A System for Learning Financial Accounting Bases

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Abstract
This paper describes a method for teaching students financial accounting bases. The method is based on correcting some typical mistakes, which can be observed at the beginners.
Keywords: accounting, e-learning, software agent

1. Introduction

This paper describes a method for teaching students financial accounting bases. The method is based on correcting some typical mistakes, which can be found with beginners.

We have defined the relationship of "mixing-up" between accounts. The relationship can be in a dynamical evolution, and it depends on the mistakes of the student. We have combined this relationship with the rules of accounting, and we have presented the types of mistakes that can be obtained, and then we have provided the methods of dealing with them. The goal is to provide a very good teaching and learning strategy. Finally, the paper presents a simple prototype of a system for instruction in accounting.

2. Some Difficulties in Self-Teaching Financial Accounting

Accounting is one of the most important economic fields, where students often face difficulties. The problems are due to many reasons, but most of the mistakes are due to the fact that students do not understand well concepts such as assets, capital, means, and resources, they do not know if an account is an active one or a passive one, they do not know the functioning rules of accounts, or they mix up the accounts. It is true, there are several accounts that can be mixed up, not because of their symbols, but because of their similar names. The mistakes can be due to the fact that the student does not know how to make a correct accounting analysis.

Practically, for an economic operation, described in natural language (Romanian language), the student has to present the corresponding accounting record, in the form of an equality x = y (followed by a sum).

For example [3], for

> *According to the founding agreement, the associates of the commercial firm subscribe a capital of 10,000 RON.*

the correct answer (according to the accounting rules from Romania) is:

456 (Debits with associates regarding the capital) =1011 (Social capital) RON 10,000

RON is the notation for the "Romanian leu" (the currency in Romania). This type of accounting record for an economic operation is used in the Romanian and French accounting system, but it is equivalent with this one:

Debits with associates regarding the capital	RON 10,000
Social capital	RON 10,000

3. Some Accounts Can Be Mixed Up

Surely, the accounts can be mixed up, because of similary of their names, because of their corresponding accounting subjects, or because of the bad interpretation of some economical operations. Thus, marking with M the set of the accounts from the *General Account Table*, we could draw a **"*mixed-up" relation*** between accounts: **$\rho \subseteq MxM$, $(a,b)\in\rho$ meaning that, from one reason or another, the *a* account can be mixed up with the *b* account**. The relation is symmetrical, thus $(a,b)\in\rho \rightarrow (b,a)\in\rho$, but not also transitive: $(a,b)\in\rho$ and $(b,c)\in\rho$ $\not\rightarrow$ $(a,c)\in\rho$. Actually, the ρ relation will appear under a form of a matrix, where both the rows and the columns are labeled with the symbols of all the accounts, and at the crossing of the rows with the columns we have 1 if the two symbols stand for accounts that can be mixed up, and 0, if they cannot. (Another perspective is the use of real numbers from 0 to 1.) The matrix will be modified (will evolve) depending on the student's answers, as the user of the system. Yet, the starting point will be a matrix, different from the null matrix. Establishing the initial mixed up relation is based on certain observations made by those teaching accounting, respectively professors with a certain experience in working with fresh year students. Of course, the system can adopt one matrix or another, depending on some statistic data referring to the level of students.

According as the student is tested and taught with the help of the computational system, a problem can be raised: *is the system able to direct the student based on the assumptions referring to the mix-ups he might make, or do we have to adapt the ρ relation to the mistakes of the student?* Thus, if the system expects the answer x=y and the student answers x=y', where $(y,y')\in\rho$, we can assume that the student mixes up the y and y' accounts, but for the other problems he might be able to give the right answer.

But, if the student answers with x=z, with $(y,z)\notin\rho$, it can be assumed that either the student does not know almost anything about the right side of the accounting equality, or the student mixes up the z account with the y account, and the ρ relation is badly described by us, and in this case we could write: $\rho:=\rho\cup\{(y,z),(z,y)\}$, i.e. we would add to the matrix the fact that y can be mixed up with z. This newly added fact should take place if we notice that the student keeps on answering z where it should be y and in other situations like u=y, y=u etc. It is likely that in the case of a poorly trained student, through this kind of enriching of the knowledge of the matrix of ρ, he/she might give the answer $(x,y)\in\rho$, $\forall x,y\in M$, and we create a very unpleasant situation. This is why it is best for the system to remove from the matrix of ρ those 1 values that correspond to situations that are rarely encountered in the answers of a well-trained student.

Thus the ρ relation evolves depending on the right or wrong answers given by the student.

4. Possible Mistakes And Their Solutions

For an economic operation to which the right answer is the *x=y* accounting recording, we could have the following answers. Each of them, except the first one (the correct answer) is one type of mistakes, which shows that the student does not know the answer.

Depending on the student's answer, a software agent will try to teach the student by explaining what he does not understand:

1) *x=y* - the right answer;

2) *x=y'*, $(y,y')\in\rho$ - the *x* account was well chosen and positioned, but instead of the *y* account there is a similar *y'* account, with which the *y* account is mixed up; in this case, the differences and similarities between *y* and *y'* are shown;

3) *x=z*, $(y,z)\notin\rho$ - the *x* account was well chosen and positioned, but instead of the *y* account there is the *z* account, that is quite different from the *y* account, thus it cannot be mixed up with it; in this situation, we can choose a detailed presentation of the *z* and, also, *y* account, so the right answer is being suggested, *x=y*; also, if we notice that the number of wrong replacements of *y* with *z* has

appeared quite often, the 1 value can be positioned in ρ's matrix at the crossing of the *y* row with the *z* column, and at the crossing of *z* row with the *y* column, that is: $\rho:=\rho\cup\{(y,z)\}\cup\{(z,y)\}$;
4) $x'=y$, $(x,x')\in\rho$ - is a situation similar to 2, so the similarities and differences between *x* and *x'* accounts are shown, hoping that in the future they won't be mixed up; if we notice that the number of mix-ups between *x'* and *x* diminishes then, the corresponding 1 can be removed from the matrix, thus $\rho:=\rho-\{(x,x'),(x',x)\}$; this is the case of 2: $\rho:=\rho-\{(y,y'),(y',y)\}$;
5) $x'=y'$, $(x,x')\in\rho$, $(y,y')\in\rho$ - is a more complex situation, because it is possible either for two mix-ups to be made (between *x* and *x'* and between *y* and *y'*), or it may be the general mistake (see the last case); if it is about two mix-ups the differences and similarities between *x* and *x'*, respectively between *y* and *y'*, will be presented; but it is possible that the $x'=y'$ mistakes may appear more often, that means that we have to deal with them as with a $z=t$ general mistake, where $(x,z)\notin\rho$, $(y,z)\notin\rho$, $(x,t)\notin\rho$, $(y,t)\notin\rho$; but, in this case, we have to "reduce" (at least for a while) the ρ relation by: $\rho:=\rho-\{(x,x'),(x',x),(y,y'),(y',y)\}$;
6) $x'=z$, $(x,x')\in\rho$, $(y,z)\notin\rho$ - in this case, the differences and similarities between *x* and *x'*, hoping that it will become $x=z$, which is not so wrong, and can be dealt with similarly to the 3rd situation; another variant would be that of mimetically presenting the *y* and *z* accounts in order to get the x=y correct answer faster;
7) $z=y'$, $(x,z)\notin\rho$, $(y,y')\in\rho$ - this situation is similar to the latter one, thus it can be similarly analyzed;
8) $y=x$ - this is a different situation, in this case the student proves that he/she doesn't know the functioning rules of the accounts and then they can be presented and explained.
9) $y=x'$, $(x,x')\in\rho$ - this is a combination between 4 and 8, so it would be necessary to present to the student both the functioning rules of the accounts and the differences and similarities existing between *x* and *x'*
10) $y=z$, $(x,z)\notin\rho$ - it is a more complex situation, because the *y* account was well found, but it is wrongly positioned (it sells instead of crediting), and instead of the *x* account and being wrongly positioned is the *z* account, an account that can't be mixed up with *x*; that is why a helping variant would be to mimetically present the *z* account, and possibly the *x* account and also the functioning rules of the accounts;
11) $y'=x$, $(y,y')\in\rho$ - it is similar to 9, and is dealt with similarly;
12) $y'=x'$, $(x,x')\in\rho$, $(y,y')\in\rho$ - a combination between 5 and 8, so the differences and similarities between *x* and *x'*, respectively between *y* and *y'* will be presented, and also the functioning rules of the accounts;
13) $y'=z$, $(y,y')\in\rho$, $(x,z)\notin\rho$ - this is a case in which the differences and similarities between *y* and *y'* and also the functioning rules of the accounts together with, possibly, the *x* and *z* account should be clearly presented;
14) $z=x'$, $(x,x')\in\rho$, $(y,z)\notin\rho$ - this is similar to the last case;
15) $z=t$, $(x,z)\notin\rho$, $(y,t)\notin\rho$, $(x,t)\notin\rho$, $(y,z)\notin\rho$ - this is the biggest mistake that can appear, and in this case, all four accounts (*x*, *y*, *z*, *t*) should be presented; it is possible that the student may subsequently give a wrong answer that can be solved like the previous case.

5. A System For Learning The Accounting Bases

We have developed, at the University of Bacău, Romania, the FABL (Financial Accounting Bases Learning) program. It is a functional system for learning accounting (the bases of accounting). The system deals with all kinds of mistakes, but it doesn't modify the ρ relation. The knowledge base contains:

- all the correspondences between the accounts, that can be mixed up,
- questions (economical operations) and their answers, that are in fact, the corresponding accounting records.

The system uses a special agent that counts the users' mistakes, divides them into 3 categories and warns him/her about the lack of activity. Also, in the near future, we intend to add an

agent to the system that will have lectures under the form of videos. This agent will act each time the student makes the same big mistake on the same subject, or if it has to modify the ρ relation.

6. Conclusions and Future Works

We have dealt, in this paper, with some types of mistakes that can appear in writing accounting records, for economic operations. We defined a mix-up relation for the accounts in *General Accounting Table*. This relation is not a static one, it evolves depending upon the student's mistakes. We have observed that there are 14 categories of mistakes. For each category, have we presented some variants to deal with.

Finally, we have briefly described the FABL system, which helps students learn the accounting bases. This system is developed within the ContTest multi-agent system [2] and some ideas are from [1].

We are going to add some new characteristics to the system, so that the system may learn from the student's mistakes, and the mixing-up relation may be modified accordingly.

7. References

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