Use of a Model for Information Technology Education

Peter Trkman and Peter Baloh
Faculty of Economics, University of Ljubljana, Ljubljana, Slovenia

peter.trkman@uni-lj.si peter.baloh@uni-lj.si

Abstract

In the paper, a model for planning and evaluation of education is presented. In this model, the main goal of education is divided into 4 sub goals that should be obtained in every educational activity. The 4 main components identified in the model are: total knowledge gained, degree of usefulness of that knowledge, reduction of effort in later learning and effort invested in the educational process. The importance of each of those components varies depending on the level and purpose of education.

The model is then specially adapted for computer literacy education at various levels of education. It is shown how the emphasis shifts between different sub goals at different levels of education from kindergarten and lower grades of primary school to workplace learning. At the end, the use of the model is shown on a case study that deals with teaching information technology use at university level.

Keywords: information technology, IT education, pedagogic model, university education

Introduction

In recent years, plenty has been written about the importance of education and different models were proposed for planning, organization and evaluation of educational process. The main contribution of this paper is to provide a general theoretical framework that can be used for various sorts of education at different levels and can help in planning and evaluating it. The model emphasizes the importance of student and his or hers goals in education and identifies four main sub goals from the student's point of view that should be fulfilled in every organized learning. As shown in the next chapters the advantage of the model is that it can be easily adapted if needed, according to specific characteristics or demands of different ways of education. In this paper, the model has been tailored to computer literacy education at undergraduate university level.

The paper is organized as follows: in the first section a few words are devoted to education itself. Next, the model for planning and evaluation of educational process, which formalizes a process of life-long learning is presented and explained. Then the model is applied to the computer literacy education in general and specifically to computer literacy education and its role in higher education. At the end the practical improvements that can be made following the model guidelines are shown with the case study of computer practicals for first year undergraduate business students at Faculty of Economics, University of Ljubljana, where both authors have worked in recent years.

About Education

Each instructor uses his own approach to teaching and instructing, which he believes is the best for the students. Unfortunately, many educators seem unaware of the abundance of the research literature in the teaching and learning sciences to support and question their teaching approaches (Collis, 1998). Key principles for university didactics,

as comprehensively reviewed and summarized in (Collis, 1998) are:

- Learning arises from the active engagement of the learner; cognitively active roles of both instructor and learner are necessary (Moonen, 1994).
- Communication oriented pedagogy is turned towards the learner; assessment of competence depends on listening, observing and responding to learners.
- Good learning is not instructor-transmission oriented but rather process-based and learner oriented.
- A well-designed instructional environment requires instructor preparation, yet it is aimed at learner self-responsibility (Luft & Tiene, 1997).
- "We must do more with less"; students want to move efficiently through their studies, instructors have to move efficiently through their budget (McAvinia & Oliver, 2002).

One can, inexplicitly, recognize a common compass reading behind the mentioned principles: some sort of strategic orientation in knowledge and skills that educational system has to provide to the student. Though, not with *pushing* but rather to prepare learners for *pulling* knowledge and to endow them with skills that will enable and ease their further education.

As cited in (McAvinia, & Oliver, 2002) Candy (Candy, 2000) argues that since organizations are becoming more knowledge-based, academics as knowledge workers are ideally equipped to help students become lifelong learners in the information society. He suggest that:

> *"Universities have a leadership role in producing graduates who are [. . .] attuned to the need for, and equipped with the skills of, continuing lifelong personal and professional development." ((Candy, 2000) as cited in (McAvinia & Oliver, 2002))*

Similarly and in connection with the topic, Director of the Information Centre of the International Association of Universities, has indicated:

> *"The future of universities depends on the capability to adapt to the new information society and meet the needs of an ever more demanding professional market…" ((Langlois, 1997) as cited by (Collis, 1998))*

The importance of educational system for young people cannot be overemphasized. To sum up in plain words: what students learn has to be useful, and they have to learn it in the way that they learn also how they will be able to gain new knowledge without too much trauma and unnecessary efforts.

Presentation of the Model

As outlined in previous section education is extremely important and its importance is increasing even further. Therefore, careful planning and evaluation of every organized education is essential. The purpose of the model presented in the paper is to offer a comprehensive framework for evaluating every educational activity. The starting point for the planning and evaluation of education is student's point of view – his needs and expectations from education where he is taking part. The following model – its schema is presented in Figure 1 and it is explained in the continuation of the paper – can serve as general set of guidelines for this important activity.

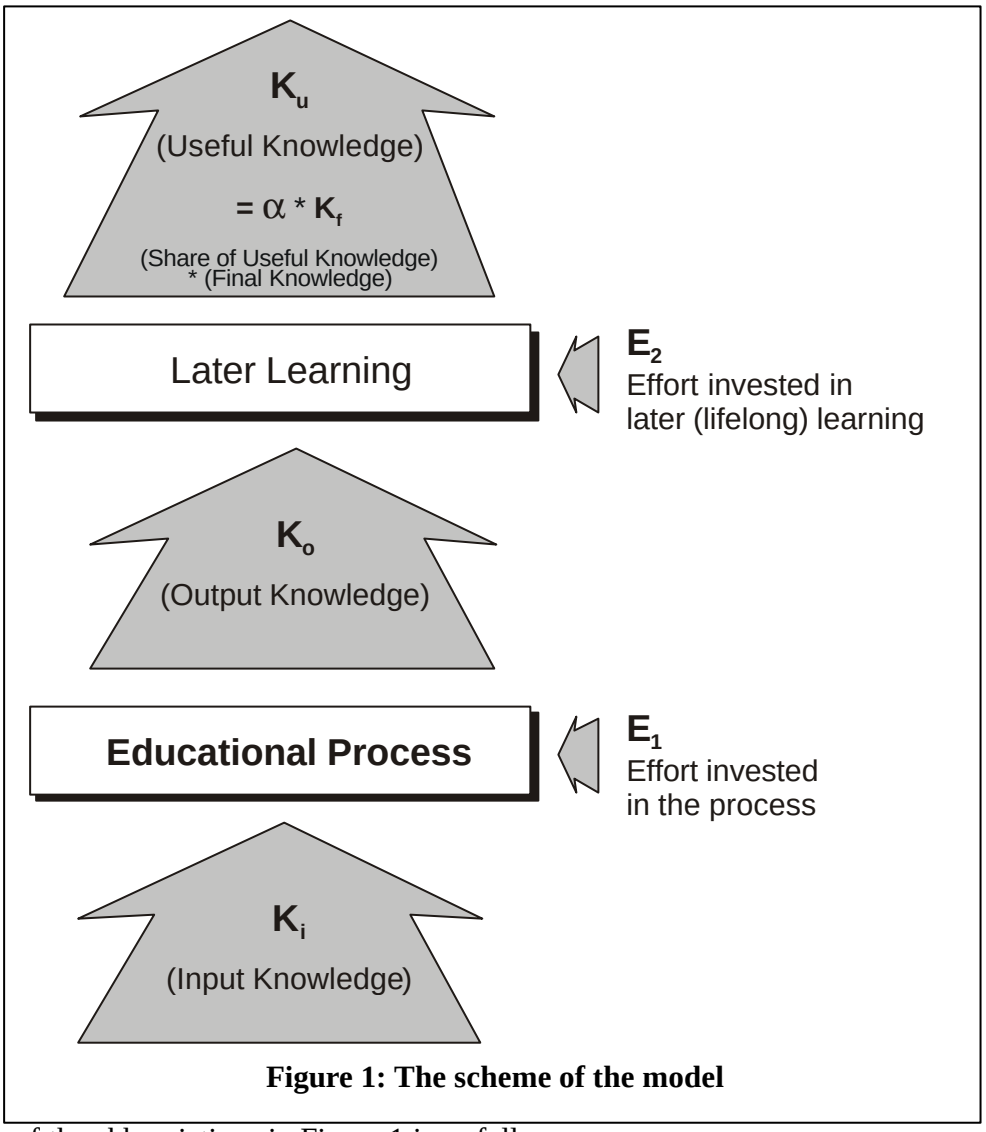

Figure 1: The scheme of the model

The meaning of the abbreviations in Figure 1 is as follows:

- K_i - *input knowledge* – The student's knowledge at the start of the process.
- E_1 - *effort* – The student's effort invested during the process.
- K_o - *output knowledge* – Knowledge at the end of the process.
- E_2 - *effort in later (lifelong) learning with this process* – If our educational efforts are successful they should also help the students to gain new knowledge easier – thus reducing the effort in later education.
- K_u - *total useful knowledge* – Obviously not all knowledge is useful for each individual. Therefore this variable measures only the useful knowledge – the knowledge than can be applied or can help in life or at work.
- K_f - *total final knowledge* – Total knowledge gained by the student.
- a - the share of total knowledge that is useful for each individual.

Also needed for our purpose (and not shown in Figure 1 yet described below and used later in the model) are two additional variables:

- E_2' - *effort in later (lifelong) learning without this educational process.*

- *K_u' - total useful knowledge without this educational process*.

Traditionally it would be assumed that the goal is to maximize the amount of knowledge gained by the students in the process (that is to maximize K_o-K_i). This can be relatively easily achieved and measured with various simple tests at the end of educational process. However, in the constantly changing environment and the concept of lifelong learning gaining more and more importance, this is an assumption we should not make. The educational process that is concentrated solely on the amount of knowledge gained is missing important parts of the big picture.

Therefore, we need to take the broader situation into account. The proposed model based on Figure 1 can be written as: *the main goal of the educational process is to maximize the difference between the benefits of the education and its costs.*

This means we need to maximize the sum of the product between useful and total knowledge and reduced effort in later education minus the effort that needs to be invested in the process. This can be written as:

$$\max ((K_u-K_u')+(E_2'-E_2) - E_1) = \max (a*K_f-K_u' + (E_2'-E_2)-E_1)$$

As total useful knowledge without our educational process (K_u') is given (from our viewpoint), this parameter in the equation can be ignored and the final equation is:

$$\mathbf{\max (a*K_f + (E_2'-E_2)-E_1)}$$

The idea of the model is to serve as a framework when considering possible changes in education and not to calculate a single number that would reflect total benefits of the process. Therefore, a simple addition and subtraction formula is chosen instead of a more complex way of presenting this model (e. g. exponential).

Four sub goals can be derived from the main goal:

1. Maximize the total final knowledge of the students (K_f)
2. Maximize the share of useful final knowledge (a)
3. Maximize the difference between the (E_2'-E_2)
4. Minimize the effort needed in the educational process by the students (E_1)

This division can improve the approach to both planning and evaluation of educational effort. However, it should not be forgotten that those sub goals are usually interconnected. Typically, we need to obtain all four goals in order to claim that the education was successful. The priority shifts between the sub goals depending on various factors (e.g. the level of education, topics of the course, students' characteristics such as age, interests and so forth.) – an example on how the priorities are different on diverse levels is shown in the section about computer literacy education.

The four sub goals are further explained:

1. Maximize the total final knowledge of the students. Students should learn as much as possible: this is a clear sub goal as after all, one of the roles we concentrate on in presented model, is how to teach students something (or even better to help them learn it themselves). Significance of knowledge in today's world has already been discussed extensively (Drucker, 2001; Burton-Jones, 2001; Johannessen, Olaisen, & Olsen, 2001; Bell, 1973, to name only a few), so every bit of knowledge that can be gained is important.

However, the main difference between this model and traditional education is that this is only one of the 4 sub goals and not necessarily the most important. Quite the opposite in fact – other sub goals are putting on importance. Therefore, the amount of total knowledge gained by the students is not adequate proof to claim that our work was successful.

2. Maximize the share of useful final knowledge. As knowledge is becoming obsolete quicker than ever before, it is obvious that even a perfectly designed and executed curriculum certainly has some topics that will not be useful for most of the students. Also in today's education, every group is surely very heterogeneous. Due to likely diversity of students in every group it is hard to offer only useful and interesting things to each individual (although the World Wide Web can certainly help in adjusting the program in such a way that it is more appropriate for each individual – an example is shown in (McIntyre, & Wolff, 1998) and (Trkman, & Baloh, 2002). Also it is quite hard to predict which skills the employers will likely need in the future (McAvinia, & Oliver, 2002; Drew, 1998).

However all this shouldn't be use an excuse not to continuously adjust the educational program in such a way that it offers useful and relevant topics to that diversified groups of students and each individual. Therefore special attention has to be paid to teach things that students will need and in such a way that the usefulness of gained knowledge is transparent to them, even to those that would otherwise classify themselves as "totally uninterested".

3. Maximize the difference between the (E_2'-E_2). This can be explained as: "teach the students to learn". With the importance of life-long learning is ever increasing it is clear that it is impossible to teach the students everything they need to know within the given course regardless of the subject, level of education, available time and funds. As stated before everyone will have to invest significant time, effort and resources in formal or informal ways of education later in their lives. Therefore, we need to make everything possible to help them to ease the effort needed in later education.

This important component is expressed in the model as a difference between the efforts that students will need to invest in later education after visiting the course (E_2) and the effort that would be needed if they had not attended our course (E_2'). If we were successful in attaining this goal, the effort needed later should be considerably reduced. As discussed parameters are important for the model-implementation, a question of evaluation arises. At present stage of research, the model is still formulated in conceptual form, requiring refinement of instruments for measuring the achievement of some of the sub goals.

The idea of this sub goal can be further explained with the following quote:

> *"Traditional training methods are appropriate for teaching people what to think … If they are to get the most out of information technologies, people also need to learn how to think. Learning how to think means developing the intellective skill required for original, independent problem-solving." ((Schuck, 1996) as cited in (Candy, 2000)).*

This sub goal has already been widely acknowledged as one of the most important goals in every education. Therefore, one of vital aspects of every education is to empower learners to develop their own skills of observation, enquiry, and interpretation and not just to transmit authoritative expert knowledge (Hawkey, 2002). Surely today's educators can deliver to students a knowledge in how to redirect useful methods learned that will not be wasted by becoming obsolete but rather be redeveloped in a recycling and updating fashion.

If we manage to do this we certainly made a large step towards achieving the third sub goal of the model – the student that develop the mentioned skills will certainly find it easier to acquire new knowledge and even more importantly, use it productively. Then future education is definitely easier.

4. Minimize the effort needed in the educational process by the students. This is one of the sub goals that is often neglected or considered less important. Nevertheless, we do not want to claim that education is possible without student's involvement or effort. The invested effort can be measured with the sum of opportunity and actual costs incurred by the students. Both types of costs are understood broadly – the actual costs for example include costs such as scholarships, study materials (books, computers, etc.), also the cost of transportation, lodging etc. (those costs can also be considerably reduced with use of World Wide Web). On the other hand, although opportunity costs can be high for the students, it is

obvious that those costs increase greatly once the students start their working careers, as every day of absence from work place is rather expensive for their employers. Consequently, as many skills as possible (especially the ability to learn new things quicker) should be obtained as early as possible.

Besides the economic aspect (total costs of education), effort (as perceived by students) can be quite subjective and depends on their attitude towards the course. The learning is certainly considerably easier if students see the usefulness and applicability of lessons learnt. Therefore achievement of the second sub goal is not enough – the usefulness of gained knowledge should also be made clear to the students; so in that way we also move closer to the achievement of the fourth goal.

It is an undeniable fact that any learning requires effort – we only claim that the goals should be reached as easy as possible without making it unnecessarily difficult.

Every change or improvement in the education can be explained within this framework as it affects at least one of the 4 the sub goals. The change in the education that does not do so is most likely useless.

The proposed model is deliberately set quite broad – so it can be used for various sorts of education and in various fields of science. Other educational models can also be included and explained with the previously defined 4 sub goals of our model. For example, one the models proposed by (Bradley & Oliver, 2002) has the following guidelines:

- Open learning (OL)—the learning should take place at the time and place of the learner's choosing;
- Computer based learning (CBL)—the learning should be delivered through a computer system;
- Work based learning (WBL)—the learning should be applicable to and developed within a working environment

The first guideline can be explained with the 4^{th} sub goal – if we manage to enable the learner to choose his time and place for the learning process that certainly considerably decreases the effort needed and the costs incurred. Work based learning can considerably influence both the 2^{nd} and the 4^{th} sub goal as the learning that is applicable to work environment increases the percentage of the gained knowledge that is useful and on the other hand decreases the effort needed as the learning problems are directly connected with work and therefore easier to comprehend and solve for students.

The model presented in this section can serve as a guideline for any education; in the following section we apply it to field of computer literacy education in general and expressly to computer literacy education at the university level.

Computer Literacy Education

Computer literacy is, without doubt, one of the most important skills a person can have in today's competitive environment. According to Kaplan and Norton (Kaplan, & Norton, 1996), “who described a new set of operating assumptions underlying the information age and contrasted them with their predecessors in the industrial age”, one of the most important changes was the transformation of blue-collar workers into white-collar workers ((Kaplan, & Norton, 1996) as cited by (Hughes, Ginnett, & Curphy, 1999)). Employees today must contribute value by what they know and by the information they can provide. Following that, it is harder and harder to imagine a successful professional career without decent knowledge of information technology (IT) and its effectual use.

Accordingly, one of the important tasks the school system has to fulfill is to empower students for effective use of technological tools in their future and present daily work.

There are some issues and constraints that need to be taken into account, though. Firstly, distinctions in students' interests cause that the *entry level* of IT knowledge, when enrolling to any educational institution, regardless of the level, varies significantly. Additionally, in case of university level, prior-education

wise, students greatly differ in their backgrounds – they come from technical-, natural- and social- sciences oriented secondary schools.

Secondly, *attitudes and interests of students* and the way in which they accept computer practicals vary from interested to uninterested.

Thirdly, both students and instructors (or University as institution) work within their *budgets*. As already said, “we must do more with less”. On learners' side it means that students are aware that their time and energy is a scarce resource and that they want to rationalize the way they move through their studies (Collis, 1998). On the side of lecturers, it means that they cannot afford to instruct each of their students individually and “forever”. There is a time constraint (in non-technical university programs, the time “budget” for information technology practicals is usually very limited) and often shortages of both properly qualified instructors and properly equipped classrooms.

Fourthly, there is an additional problem that we face in the field of computer literacy education. As it is known, “experience leads to habitual behavior patterns” (Hughes, Ginnett, & Curphy, 1999). Following that and applied to instructing of use of information technology, we have recognized that students misapply old solutions to new problems. That is, since they are not aware of extensive functionalities of modern IT tools, they indeed use them “in old ways”; only the (already) known portion of certain applications are consequently used in most cases. Of course, problems that students are faced with (for the period of their studies and during real jobs) are often solved in numerous different ways, mostly inefficient and ineffective ones. In example, instead of using the "filter" tool in spreadsheets (which returns required information from a table of data in hassle-free manner), combinations of various known tools ("sort" tool) and manual data-manipulation (manual checking) are used.

Natural conclusion and solution to this problem is to (1) face students with real-life cases and problems they are most likely going to be drawn against in the (near) future, and (2) present them the way of solving a certain case with the use of those functionalities of a certain (proper) application that were intended for such tasks.

Fifthly, the issue of the main goal of the computer practicals, has to be resolved – in times of perpetual changes, something learned today not only “might not be” but rather “will not be” usable tomorrow in the same form as today. Today's students will have to deal with many new software and hardware solution for a variety of problems during the span of next thirty, forty years. Most of those solutions are not even known today. Therefore, in computer literacy education, of the four sub goals mentioned in the previous chapter, the third should be emphasized. Consequently, in example it doesn't make much sense to show the students only how to accomplish a certain task in one of the applications with a series of mouse clicks and keyboard commands and leave them with that.

Rather, students have to learn how to learn in order to survive in the “jungle” of upcoming software and hardware. The objective of the educational process has to be to *qualify students to be able to learn independently and continuously*. This also coincides with the lifelong learning mentioned in the introduction. That means that the amount of *useful knowledge* they gain from the practicals is important. Namely, the central goal is to prepare the students for effectual use of information technology for dealing with problems and challenges they will face in their upcoming student and professional careers.

In order to achieve this we put forward the following system of computer literacy education at various levels of education. From this system, it is also understandable how the emphasis shifts between different sub goals at different levels:

- Kindergarten and lower grades of primary school: special emphasis should be paid to sub goals 3 and 4. Sub goal 4 is important because if too much effort in learning the use of computers is needed by the children at this level, it might negatively influence the children's attitude towards computers and information technology, which can importantly influence the success of later edu-

cation. At the end of this educational level, the children shouldn't be afraid to use computers and be able to perform basic tasks.

- Higher grades of primary school: pupils should be familiar with use of computers and should be aware of common applications and their purpose - i.e. operating system Microsoft Windows, word processor Microsoft Word, spreadsheet Microsoft Excel, database management system Microsoft Access, Internet browsers… As a result, they should be able to perform general tasks related with file management, formatting, inserting pictures in documents, browsing the Internet; …
- Secondary school: at the end of this level, students are computer-literate: they should be able to confidently use the most widely spread applications for various general and specific tasks – i.e. creating a document with headers & footers, inserting table of content, working with page numbering; creating a presentation and performing it; using the Internet to find certain information; …
- University level: In an ideal world, students bring computer literacy from prior educational levels. At the undergraduate level they acquire expertise in use of mentioned (common) and other (specific) applications for solving problems that would most probably occur later in their future life and professional career.

  The content of the practicals and the examples discussed naturally depend on the field of study program. Instructions for business students need to, therefore, put special emphasis on solving problems (naturally using contemporary IT tools), experienced in business and economics.

  Similarly, English law-association BILETA (Bileta, 1994) offered "common minimum standards of computer competency for undergraduate law-students", which were divided into three contextual parts: (1) Common knowledge of information technology, (2) Information technology for lawyers, and (3) Law of information technology. The first one deals with basic computer skills: operation system, file and disk management, word-processing, use of e-mail, spreadsheets and databases – all at general level and of generic use. The second and the third deal with specific, law-oriented needs. As we argued above, our opinion is that the first level – common knowledge of IT – has to be taught at lower levels of education, not at university. Undergraduate level should focus on special needs that each student will need in his future career.
- Workplace learning: there, evidently, the most important sub goal is no. 2 – the gained knowledge should be directly applicable to the problems encountered by the employees in the workplace. When instructing professionally active students, practical examples taken from the workplace should be solved in a pragmatic manner – in teams or independently; essentially, learning here comes from the active engagement of the learner.

Of course, only when horizontal and vertical integration and coordination between educational levels are achieved, the fulfillment of the goals set for computer literacy education can be expected. A national (maybe even worldwide) scheme should be developed and followed; some have already started – in Slovenia a program for Computer Literacy has began in primary schools (Rajkovic, 1998); worldwide, European Computer Driving Licence (http://www.ecdl.com) has been promoting a "computer license" for the last couple of years.

Arguably, without extensive coordination of (especially) vertical levels of education, the goals are more difficult to reach. Also, vertical and horizontal harmonization brings additional benefits, such as set standards that assure working conditions for educational institutions and overall higher quality of educational system (Schuck, 1996).

Case Study: Faculty of Economics, Ljubljana

In order to show how the proposed model and guidelines for implementation of the model for computer literacy education can be used in practice, the case study of computer practicals at University of Ljubljana, Faculty of Economics, is presented.

Here mainly the changes and improvements that were made following the model guidelines are offered. A more detailed presentation of this case study can be found in ((Baloh, & Trkman, 2002), (Trkman, & Baloh, 2002).

The Faculty was established in 1946 and has grown in number of students ever since. In the last decade, yearly approximately 600 students enroll into University study program and 400 in the Business school study program. In addition, there are approximately 800-900 first-year students in part-time and distance education programs. The background of those students varies extremely as they come from high school (around 45%) and economics secondary schools (36%), while only 2% finish a technical secondary school, where the use of computer and information technology is most widely spread according to a survey presented in (Gerlic, 2001).

Although in previous sections the system in which students should be completely computer literate at the end of secondary school was outlined, this is not (yet) the case. Partly because students that enter higher education today, started their formal education at the end of eighties/beginning of nineties, when the use of computers was not widely spread in primary schools.

Also, as described in (Krapež, 1999), the goal of secondary school system in Slovenia is to *"enable students to work with any data format and would be able to use software in different version and from various vendors"*. However as in most secondary schools there are only 70 hours (in 4 years) of computer literacy education (Krapež, Rajkovic, Batagelj, & Wechtersbach, 2001), we are still far away from the achievement of this goal. Due to various programs and initiatives (such as Computer Literacy Program described in (Rajkovic, 1998)) the average level of computer knowledge is noticeably increasing year after year but it will certainly take years before the afore mentioned goal will be achieved.

At Faculty of Economics Ljubljana, students in both programs have a course in first year that deals with computer and business information systems concepts that will likely be needed by business students in their future careers. It is a one-term subject and is divided in two parts: "theoretical" and "practical". In this case study we deal solely with the practical part of those two courses. Due to time constraints and limited budget, there is only 1-2 hours per week left for the practicals for each student. At the end this totals between 15 (University study program) and 30 hours (Business School program). In this (small) amount of time students should learn how to *use* the computer to solve problems during their studies and later in the workplace. Main topics covered are MS Windows, MS Office applications (Word, Excel, PowerPoint and Access) and the Internet (World Wide Web and use of e-mail). As the amount of time is extremely limited (commercially available training programs usually last 30 hours just to complete one level-course in one application (i.e. introductory course to Excel)) no major mistakes should be made in utilization of the available time. However, in spite of limited time we keep our mind on each of the sub-goals and try to improve the added value of all four sub-goals.

As can be seen from above, there are significant issues for planning and implementing the educational process. For that reason we try to follow the model guidelines and maximize the value of practicals for our students.

In summary, the pedagogic model based on certain methods for obtaining each of the mentioned main sub goals individually while meeting the limitations and problems presented earlier in the account, was developed. The resulting model is realistic and pragmatic; it is founded on following methods:

For **goal no. 1** *("maximize the total final knowledge of the students")*: firstly we decided to make attendance at the practicals compulsory. Although this was an unpopular decision at the beginning, it was soon accepted (in the survey (Business Informatics 1, 2001) less than 17% of the students found that inconvenient). At the end of the practicals the knowledge of all students is tested and the result contributes towards their final grade of the course (together with the "theoretical" part) so extrinsic motivation also plays a part although intrinsic motivation (explained in detail below) is certainly the most important.

A special attention is being paid towards a proper qualification, training and prior experience of all instructors. Even greatly designed program that follows all the guidelines of the model would fail miserably if the instructors were inappropriate. The success in the selection of the instructors can be illustrated with the results of the survey (Business Informatics 1, 2001) where students also marked their satisfaction with the work of the instructors – on scale from 1 to 5, the average grade was 4.5, which shows that students were very satisfied with the work of instructors.

The program of the practicals is revised each year to meet changing demands and entry-level knowledge of students; every year the level of those practicals increase slightly and new topics and examples are added.

In order to offer added value to all students (even those with very high entry-level knowledge) we partially segregated our students based on their knowledge and offered special courses both for those with little knowledge (an additional introductory course to Windows/Word and Internet than can be taken besides the basic course) and for those who already know most of the things discussed in the practicals. For the latter we organized an advanced-topics-course with content like advanced use of Microsoft Excel, introductions to Visual Basic for Applications, HTML, Active Server Pages, VBScript, JavaScript etc. Obviously, an even more detailed segregation of the students could be useful but is not possible due to organizational, financial and other constraints.

We can argue that every first year student gains added value (expands knowledge) in practicals and that topics are at least to some extent adjusted to their interests and entry-level knowledge.

For **goal no. 2** *("maximize the share of useful final knowledge"):* As discussed above, students gain a lot of new knowledge in the practicals. Nonetheless, we also pay special attention to the usefulness of gained knowledge. Thus, we put special emphasis on "learning by example", by introducing solely practical problems into exercises. For first grade students such problems might be a bit distant though, therefore we also include problems that students will already be facing during their undergraduate studies. For example, we show the use of Excel for creating charts and solving financial and statistical problems that are (methodically) taught in other courses or the use of Word for technical preparation of their seminar assignments and graduate thesis.

We should accentuate that we don't teach the students to know something about software application itself – but to enable them to solve real life problems and to find the solution for the problems, they are not yet able to solve, more easily.

For **goal no. 3** *("teach the students to learn"):* as already acknowledged this is arguably the most important of the four sub goals, especially for teaching the use of computers. Also as stated in (Candy, 2000), academics are ideally equipped to help students to become lifelong learners.

Therefore, special attention is being paid to achievement of this goal and various approaches are used. In every lesson a certain part of the lecture is used for independent problem solving by the students: they are confronted with a real-life problem (e.g. drawing and formatting a certain chart from the given data) and try to solve it. Obviously, the instructor is present during this and can give some tips (but not the final solution) to the students.

During the lecture we try to encourage students to participate actively and offer their suggestions (even if those suggestions are wrong) about the possible solution for each encountered problem. With every new problem they are usually given certain amount of time to try to find appropriate way to solution themselves (even if they don't manage to find the correct solution this is valuable experience).

Another approach we used was to divide students into small groups (2-3 students per group) at the beginning of the course. Each group had to study a certain aspect of one application (usually Microsoft Word or Excel) and then prepare part of the lesson for next week (one group per week) and present it to their colleagues. They should study this problem independently with use of computer books, built-in Help etc. During the preparation phase an instructor is available to provide general guidance. This approach brought some benefits: we try to encourage students to solve problems independently and to enhance their team working and presentation skills. However due to serious time limitation it was abandoned this year.

By presenting real problems, we are trying to accustom students to independent problem solving: to become familiar with resources they can use to help them out (built-in Help, Internet, reference books…).

For **goal no. 4** *("minimize the needed effort in the educational process by the students"):* in order to minimize effort needed by students to achieve the goals we try to make the learning process as easy as possible. Therefore, special attention is being paid to keep the explanation of important things as clear as possible and to explain them entirely on practical examples.

In every class of approximately 25 students, the instructor has one assistant that helps students, which either have difficulties or additional questions that are not directly related to the subject of the practicals. Additional information can also be obtained either from the WWW page (more about the use of Internet for communication with the students can be found in (Trkman, & Baloh, 2002). During and after the course all instructors can be reached by e-mail for additional questions, explanations or clarifications. The examples used at the practicals are structured and explained in such a way that they are straightforwardly understandable for the students and as close to their current interests as possible without endangering the other sub goals. Based on authors' experiences from previous years a special reference book for this course was written (Baloh, & Vrecar, 2001) that also includes a CD-ROM with all examples (including solutions) from the practicals. Hence, students can easily repeat exercises performed at the practicals at home or/and after the end of the course in case they encounter a similar problem.

Noticeably a considerable amount of effort is still needed in order to achieve the other three sub goals, though we try to eliminate any excess or unnecessary effort.

In order to better understand the success of our efforts a survey was carried out at the end of academic year 2000/2001 (and will be carried out continuously in future). The survey was implemented as a questionnaire published on the World Wide Web and at the end of the course students were asked to fill it out. An instructor was present to help those that were still unfamiliar with the WWW although the majority of students had no problems. In total 458 students took part in the survey out of the approximately 650 that attended the classes at University program. Most statistical data mentioned in this paper comes from this survey; complete summarized results of the survey – after the survey they were available to participating students as well – can be found in (Business Informatics 1, 2001).

The purpose of the survey was twofold: firstly to identify the main characteristics of prior students' knowledge, experience and interest; secondly to find more about their attitude and interests towards computers. The important results are presented in the continuation of this paper.

Results show that almost all students already have a computer (97% of them have a computer at home) and use it regularly. However, most of them use it only for basic tasks (basic text editing, surfing the WWW etc.). As majority is familiar with World Wide Web and e-mail use, it is obvious that Internet can be and is used as a very efficient medium for communication with students (97% of the students

found the information published on home page of the course either useful or very useful). Also we can conclude that the efforts invested in preparation and execution of those courses paid off – 94% of the students found the practicals useful or very useful. This is a remarkable achievement considering, firstly, the fact that our students were business students, whose primary interests don't lie in field of computers and information technology, and secondly, considering the fact that practicals are compulsory.

Also 73% found the difficultness of those courses to be exactly right, with additional 24% who found it either slightly too high or slightly too low. Only the remaining 3% found it much too high or much too low. Once again, we consider this as a fine achievement, especially when considering the diverse backgrounds of students.

The survey confirmed the claims we made before: the use of the model guidelines for computers practicals at Faculty of economics resulted in a well structured course that offers interesting, relevant topics and also equip students for further learning without unnecessary excess efforts. This was also well received by the students who recognize the effort invested in those practicals by the instructors and respond well to it.

Conclusion

The model presented in the paper can serve every educator as a tool when considering changes in the way he teaches a certain topic. It can be used to establish which of the sub goals mentioned in the model is influenced by every change. Since the main model proposed is quite broadly set, it can be used in various fields and levels of formal or informal education.

As the importance of computer literacy education is increasing the model was applied to this field. We have shown the general guidelines that should be followed in it and the application of the model for computer literacy education at the University level. The presented case study of the Faculty of Economics, Ljubljana, where both authors have worked in recent years, showed that this can indeed lead to improved results of education and is also perceived as such by the students.

Further research and work on this model could include the application of it to various levels and fields of education as well as the refinement of instruments for evaluation, that is, measurement of the achievement of each of the four sub goals.

Obviously, the model in this paper is not a panacea for problems connected with education. Any learning requires an active involvement from students, teachers and others involved with it. As already written, every education is doomed to fail without involved and motivated teacher who knows what he is trying to achieve and how he is going to achieve that.

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Biography

Peter Trkman, M. Sc., is an assistant for Management Information Systems at Faculty of Economics, University of Ljubljana, Slovenia. In the past seven years, he has taught computer practicals for first year students at the Faculty and written several papers about theoretical and practical considerations of computer literacy education. Additionally he has published research papers on other topics such as operations research, strategic use of information technology and liberalization of telecommunications.

Peter Baloh, M. Sc., is an assistant for Information Management at the Ljubljana University, Faculty of Economics. His pedagogical work in past seven years has mainly been teaching computer practicals for business students. His main research interest is concentrated around the question of influence of contemporary Information and Communication Technologies and Information Management as a whole on (better) business performance. Topics of interest in view of that include business informatization, information audits, business process modeling, stochastic financial modeling, constrained optimization, and education in ICT field.