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Improving Communication Skills of Students in the Informatics Curricula

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Abstract. Writing has always been recognized as an important communication skill of an engineer. Also ability of oral communication has big influence on success of work. Developing communication skills of students play an important role in education. In this paper we report on experiences with improving communication skills in Informatics undergraduate and postgraduate courses.

Keywords: Informatics curricula, writing skills, presentation, communication.

1 Introduction

The ability of communication has big influence on success of work (e.g., a software project). An engineer must be able to deliver his information and also receive information from another person. In this process an interpretation of delivered information should reflect sender intention. Keeping interpretation of delivered information is important. In order to achieve this the engineer must be able to communicate, e.g.,

- clearly express his ideas (in writing - orally; formally – informally);
- lead/facilitate a group discussion;
- participate on decision process in a group.

A common approach to improving communication skills is to include into the education such components that develop these skills, e.g.:

- students have to produce documentation that is evaluates not only on the basis of content and achieved results, but also on clarity, style of writing, appearance of a document, technology used for creating the document;
- students have to present results of their practical work that is evaluated not only on the basis of content, but also on clarity, style of presentation, impression made by presenter, technology used for presentation;
- students have to communicate in group or team in order to solve a given problem.

Technical aspect of communication plays important role. Students should experience different forms of communication and use modern information technologies and software tools, e.g. electronic mail, electronic conferences, hypermedia, electronic presentation, etc.

In response to this appeal we have expanded at the Slovak University of Technology in Bratislava several existing assignments both in undergraduate and postgraduate study to include writing and presentation components. This enforces the students to reflect on the assignment and they often have better results (e.g., develop better programs). In group and team projects students have opportunity to solve tasks in cooperation with their team-mates and can further improve their communication skills.

The purpose of this paper is to stimulate discussion about desirable experience linked to communication ability of an engineer, which should be considered in Informatics curricula. We discuss several approaches to improving communication skills of the students. Discussion is based on experiences gained during several years of teaching at the Slovak University of Technology in Bratislava. In Section 2, we describe approaches to improving writing skills in the Informatics curriculum. Section 3 is devoted to the role of presentation of students' work. Next, in Section 4 we discuss communication within the module Team project. The paper closes with our conclusions.

2 Writing across the Informatics curriculum

To improve writing skills of the students we follow similar strategies as presented in [5]:

- require revisions;
- use peer editing;
- distinguish syntax and mechanical errors from flaws in the content or organisation (give separate grades for each);
- don't be a human language spellchecker, red-penciling every mistake and refusing to proceed with evaluation at a deeper level;
- encourage students to read broadly and frequently (the newspaper instead of the television news, a recreational novel rather than a movie or entertainment on television).

Introductory computer science modules usually involve little writing in a form of comments to developed programs (restricted form of program documentation). Here could be involved writing exercise of precise description of the implemented algorithm. Also description of a piece of code implemented by another student is a good writing exercise. Students should abstract and describe the purpose of code rather than just describe the code in a natural language. Another possibility is to analyze implementation of the same problem in several different programming languages. This type of assignment is useful when new programming paradigm is to be introduced (e.g., in the module *Functional and logic programming* students analyse functional program and compare it with a procedural program which solves the same problem).

To prepare students for larger writing assignments (typically term projects) several short writing components should be included to different modules. Students should have regularly

brief writing exercises in order to perform better on more extensive writing tasks later. Short, simple writing assignments can be integrated into almost all modules of Informatics curricula. Several examples of simple writing assignments in the Computer Science Curriculum are described in [3].

Bellow is the list of some examples of writing assignments at the Slovak University of Technology in the undergraduate study:

- develop a program documentation (most often in a form of comments to the developed programs);
- describe the behaviour and the purpose of a program (typically written by another person);
- write a user manual for developed program (part of the final bachelor project);
- write a technical documentation of requirements specification (group project);
- write review of documentation of another student;
- write a design document (e.g., design of a database structure);
- evaluate experiments (e.g., efficiency of different algorithms);
- describe and discuss method used for solving a problem (part of the final bachelor project);
- research and describe state of the art in the selected area (part of the final bachelor project);
- evaluate lectures and/or labs (questionnaire at the end of a particular module).

The above mentioned writing exercises are exercised also by students during the postgraduate study. Moreover postgraduate students work on three relative complex projects: diploma thesis project I, diploma thesis project II and team project. In these projects we put big emphasis on developing and subsequent evaluation of writing skills of the students.

Reviewing is exercised mostly in a Team project module. Moreover the students:

- write logs and progress reports (part of the team project documentation);
- create and keep up to date on the World Wide Web a hypertext presentation of a project;
- write an essay;
- write a standard for specific activities (as a part of team project and the module Management in Software Engineering);
- write a survey paper about a collection of the papers (from the selected problem area related to the particular module).

In the following paragraphs we describe two examples of writing exercises which contribute not only to enhancing specialized knowledge but also to improving the writing skills.

2.1 Essay assignment

In the module *Management in Software Engineering* each student should produce an essay on a given topic. Themes for essays are selected from existing sources, mainly from the available

books on software engineering. For example in the academic year 1997/1998 we used Davis' *201 Principles of Software Development*, and in 1998/1999 Brooks' *The Mythical Man-Months*.

Students are divided into groups of 8-10. Each group produces proceedings of their essays. The proceedings are developed after the revision process. Students should improve their essay according to comments made by teacher.

This kind of assignment forces the student to gather information from a nontraditional source. It is a break from the typical "read and report" type of assignment. It provides a useful resource to supplement the module materials, as many of the essays are very good and become the mandatory reading for all students in the module.

Moreover students gain experiences with some available tools supporting development of a professional looking paper and book. They have to produce a "good looking" book with its all parts such as preface, acknowledgement, contents, index, etc.

2.2 Technical paper writing assignment

In the *Knowledge Based Systems* module students produce a term technical paper. Students have to

- identify topic,
- find sources of information,
- experiment with some aspects of it (if needed),
- write a paper,
- prepare and deliver a presentation.

The problem with this approach is that students often approach writing the paper in the last minute, collect easily available information from the Internet and textbooks available in the university library, and use them without any deeper understanding. They often only rewrite (or translate) sources in some way.

In order to improve this approach we included peer reviews of students' writing. Peer evaluations are useful in several ways. First, students tend to be more careful about their work if they know that a colleague (perhaps a friend) will evaluate the result. Second, students often pay much attention to the accuracy of the work if they know that the author is another student.

Typically, students are not prepared to write papers. We discuss the format and structure of the paper to be submitted. Some time is also spent discussing language usage relevant to technical papers. We do not teach writing, and do not want to correct mechanical errors. The focus is put on organization, content, and appropriateness for the intended audience. The commonly accepted way to achieve this is to make clear for students that written work will not be accepted unless students take the time to meet minimum standards of correctness and polish.

3 Presentation

Presentation of the work done is important part of the success of any project. Grading criteria for the presentations are organisation and content, presentation style, stimulation of interest,

relation to the module theme and the quality of the handout. Students should present their work (or progress) in several modules (usually the same modules that involve some writing exercise).

There are two basic possibilities to developing presentation style:

- make sample presentations, show good and poor organization, use of visual aids, …;
- give students some minimal recommendations and let them prepare presentation by their best, then comment and discuss all aspects of individual presentations.

For example, in the module Management in Software Engineering we use the second approach. Although this module is provided in the postgraduate study (students presented their work several times during the undergraduate study already) students still have little experience in presentation (sometimes they are much accustomed to lecture format).

Students present main ideas of essay (essay writing assignment was described briefly in the Section 2). Last three lectures are divided to three segments of approximately 50 minutes each. Students are responsible for the first two segments and the lecturer for the third segment. Students are told to plan presentation of approximately 10 minutes each (this time can be increased according to number of students enrolled the module).

Students have strict time constraints for the presentation. This makes them to plan the presentation. If presentation stimulates discussion that is lively and productive we allow it to last more and compensate time by shortening the lecturer's segment.

After the presentation block we discuss the style of presentations. Lecturer summarises an overall impression of a group and comments on individual presentation. Simple method of discovering students' understanding of particular presentation is to ask them briefly describe (write down two or three sentences) content of presentation of their colleagues. In most cases students remember "good" presentations and totally forget some (not very good) presentation. Our goal is to stimulate live discussion about the presentation style, but also about the content of the particular presentation.

The problem is that very often students perform even worse at participating than in presentation. This situation can be improved by forcing students who reviewed work of their colleagues to prepare questions in advance and to stimulate discussion after each presentation.

4 Team Communication

Communication skills of students can be improved not only by forcing student work individually on writing assignment or present his/her work. Another possibility is to let students work on an assignment in group or team.

Students must decide how to mesh their various work patterns to develop the required product. Basic skills which should be exercised and monitored include time planning, product presentation, decision making, keeping personal log on work hours, negotiating and keeping work contracts, managing priorities and deadlines, acquiring information (e.g., by interviewing people) and accessing information (e.g., by searching documents).

To facilitate communications among team members (and also among teams) there is more and more often used internet or intranet. We encourage this practice, not to speak about such

elementary means of electronic communication as e-mail, which is indispensable. Moreover, each team creates and regularly maintains its web page that includes also their "official" presentation of their project.

Students within a team should meet on a regular basis. Teams meet with their project supervisor at least once a week. There are also regular private meetings of the team. All major decisions should be recorded in a project log.

5 Conclusion

This paper is a report on our approach to the widely recognized need to improve communication skills of students. This involves incorporating classroom presentations, changing the level of participation of students, increasing expectations and requirements for student performance, and making students more responsible for their own learning.

Improving communication skills of the students is increasingly being considered important in Informatics education. Norris and Wilkes [6] describe an interesting "student conference" approach as a means to teaching communication skills. Each student performs an implementation and experimental study, then writes a research-style technical paper on his work on the topics selected according Computer Systems module. Students also participate in an anonymous review process, then revise their own papers, and make oral presentation of their work. Similar approach is described also in [4] where result of the process of writing and reviewing papers is publishing the magazine of students' work.

Some students are not pleased about doing much writing. But at the end of the course most of the students admit improving their skills. Some of them appreciate the opportunity to rewrite assignment based on the reviewer comments.

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