CONTEXT-BASED AND PROJECT-ORIENTED TRAINING COURSE IN INFORMATION AND COMMUNICATION TECHNOLOGIES FOR BACHELOR STUDENTS IN PHYSIOTHERAPY

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Abstract

The paper presents the results of a context-based and project-oriented approach in teaching for five consecutive academic years by the author of the practically-oriented compulsory subject “Informatics” (Information and Communication Technologies – ICT) to first year undergraduate bachelor students in “Medical Rehabilitation and Ergotherapy” (MRE) at the Faculty of Medicine (FM) of Sofia University “St. Kliment Ohridski” (SU), Sofia, Bulgaria. The MRE is a four year university bachelor programme. The author decided to develop a training course, based in a context case scenario of preparing and running by the students of their own team based private physiotherapy centres. The project case was named “Plan to an investor” for financing a physiotherapy enterprise, and was envisaged to be the final assignment for the course. The students worked in teams. The final course grades were formed on the base of the weekly assignments (50%), and final course assignment plus its public presentation and defence (50%). The research goal of the paper is to analyse the quality of the teaching approach and the occurred learning by evaluating the 48 practical course products, developed by the teams of students during the five years of course delivery. In addition to the mastered ICT skills the students were taught implicitly and acquired some basic business planning and entrepreneurial skills with respect to their profession. The interest and motivation for work proved to be very high, reflected in the high quality plans to prospective investors.

Keywords: Context-based course, Project-based course, ICT skills, Physiotherapy.

1 INTRODUCTION

Since the academic 2012-13 year, and continuing for five consecutive academic years, until now, the author started teaching the practically-oriented compulsory subject “Informatics” (Information and Communication Technologies – ICT) to first year undergraduate bachelor students in the specialty “Medical Rehabilitation and Ergotherapy” (MRE) at the Faculty of Medicine (FM) of Sofia University “St. Kliment Ohridski” (SU), Sofia, Bulgaria. The MRE is a four year university bachelor programme. There are 2 to 3 groups of 10-15 students each year during the different academic years since 2012-13 academic year.

The research goal of the paper is to analyse the quality of the chosen context-based and project-oriented teaching approach and the occurred learning by evaluating the 48 projects - practical course products, developed by the teams of students during the five years of course delivery.

1.1 The “Medical Rehabilitation and Ergotherapy” (MRE) bachelor programme

In academic 2011-12 year a new medical specialty was open for admission of students at the Faculty of Medicine of SU, namely, the bachelor programme's specialty “Medical Rehabilitation and Ergotherapy” [1]. MRE prepares high-level specialists for work with persons with various neurosomatic, sensory, motor, mental, speech, cognitive, communicative, intellectual and other disabilities and children with specific educational needs. Graduate bachelors are able to successfully correct and develop motor, cognitive and communicative disorders of the needy. Such qualified specialists are indispensable for the specific practice in the state and the private sector to perform functional diagnostic, prophylactic, curative and rehabilitation activities [1]. There is no courses in the MRE curriculum, related to the professional and market orientation and realisation of the MRE graduates.

1.2 The Bulgarian context of the profession

According to the professional characteristics of the specialty the bachelors of medical rehabilitation and ergotherapy can work in the following state and private institutions: medical and medical...
institutions; Rehabilitation centers; Day care centers for adults and children with disabilities, specialized enterprises for people with disabilities; Special schools; Centers for mentally ill and addictions; Homes for medical and social care; Centers for temporary placement of children, national and regional services for the integration of disabled people, therapeutic institutions; Restoration centers, the tourism industry and others. They can participate as consultants and experts in national, regional and municipal centers, international and national projects, non-governmental organizations, and the like ([2], [3], [4], [5]).

The MRE specialists in Bulgaria are in demand, and the demand for their services will steadily increase due to the aging of the Bulgarian population. However in the public health care they are underpaid, [6], ([7], pp.12-13). From another side, the customer demand for these services is not, in general, solvent enough ([7], p. 13). The described above situation causes many of the graduated rehabilitators, ergotherapists, and kinesitherapists to go working abroad, or at least to leave the public health care system going to private rehabilitation centres and services.

At one or another point in their professional career significant part of them try to organise and manage their own micro- and small business, founding own private centres or studios for medical rehabilitation and/or fitness & massages; or arrange individual professional practice for MRE services. Thus, the private professional careers turn to be the biggest in number, and with the biggest potential for MRE job places.

### 1.3 The “Informatics” subject

#### 1.3.1 The “Informatics” subject

There is a compulsory course “Informatics” in the MRE curriculum, scheduled for teaching at the first semester of the first study year of the specialty. The subject is taught for 30 study hours (2 study hours per week), in entirely practical mode in a computer lab, with no any theoretical lectures. The course has application character, oriented towards capabilities to work with up-to-date general ICT application software (office packages) in the context of the MRE profession. The curriculum of the Informatics subject is aimed at provision and assurance of the necessary general ICT skills to the first year students, needed for their further academic study, and for their subsequent professional realisation as practicing rehabilitators, kinesitherapists, physiotherapists, and/or ergotherapists.

The main reason for absence of a theoretical/lectures part of the Informatics course is that there is a subject “Information Technologies” (IT) at the Bulgarian schools, which, in all the secondary schools in Bulgaria, is taught for compulsory minimum of 72 study hours. The IT school subject covers work with operating systems, wordprocessing, graphic editors, spreadsheets, and presentations, e-mail and Internet (WWW). Thus, the role of the Informatics subject in the MRE curriculum is to recall, refresh, and update to the necessary level for the MRE specialty the general practical ICT knowledge and skills of the students, so as these skills to be of functional use for the physiotherapy study and profession. In this way, the subject “Informatics” poses a challenge to its academic teacher with regards to its practical usability, attractiveness, and motivation for the students.

#### 1.3.2 Purpose and goals of the study programme

Purpose: The training in the ICT-domain discipline should be of practical usability for the MRE study, and for the professional and business realisation of the students.

Main goals of the “Informatics” course:

1. Students to recall, assimilate and apply context-applicable key skills in working with office applications, the Internet and modern ICT;
2. Implicit and concomitant formation and learning of basic skills for business planning and entrepreneurship by the support of ICT.

### 2 SELECTION AND DEVELOPMENT OF TEACHING METHODOLOGY

In order to develop the Informatics course in the most suitable way, the author conducted in 2012 a preliminary survey on the professional perspectives and realisation of the profession in the country. The results are presented briefly in Section 1.2. above, and showed that according to e.g. the Bulgarian Employment Agency [5], the places for professional realisation of the physiotherapists include public or private: polyclinic and hospital healthcare facilities; spa complexes of hospital type;
medical centers to resorts and sanatorium-resort complexes; sports medicine and cosmetic medical prophylactic centers; medical clinics in physiotherapy and rehabilitation. A significant part of the physiotherapists in the country during their career try to organise and run their small and medium private centres or studios for physiotherapy-related cares and services. From other side, the conversations with the academic teachers of the MRE specialty outlined the necessary practical ICT skills, needed for the period of the MRE study.

Thus, the question arise on how to ground the “Informatics” training in the prospective professional context of the MRE students?

2.1 Related theory and research work

When looking for appropriate learning theories and experiences that could be useful in the outlined study situation, some of the relevant theories and the practices, stemming from them to refer to, may include the Functional Context Theory by Thomas Sticht ([8], [9]), the related Situated Learning Theory by Jean Lave [10], as well as two well-known active methods of instruction – the Problem-Based Learning (PBL) ([11], [12]), and Project-Based Learning [13].

The Functional Context Theory is developed as a cognitive learning theory by Thomas Sticht, initially for training adults in Navy military. It is developed strictly as a theory for training of adults. The theory is based on the assumption that learners learn best when learning is based on their prior knowledge and skills [8]. The assumption is that adults will be reluctant to embark in learning activities that are not relevant to their work and experience. Being adults, they know already the things they want, and that is why they prefer training that is context specific. The developed strategies of instruction should require learners to use their problem solving skills. The theory accentuates that learning is influenced by the learner’s (experiential, professional) personal environment [9]. According to that theory, it is important that learning is realised through the context of the learners’ activities, which permits them to transfer successfully their classroom learning to their current and future work tasks.

Functional Context Theory close relates to the Situated Learning Theory, which also assumes that learning happens best when it is grounded in the learner’s previous knowledge and current situation [10]. The situated learning, unlike the “academic” learning, includes learning and mastering of knowledge and skills that are naturally related to real world tasks’ situations. According to Lave & Wenger [10] the learning is normally situated within authentic activity, context, and culture. Moreover, it is usually unintentional than deliberate. They call this rather unintentional nature of learning a "legitimate peripheral participation" [10]. Another important characteristics of learning, according to the Situated Learning Theory are that, firstly, knowledge needs to be presented in such authentic contexts that normally involve this knowledge. And secondly, social interaction and collaboration are important parts of situated learning -- learners become involved in the so-called "communities of practice" that include some common beliefs and behaviors, which are characteristic to the respective community and need also to be acquired by the learners.

Another appropriate learning theory and instructional practice is the Problem-Based Learning. In our case it is attractive with its hands-on, active learning centered approach aimed at the investigation and resolution of complex and/or complicated real-world problems. It is frequently used in higher education and in school settings, as well as in the corporate training ([11], [12]). Some of its main characteristics are that:

• Learning is led by challenging, open-ended problems with unknown answer/solution;
• Problems, or cases, are context specific;
• Learners should work as independent, active investigators in small teams;
• The problem is identified, formalised, and investigated, and possible solutions are sought;
• A most promising possible solution is agreed upon, implemented, then evaluated, and if needed – improved or replaced with another solution-candidate;
• Teachers have the role of facilitators, rather than providers of “the rightest” solution of learning, thus guiding the learning process and providing an inquiry-appropriate environment.

Many authors wrote about Project-Based Learning as a methodology and instructional approach. For example, Helle et al. [13] accentuate that Project-Based Learning enables students to develop skills by reconstruction of knowledge in a collaborative process of designing their project and addressing the chosen problem. In such a way they work more thoroughly with the related knowledge and skills and
during that work not only master the related knowledge and skills, but also identify gaps in their related knowledge and abilities. This is a truly authentic approach to their learning in comparison to the “traditional” study approaches. The other important features of Project-Based Learning that are emphasised by Helle et al. [13] include involvement of learners in higher order thinking, linking and integrating by them various sets of knowledge, theories and practices during their project work, directing them to synthesize new knowledge, develop ownership for their learning, and in this way leverage their motivation. The collaborative learning environment also influences positively students; learning, and engages them to study and apply concepts and skills in a meaningful for them manner, thus enhancing their experiential learning [13].

2.2 The chosen approach

2.2.1 Contextualised computer literacy skills, put in the context of the profession

Having in mind the collected background information and the related theory and research work, presented briefly above, the author decided to develop a training course, based in a context case scenario of preparing and running by the students of their own team based private physiotherapy centres/enterprises. The project case was named “Plan to an investor/bank for financing a physiotherapy centre”, and was envisaged to be the final assignment for the course. The students worked in teams of 2 to 4 people for their final assignments. The assignment task for the plan was designed so as to include textual/descriptive part, graphical part, and budget calculation part, and to be presented to the prospective investors with the development of an appropriate computer presentation. In addition, weekly assignments were planned for each week of the course, consisting of two types of assignments. The first type of weekly assignments were planned for the first half of the semester, and included appropriate context-based office applications tasks (wordprocessing or spreadsheet based) of a study-related, professional, or professional market interest. The second type of weekly assignments, planned for the second half of the semester, were related directly to concrete parts of the final project. The final course grades were formed on the base of the weekly assignments (50%), and final course assignment and its public presentation and defense (50%).

In addition to the mastered ICT skills, the students were taught implicitly and acquired some basic business planning and entrepreneurial skills with respect to their profession.

2.2.2 The ICT skills to cover through the course study programme

The Informatics/ICT content and skills to be covered in the course, are presented below in Table 1. All these skills should be refreshed and trained through the course, and should be evaluated through the interim (weekly) assignments, and through the final course project.

<table>
<thead>
<tr>
<th>Wordprocessing</th>
<th>Spreadsheets</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format: text, page, document</td>
<td>- Tables design</td>
<td>- Title and content slides</td>
</tr>
<tr>
<td>Footnotes</td>
<td>- Simple calculations</td>
<td>- Wording</td>
</tr>
<tr>
<td>Page numbering, head/footers</td>
<td>- Relative &amp; absolute addressing</td>
<td>- Pictures in slides</td>
</tr>
<tr>
<td>Tables in text</td>
<td>- Using complex formulae</td>
<td>- Color design</td>
</tr>
<tr>
<td>Styles – applying and creation</td>
<td>- Linking data in different sheets</td>
<td>- Visual design</td>
</tr>
<tr>
<td>Automatic table of content</td>
<td>- Charts and diagrams</td>
<td>- Animations</td>
</tr>
<tr>
<td>Bookmarks, hypertext, page</td>
<td></td>
<td>- Sound and media (elective)</td>
</tr>
</tbody>
</table>

2.2.3 Course interim (weekly) assignments

**Interim weekly assignments of the first type**

Assignment 1. Briefly present yourself to your colleagues and the lecturer

Assignment 2: Wordprocessing – Format the Wikipedia text “Physical Medicine and Rehabilitation”

Assignment 3. Wordprocessing - Creation and Formatting of a short written application
Assignment 4. Description and evaluation of web-sites of rehabilitation centres and units
Assignment 5. Wordprocessing – Tables: Create timetable of your weekly study programme
Assignment 6. Wordprocessing – Use of Styles and creation of automatic Table of Contents
Assignment 7. Wordprocessing - Creation of a hypertext document: bookmarks, hyperlinks, navigation

Interim weekly assignments of the second type
Assignment 8: Spreadsheets - Computer and office equipment for your rehabilitation centre
Assignment 9. Spreadsheets – Create file “Budget” and develop table sheet “Recurrent expenditures”
Assignment 10. Spreadsheets – Create table sheet “Incomes”
Assignment 11. Spreadsheets – Create entire budget file with 3 different table sheets
Assignment 12. Spreadsheets – Creation of charts and diagrams
Assignment 13. Computer-based presentations – develop and deliver individual presentation on rehabilitation theme on your choice
Assignments 14 and 15. Work on your Final course project

2.2.4 Final course project
Title: „Rehabilitation centre” - Plan to an investor/bank.
Contents of the plan:
• Description of the Centre – 5-10 pages + pictures + plan-sketch (wordprocessing file)
• Budget (spreadsheet file)
  o Budget „Investments” (Expenditures) for one year – detail („Investments” Sheet 2 in file):
    ▪ Equipment
    ▪ Furniture and premises (rent)
    ▪ Personnel (monthly)
    ▪ Consumables and materials – monthly (10 to 20 items/options)
    ▪ Investment chart - by types, with names and values shown
  o Budget „Incomes”, for one year – detail („Incomes“ - Sheet 3 in the file):
    ▪ Services offered – price-list
    ▪ Monthly incomes
    ▪ Incomes chart – by types, with names and values shown
  o General table sheet “Balance” for one year with the calculated general values of the types of Investments (expenditures) and Incomes, filled in automatically from the “Investments” and “Incomes” sheets - („Balance“ - Sheet 1 in the file):
    ▪ Balance Chart(s) by types (“Investments” and “Incomes”), with names and values shown
  o Computer presentation & its delivery and defense – Presentation of the Centre (10-15 min):
    ▪ Live mode: Live presentation to public/investor, OR
    ▪ Automatic presentation – for PC or Internet, with voice narration, in appropriate format

3 ANALYSIS
In order to analyse the quality of the teaching approach and the occurred learning we evaluated the 48 practical course projects - the final course products, developed by the students during the five years of course delivery. In 2012/13 academic year the students formed 13 teams and, respectively, developed 13 final projects, in 2013/14 – 12 final projects, in 2014/15 – 9 projects, in 2015/16 – 8 projects, in 2016/17 – 5 projects (the smallest number of enrolled students in the MRE specialty were that year).

Four sets of evaluation criteria for the final projects were developed – for the text part of the plan (Wordprocessing), for the budget part (Spreadsheets), for the presentation to the investors (Computer Presentation), and for the evaluation of the implicitly formed knowledge and skills (Marketing,
Business planning, and Entrepreneurship). Each of these four sets contains 9 individual criteria. Two of the evaluation sets – for the Text, and for the Presentation, were divided on two sub-sets – Informatics/ICT part (4 criteria each part), and Content part (5 criteria each part), while the Budget set of criteria was divided on Basic spreadsheets part (4 criteria), and Advanced spreadsheets part (5 criteria).

Each criterion is measured in a scale of 0, 1, 2, 3, where 0 is unsatisfactory/fail, 1 – satisfactory/pass, 2 - good, 3 – outstanding.

3.1 Evaluation criteria

3.1.1 Informatics/ICT evaluation criteria

The Informatics/ICT-related criteria from each of the three first sets (Text, Budget, Presentation) are presented in Table 2 below.

<table>
<thead>
<tr>
<th>ICT Tool</th>
<th>Criterion 1</th>
<th>Criterion 2</th>
<th>Criterion 3</th>
<th>Criterion 4</th>
<th>Criterion 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td>Automatic Table of Content</td>
<td>Text format</td>
<td>Graphics</td>
<td>Graphical office plan</td>
<td>-</td>
</tr>
<tr>
<td>Spreadsheets Basic</td>
<td>Income Sheet</td>
<td>Expenditure Sheet</td>
<td>Balance Sheet</td>
<td>All tables in place</td>
<td>-</td>
</tr>
<tr>
<td>Spreadsheets Advanced</td>
<td>Proper formulas in tables</td>
<td>Proper absolute addressing</td>
<td>Formulae with data from different sheets</td>
<td>Automatic Tables' Recalculation</td>
<td>Proper Charts</td>
</tr>
<tr>
<td>Presentation</td>
<td>Title and Contents Slides</td>
<td>Slides Wording</td>
<td>Color and Graphics Design</td>
<td>Animations</td>
<td>-</td>
</tr>
</tbody>
</table>

3.1.2 Content evaluation criteria

The Content-related criteria from the Text and Presentation sets are presented in Table 3 below.

<table>
<thead>
<tr>
<th>Document Content</th>
<th>Criterion 1</th>
<th>Criterion 2</th>
<th>Criterion 3</th>
<th>Criterion 4</th>
<th>Criterion 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td>Introduction, Mission, Vision</td>
<td>Centre description</td>
<td>Team description</td>
<td>Services offered and prices</td>
<td>Budget Tables/Charts Included</td>
</tr>
<tr>
<td>Presentation</td>
<td>Introduction, Mission, Vision</td>
<td>Centre description</td>
<td>Team description</td>
<td>Services offered and prices</td>
<td>Budget highlights (incl. tables / charts)</td>
</tr>
</tbody>
</table>

3.1.3 Marketing, Business planning, and entrepreneurial evaluation criteria

The nine evaluation criteria to measure the implicit knowledge of Business planning are presented in Table 4 below.

<table>
<thead>
<tr>
<th>Document Content</th>
<th>Criterion 1</th>
<th>Criterion 2</th>
<th>Criterion 3</th>
<th>Criterion 4</th>
<th>Criterion 5</th>
<th>Criterion 6</th>
<th>Criterion 7</th>
<th>Criterion 8</th>
<th>Criterion 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Planning, Financing, Marketing, and Advertisement</td>
<td>Place of the Centre</td>
<td>Target Audience</td>
<td>Target Services</td>
<td>Initial Capital</td>
<td>Investm., Equipm., Expenditures</td>
<td>Income policy</td>
<td>Personnel</td>
<td>Competitoni on and collaboration</td>
<td>Business Policy and Realism</td>
</tr>
</tbody>
</table>
4 RESULTS

This section presents in a graphic form the results of the evaluation of the 48 final student teams’ projects for the five years of teaching of the “Informatics” course. The table with the numeric data and more charts that are presented below, are available online in a shared Google table [14].

4.1 Evaluation charts of the Text documents, Budgets, and Presentations

4.1.1 Evaluation charts of the Text documents

From the data presented in the Text-related charts it can be seen that the Wordprocessing skills in general make a progression during the years (Fig. 2), but with some fluctuations of the skills for Automatic Table of Content creation and the Text formatting (Fig. 1). The Content of the text parts of the projects also improves year-by-year. In total, in all years the average marks are above 2 (“Good”).

![Figure 1. Text documents quality for 5 years by 9 criteria (4 for Wordprocessing, and 5 for Content).](image)

![Figure 2. Overall Text documents quality for 5 years by Wordprocessing & Content, and in Total.](image)

4.1.2 Evaluation charts of the Budgets

From the data in the Budget-related charts it can be seen that the Spreadsheet skills in general make a progression during the first three years (Fig. 4), and for the 3rd to 5th year reach a stable state, slightly decreasing at this high level of marks with some 0.14 points from 3rd to 5th year for the Advanced spreadsheet criteria (Fig. 3, 4). The skills for absolute addressing of cells/ranges, linking data from different sheets, and automatic recalculation, although being high for the last 2 years, make a slight decline in comparison to the 3rd – highest mark – year, which shows a room for improvement.
4.1.3 Evaluation charts of the Presentations

The Presentations design results increase during years 1, 2, and 3 and slightly decrease last 2 years.

Figure 3. Budgets/Spreadsheets quality for 5 years by 9 criteria.

Figure 4. Overall Budget quality for 5 years by Basic & Advanced spreadsheets and in Total.

Figure 5. Presentations quality for 5 years by 9 criteria (4 for Design, and 5 for Content).
4.1.4 Evaluation charts of the Business planning skills – implicitly taught

Figure 7. Business planning skills - for 5 years by 9 criteria.

4.2 Projects quality – by Text, Budget, Presentation, Overall

Figure 8. Projects quality – by Text, Budget, Presentation, Overall.
The implicitly taught Business planning skills show steady improvement during all the 5 years of the course delivery (Fig. 7).

The last chart (Fig. 8) shows that in total the first 3 years there is a steady increase of the quality of the projects to a substantially high level, and then, reaching this plateau, the quality stays at this level with a slight fluctuations, depending on the student cohorts during the years. The reached level of marks is pretty high, and it is not realistic one to expect that further major increases will occur. The goal should be to maintain the quality of the learning and the projects quality at this high level.

5 CONCLUSIONS

As a conclusion we may say that the designed course curriculum and training proves to be highly successful and yields very good results in terms of functional ICT-skills of the students, their personal and professional interest, high satisfaction with the work during the course, high motivation and gained knowledge about the basic principles of Business planning.

The envisaged next steps for the following years are directed at (1) development of detail and precise rubrics for the three different parts of the projects (Text document, Budget, Presentation), based on the evaluation criteria, presented in the paper; (2) Development of a questionnaire for students’ opinion survey at the end of the course (different from the one, administered by the faculty), and (3) Inviting colleagues academic teachers in Physiotherapy to evaluate the presented physiotherapy subject matter content in the final students’ projects, and to give them further advice on improvement.

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[4] Faculty of Medicine, Thracian University – Stara Zagora, “Medical Rehabilitation and Ergotherapy”. Retrieved on 05.05.2017 from https://goo.gl/ktqnmZ


[14] Shared Google table with the numeric course evaluation data & charts at: https://goo.gl/tU3eY1