Methodology for Developing Professional Competence of Students Using Digital Technologies in Practical Training

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Abstract

In this article, the problems of developing the professional competence of students using digital technologies in practical training are analyzed, and the analysis of the current state of the problem in our Republic is presented. In addition, the article presents the methods, methods and their forms that are necessary for the development of the professional competence of students in practical training and practice based on digital technologies.

Keywords: *digital technologies, digital education, competence, computer, system, method, tool, information, communication, knowledge, pedagogue, economy, higher education, model, internet, idea, virtual, innovation.*

I. INTRODUCTION

One of the newest and developing subjects in the educational system of human activity is the science of information technologies in education, and this subject is taught at all stages of the continuous education system. Due to the daily updating of sources in science without denying the old ones, the conveniences that arise as a result of scientific research in human-machine communication, the automation of some jobs performed by humans in the fields, and the artificial intelligence imposed by humans on machines, while creating ease in human life, the tasks are performed without errors. It was recorded in all countries of the world from the level of the sector.

Today, there is almost no field where information technology has not penetrated. Wide use of modern information technologies, especially in the economy, management and education system, is of great importance and contributes to the further increase of the educational efficiency of the learner. A large number of scientists have conducted scientific research on the pedagogical basis of conducting lessons while conducting practical training in subjects. Conducting practical training with the help of digital technologies, in turn, all the mental processes of science are considered as an integral unit of the body, and the correct formation of these units is an important tool in the implementation of the states of movement of a person to the top with the help of specified psychological programs.

Digital education is the teaching of a subject through information technologies, without the human factor in organizing and managing the learning process. In this process, pedagogical and psychological approaches are considered as factors that ensure the effectiveness of digital education. From a pedagogical point of view, digital learning is carried out through large calculations in solving scientific problems, which are very little known to the human eye, in order to develop human thinking. Below we will consider the issue of classification of products needed for daily needs.

What products are often bought together at the supermarket?

Picture 1

- Object (item).

- Set (itemset) - limited set of objects.

- k-itemset (k-itemset) - a set of k⩾1 objects.

- Transaction - pair (TID, k-set). Transaction Set - D.

- Support (itemset support)

- absolute – the number of transactions included in the collection

- relevant – the percentage of transactions containing a set (probability that a transaction contains a given set).

TID	Collection
10	nuts, beer, diapers
20	coffee, beer, diapers
30	coffee, beer, diapers, bread
40	milk, nuts, bread
50	coffee, milk, nuts, diapers, bread

sup({beer })=3/5

sup({nuts, beer})=1/5

sup({coffee, diapers})=3/5

sup({beer, diapers})=3/5

sup({diapers, bread})=2/5

here,

sup-set

({…,….}) is the name of the elements in the collection

../.. is the number of entries in the table rows of the elements in the set

The market basket problem

Minimum support (min support) – the limit of support. Relevant (part) k-set (frequent itemset) Lk is a part not less than k-minsup.

1 - The task is to find all Lk (k⩾1) of market basket analysis for given D and minsup.

TID	Collection
10	nuts, beer, diapers
20	coffee, beer, diapers
30	coffee, beer, diapers, bread
40	milk, nuts, bread
50	coffee, milk, nuts, diapers, bread

Example: when minsup=3

L_1={{nut}, {beer}, {diapers}, {bread}}

L_2={{beer, diapers}}

when minsup=2

L_1 ={{coffee},{milk},{nut}, {beer},

L_2={{coffee, beer},{beer, diapers}, …}

L_3=({coffee, diapers, bread}}

Apriori algorithm: ideas

Sequence of steps

Find L1

Use Lk-1 when finding Lk for all k⩾2.

Candidates

Based on Lk-1, generate candidate sets Ck for subsets and count them.

Discard is not for all candidates, count support, discard a rare set of candidates.

The number of candidates for the n-element set of objects: 2n-1.

Generation

We assume that the objects in the set Lk-1 are ordered

l1, l2 are taken from Lk-1

li[1] < li[2] <…< li[k-1]

Ck = Lk-1 JOIN Lk-1

Eligibility:

(l1[1]=l2[1]) and (l1[2]=l2[2]) … and (l1[k-2]=l2[k-2]) and (l1[k-1]<l2[k-1])

merge result:

{l1[1], l1[2], …, l1[k-2], l1[k-1], l2[k-1]}

example:

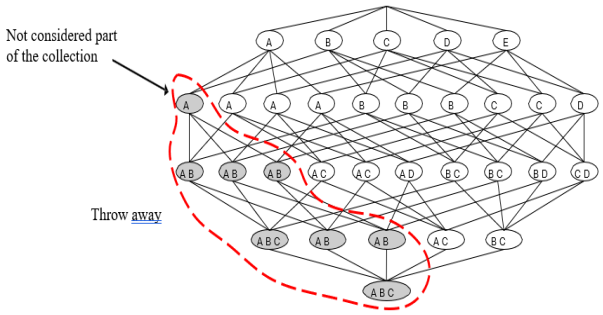
L3={abc,abd,acd,ace,bcd}

C4 =L3 JOIN L3={abcd,acde}

Cancellation of candidates (Apriori method)

Must be any nonempty subset of a set. If a set is not a part of a general set, then all sets containing it cannot be a part of a set: if Lk-1 is not a set, then Ck is a set plam is not included

Apriori algorithm



Let's analyze the above example by inserting it into the tables of the database management system. We continue the above generation in sequence based on formula (1). According to the example of the given market basket, we assume that the minimum support is equal to 2.

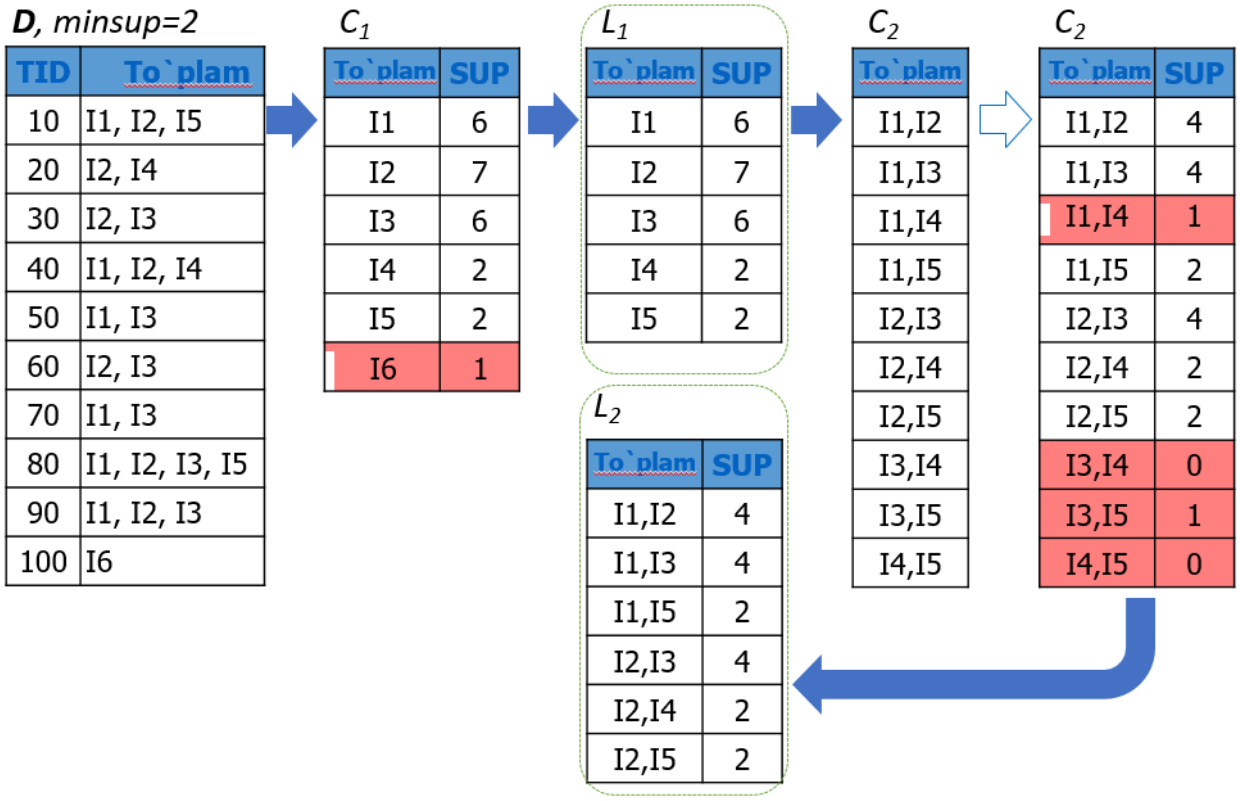
here,

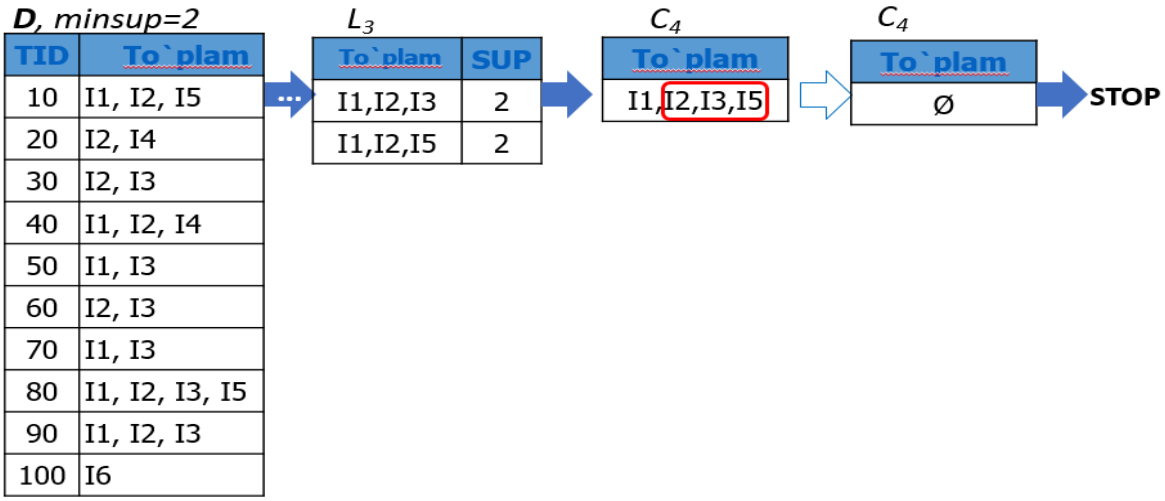
I1,I2,……..In - sets

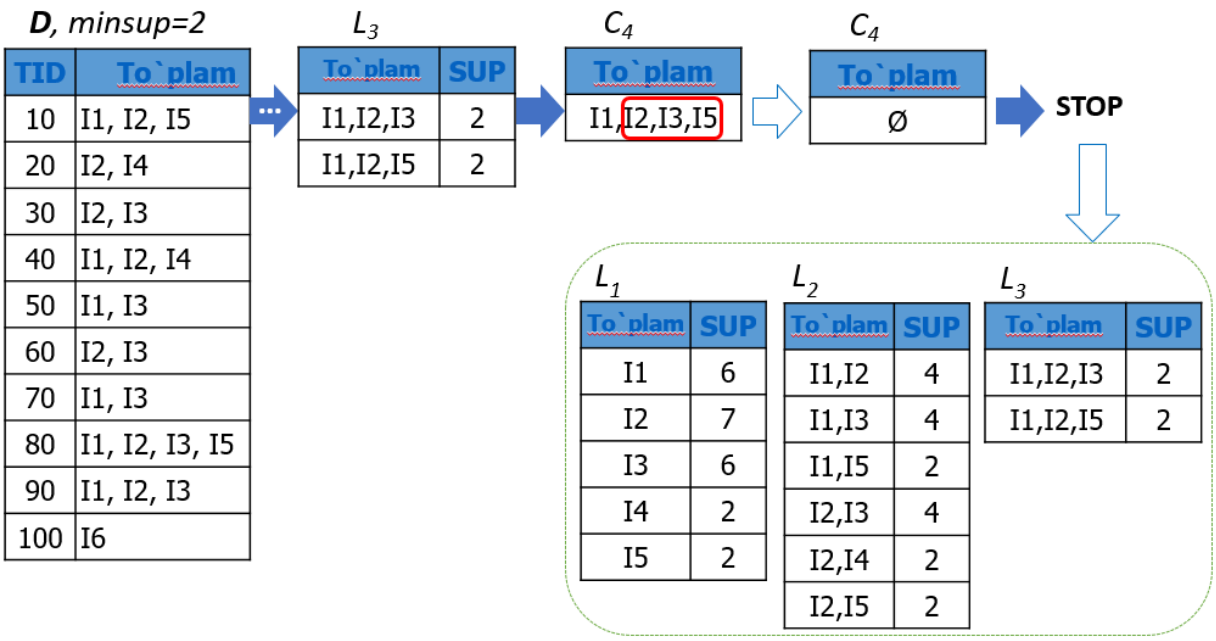
TID-Set identification number

Cn is a set of elements of the set sorted by the number of entries in the table

The elements of the set with the minimum participation in Cn are discarded and the set Ln is formed. Because of continuing this sequence, we form the sets L3 and C4.


D, minsup=2
TID
To`plam
10 I1, I2, I5
20 I2, I4
30 I2, I3
40 I1, I2, I4
50 I1, I3
60 I2, I3
70 I1, I3
80 I1, I2, I3, I5
90 I1, I2, I3
100 I6
C1
To`plam SUP
I1 6
I2 7
I3 6
I4 2
I5 2
I6 1
L1
To`plam SUP
I1 6
I2 7
I3 6
I4 2
I5 2
L2
To`plam SUP
I1,I2 4
I1,I3 4
I1,I5 2
I2,I3 4
I2,I4 2
I2,I5 2
C2
To`plam
I1,I2
I1,I3
I1,I4
I1,I5
I2,I3
I2,I4
I2,I5
I3,I4
I3,I5
I4,I5
C2
To`plam SUP
I1,I2 4
I1,I3 4
I1,I4 1
I1,I5 2
I2,I3 4
I2,I4 2
I2,I5 2
I3,I4 0
I3,I5 1
I4,I5 0


D, minsup=2
TID
To`plam
10 I1, I2, I5
20 I2, I4
30 I2, I3
40 I1, I2, I4
50 I1, I3
60 I2, I3
70 I1, I3
80 I1, I2, I3, I5
90 I1, I2, I3
100 I6
L3
To`plam SUP
I1,I2,I3 2
I1,I2,I5 2
C4
To`plam
I1,I2,I3,I5
C4
To`plam
Ø
STOP



After the number of steps in the set, the process is stopped and the result is obtained.

We have considered one way of analyzing the market trading system. Today, there are many such analysis systems. The main thing is the accuracy of the analysis results. The Apriori method is one of the most tested and proven methods today. Of course, in order for the analysis to be convenient for users, we need to program the method using programming languages. Below is the programming language code of the apriori method.

Input:

- D, a database of transactions;
- *min_sup*, the minimum support count threshold.

Output: L, frequent itemsets in D.

Method:

```
(1)    L1 = find_frequent_1-itemsets(D);
(2)    for (k = 2; Lk−1 ≠ φ; k++) {
(3)        Ck = apriori_gen(Lk−1);
(4)        for each transaction t ∈ D { // scan D for counts
(5)            Ct = subset(Ck, t); // get the subsets of t that are candidates
(6)            for each candidate c ∈ Ct
(7)                c.count++;
(8)        }
(9)        Lk = {c ∈ Ck | c.count ≥ min_sup}
(10)   }
(11)   return L = ∪k Lk;
```

```
procedure apriori_gen(Lk−1:frequent (k − 1)-itemsets)
(1)    for each itemset l1 ∈ Lk−1
(2)        for each itemset l2 ∈ Lk−1
(3)            if (l1[1] = l2[1]) ∧ (l1[2] = l2[2])
                   ∧... ∧ (l1[k − 2] = l2[k − 2]) ∧ (l1[k − 1] < l2[k − 1]) then {
(4)                c = l1 ⋈ l2; // join step: generate candidates
(5)                if has_infrequent_subset(c, Lk−1) then
(6)                    delete c; // prune step: remove unfruitful candidate
(7)                else add c to Ck;
(8)            }
(9)    return Ck;
```

```
procedure has_infrequent_subset(c: candidate k-itemset;
          Lk−1: frequent (k − 1)-itemsets); // use prior knowledge
(1)    for each (k − 1)-subset s of c
(2)        if s ∉ Lk−1 then
(3)            return TRUE;
(4)    return FALSE;
```

In marketing research, this analytical (cluster) method is widely used by marketers solving grouping problems - both in theoretical research and in grouping various objects. These customer groups, products, etc. solve problems. Thus, one of the most important tasks in the application of cluster analysis in marketing research is the analysis of consumer behavior, that is, the identification of buyers from each group about the behavior of the customer and the factors influencing his behavior; grouping into different classes. This problem is described in detail in Claxton, Fry and Portis (1974), Keel and Layton (1981). An important task that can be solved by cluster analysis is positioning, determining the criterion by which a new product will be placed on the market. Because of the application of cluster analysis, a map is created, according to which it is possible to determine the level of competition in various segments of the market and the relevant characteristics of goods for the possibility of entering this segment.

By analyzing such a map, you can find new, empty places in the market, where you can offer existing products or develop new ones. Cluster analysis can also be useful for analyzing a company's customers, for example. For this, all customers are grouped into clusters and an individual policy is developed for each cluster. This approach allows you to significantly reduce the objects of analysis and at the same time approach each group of customers individually.

In 1971, a paper was published on customer interest segmentation based on data describing customer preferences. In 1974, Sexton's article was published, the purpose of which was to identify groups of families who are product consumers, because of which brand identification strategies were developed. The study was based on respondents' ratings of products and brands. In 1981, a paper was published that analyzed the behavior of new car buyers based on factor loadings derived from a number of variables.

In this article, we have considered in detail the problems of classification and clustering using the Apriori method. Despite the appearance of these tasks, they are solved in different ways and using different methods. The difference in tasks is primarily in the initial data. Classification, which is the simplest task of Data Mining, belongs to the "supervised learning" strategy, because in order to solve it, the training sample must contain the values of the input and output (target) variables. Clustering, on the other hand, is associated with an unsupervised learning strategy for data generation, that is, it does not require the presence of target variable values in the training sample. The classification problem is solved using various methods, the simplest of which is linear regression. The choice of method should be based on the study of the initial data set. The most common methods for solving the cluster problem: k-means method (only works with numerical attributes), hierarchical cluster analysis (also works with symbolic attributes), SOM method. The complexity of clustering is the need to evaluate it.

In conclusion, it can be said that it is possible to improve the knowledge, skills and professional competence of students by using digital technologies to solve the above problems in practical training. The analyzed literature showed that based on digital technologies, it is possible to automatically determine and objectively assess the level of development of students' knowledge and skills, and to monitor them in practice based on software. In general, adapting the educational system to the future generation through the effective use of didactic models of educational process organization based on innovative and digital technologies based on information technologies, forming their thinking and will regarding informatics, developing their scientific and practical knowledge and skills,

information serves to form creative-scientific abilities based on competence.

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