and its influence factors from paper questionnaires. Secondly, the influence degree of the various factors on the decision attribute was analyzed by rough set theory.

In the questionnaire survey, 10 questions with a 4-point Likert scale were asked: (1) How do you think about the teacher's teaching attitude to professional courses? (a. very serious; b. serious; c. still line; d. not serious) (2) Can the praise from your teachers arouse the enthusiasm of your learning professional courses? (a. It can largely improve the enthusiasm of learning the professional courses; b. It can temporarily improve the enthusiasm of learning the professional courses; c. It can rarely improve the enthusiasm of learning the professional courses; d. It cannot improve the enthusiasm of learning the professional courses.) (3) How do your teachers manage the specialized course classrooms? (a. very severe; b. severe; c. less severe; d. it doesn't matter.) (4) How is the teaching level of your professional course teachers? (a. very high; b. high; c. average; d. low.) (5) How is the teachers' attitude to students? (a. very amiable; b. amiable; c. indifferent; d. extremely

Table 60.1 Questionnaire of professional courses learning interest

No.	The condition feature(C)									D
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	
1	a	a	a	b	b	d	b	a	c	b
2	c	b	a	c	b	c	d	b	c	c
3	c	b	b	c	b	c	c	a	c	b
4	b	b	b	b	b	a	a	a	a	a
5	a	a	a	a	a	a	a	a	a	a
6	a	a	b	a	b	a	a	a	a	a
7	d	d	c	b	b	d	b	b	c	b
8	b	b	b	a	b	d	b	b	b	b
.....										
103	a	a	b	a	a	d	b	b	d	b
104	b	b	a	b	c	c	c	b	c	b

indifferent.) (6) Is the cramming method reasonable for professional courses? (a. very reasonable; b. reasonable; c. relatively reasonable; d. unreasonable.) (7) How do you like your major? (a. I like a lot; b. I like; c.I moderately like; d. I dislike.) (8) What is the employment competition like in this day and age? (a. extraordinary fierce; b. fierce; c. relatively fierce; d. not fierce.) (9) Is the curriculum of professional courses reasonable? (a. very reasonable; b. reasonable; c. relatively reasonable; d. unreasonable.) (10) Are you interested in learning your specialized courses? (a. very interested; b. interested; c. little interested; d. not interested.)

The mapping in Table 60.1 shows the learning interest of 104 senior college students and its influencing factors. In the table, C is called condition feature set and composed of the attributes x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9 representing question 1–9 respectively in the questionnaire. D, the decision feature, represents the 10th question, and the answer No. represents each attribute value. Due to the limited space, only part of data is given.

60.3.2 Establishing the Decision Table

MyRS, which is a cross-platform development tool system of rough set realized in Java programming language, is composed of GUI and core computing of rough set. By using the functions of input/output, data pre-processing and core computing, MyRS can realize the classical algorithm about positive field, kernel, attribute reduction and rule extraction (Wei and Li 2010).

As for the data-entry format, file of MyRS adopts the CSV format which can be realized by Microsoft Excel software. The decision table could be established by setting the weight for the attribute based on the importance of it; and the students' answers a, b, c and d set the weight 4, 3, 2, and 1 respectively.

60.3.3 Computing the Indicators of Condition Attributes

The significance of attribute can be calculated by MyRS tool. When the attribute is removed, the greater the classification variability, the higher attribute importance degree is, and vice versa.

The significance of every attribute about D is:

$$\begin{aligned}
\sigma(x_1) &= attr0 = \gamma_C(D) - \gamma_{C-(x_1)}(D) \approx 0.058,\\
\sigma(x_2) &= attr1 = \gamma_C(D) - \gamma_{C-(x_2)}(D) = 0,\\
\sigma(x_3) &= attr2 = \gamma_C(D) - \gamma_{C-(x_3)}(D) \approx 0.029,\\
\sigma(x_4) &= attr3 = \gamma_C(D) - \gamma_{C-(x_4)}(D) \approx 0.096,\\
\sigma(x_5) &= attr4 = \gamma_C(D) - \gamma_{C-(x_5)}(D) = 0,\\
\sigma(x_6) &= attr5 = \gamma_C(D) - \gamma_{C-(x_6)}(D) = 0,\\
\sigma(x_7) &= attr6 = \gamma_C(D) - \gamma_{C-(x_7)}(D) \approx 0.029,\\
\sigma(x_8) &= attr7 = \gamma_C(D) - \gamma_{C-(x_8)}(D) \approx 0.019,\\
\sigma(x_9) &= attr8 = \gamma_C(D) - \gamma_{C-(x_9)}(D) \approx 0.029
\end{aligned}$$

where $\sigma(x_1)$ is the significant degree of condition attribute 1, and $\sigma(x_2)$ the significant degree of condition attribute 2, and so on.

Thus, the significant degree relationship of the factors influencing learning interest of professional course is:

$$\begin{aligned}
&\sigma(x_4) > \sigma(x_1) > \sigma(x_3) = \sigma(x_7) = \sigma(x_9)\\
&> \sigma(x_8) > \sigma(x_2) = \sigma(x_5) = \sigma(x_6)
\end{aligned}$$

60.4 Discussion

According to the calculation result of the conditional attribute indicators, through sorting important attributes influencing learning interest of professional course, it is found that the teaching level of the specialized courses is the most important. The teaching attitude is the second important except the teaching level. The requirements of the classroom discipline and enjoyment about learning the specialized courses are less important than the teaching attitude. The teachers' praise and attitude are the least important, which can only temporarily stimulate interest in learning the courses. Therefore, the three attributes—the teaching level of the specialized courses, the teaching attitude and the requirements of the classroom discipline—are key to improve college students' interest in learning specialized courses.

60.5 Conclusion

Based on the above analysis, we know that college students' learning interest is key to improve students' performance and the teaching level of professional course and teaching attitude are the core factors to stimulate the learning interest. And by using of rough set theory, the attributes influencing college students' learning interest in the specialized courses is classified by the way of reduct rules. And the significant degree of every attribute can provide effective method to improve learning interest of individual learners. The results could be obtained collecting data in rough set decision table and analyzing appropriate attributes with MyRS tool.

Although the theory of rough set is used in many study fields, it is not fully used in a specialized course learning system. And this research tries to make it possible.

With MyRS, the significant degree of the usable and necessary data can be easily obtained, when amounts of data greatly increased in the decision table, the tool is highly suggested.

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