Automatic generation of documents and reports for educational process

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Abstract. Management of educational process implies a large number of documents and reports that are interconnected and have high impact upon students and teachers. Coordinators of educational processes struggle with time management, correlation between implied parts and specific requirement. Present paper is focused on distance learning educational process that has specific requirement regarding students, teachers timetables and discipline management documents. Authors developed an informatic application that allows users to obtain: students’ and teachers’ timetables; reports regarding teachers from all study program; calendars of disciplines. Using this application, time invested in the process is reducing with almost 55%, proving the opportunity and efficiency of application.

1. Introduction
Management applied in standardization of different area is a real trend during these days [1]. Informatic application used in management of standardization is a real benefit in efficiency and sustainability of any process.

Management of study programs implies reports that are based on different type of document, mainly Microsoft Word documents. On national level there is no unique informatic application that may help coordinators to design these reports.

There is an international interest for managing documents, existing informatic applications designed for human resource departments in recruitment process, or for email management at organization level. These applications allow users to manage, store, protect documents, but not necessary to generate ones based on templates. Thus, there can be mentioned: OpenKM, Open DocMan, Seedddms, Kimios, GoogleDocs, Bitrix24, Nuexo, Krystal DMS, LogicalDOC, etc. [2]. All mentioned application are Open Source ones.

At universities level there is no national/ international software, agreed to be the most used. In Romania, universities, most of the time, develop their own informatic application, that include curricula development, position chart, students management, etc.

The Romanian Agency for Quality Assurance in Higher Education [3] doesn’t impose specific informatic application but the format of the document as structure and aspect, not as specific type of file. The Agency doesn’t have an on-line procedure to evaluate program and thus there are no restriction regarding file format of documents.

National evaluation of distance learning programs is based on the documents as:

- Curricula (specific format, standard formula implemented);
- Syllabus for each course;
• Timetable for each group of students per course;
• Timetable for each course;
• Timetable for each teacher.

All these documents are interconnected and dependents and thus accuracy is very important. Besides, these aspects is the copyright and license issue that restrict the applications.

2. Conceptual design of informatic application

In the context of minimum investment, at the universities level, an informatic application should be developed and used with more or less common software, eventually included in some packages, at low cost.

Thus, informatic application was developed using C# programming environment [4, 5]. This environment allowed authors to connect a user friendly interface to Microsoft Excel [6] input and output data. These two software are included in hardware systems acquisition. Authors choose to develop application in C# because the flexibility of it to interconnect different data. Even if input data is an *.xls file, scheduling application is not an Excel or Visual Basic application because the complexity of the conditions. Besides this, authors intention is to develop an general application, independent of Microsoft Office licence, output files being easily changed, if it is necessary.

Structural diagram of informatic application is shown in figure 1. The main idea of the application is to import data as *.xls format and to export data also as *xls or *.xlsx format.

![Figure 1. Structural diagram of informatic application.](image-url)
Data structure is an executable application that concatenates data from input data base and allow interface to be active for the user. Output documents are generated in a typical Excel formats, that correspond to ARACIS standards, oriented on distance learning formats.

Input data base should be a specific formatted document, with specific conditions satisfied, as it can be seen in figure 2.

![Figure 2. Input data base structure and conditions.](image)

Input database has the following characteristics:

- **Calendar dates**: full date (time and hour, according to university laws); for distance learning, these data are weekend days; they include national holidays but mark them with different colour thus the user is well informed that should not plan any activities in those days;
- **Teachers**: full name, academic degree and institutional e-mail address; for each teacher is generated an unique identifier;
- **Curricula**: distance learning format with specific activities (individual study, tutorial activities, homework activities, applicative activities); each discipline has a unique identifier and a unique colour code (last code is to make the students and teachers timetable more visible per courses);
- **Rooms**: codes for available and appropriate rooms for each semester; data sheets includes coordinator department; number of places and type of room (for seminar, specific laboratory, etc.); each room has a unique identifier.
- **Students groups codes**: official code for each group or semigroup of students, according to secretariat; each entity has a unique identifier.

As it can be observed in the above description, performance of the application is increased by using unique identifiers for each input data. These identifiers are not visible for the user and are automatically generated using H tables.

The whole data base is design as a three dimensional matrix (figure 3).

In this matrix, students groups, hours and days work based on index. Each cell stores code for one teacher, one course (name and type of course) and one room. For each change date from data base is depth-first checked (using sub-group index) uniqueness used of room and teacher. If there is an overlap it will be marked on interface.

When it is first generated, the oriented format file stores all scheduling data, including input data. This is the only file which may restore data structure from the last saved version. This file is used to save intermediary versions or to generate all the output files.
3. Functionality of informatic application

The informatic application is a user friendly application that helps to fill out timetable by marking overlaps regarding rooms, teachers, students and also include exactly the number of hours/ course from curricula.

Logic diagram of informatic application is shown in figure 4.

Filling-out the schedule implies to select one student group, this one will be the active area. Interface allows user to open multiple schedules for different group of the same year or different year (figure 5). On the interface are show 4 different areas that have the following roles:

- Area 1: is the active area, on which is fill-out schedule of the current group of students (in figure group no 2LD491);
- Area 2: inactive area that allows user to see different timetables (from the same year or different year);
- Area 3: active area that allows user to choose name of the discipline, type of activity according to curricula, teacher and room; inside this area user is able to see how many hours are already allocated for one course on each activity (SI:... AT:.... TC: .... AA: ....);
- Area 4: includes schedules, with dates according to input data file; holidays or evaluation sessions are marked automatically on the schedule.

Figure 5. Interface of informatic application.

Students’ timetable (*.xls format) is one file for all study years, a sheet for each group of students (figure 6).

Figure 6. Timetable of one group of students.
File contains the following data:

- Each sheet is a bidimensional matrix: rows are timelines and columns are dates;
- Name of each sheet is name of the students’ group;
- Schedule is coloured, each course has its own unique colour;
- Each cell (a class) contains: abbreviation of each course, type of activity, teacher name, room and a hint that contains full name of course and complete data regarding teacher;
- On each sheet, based on colour code, there are full name of teachers and their official e-mail address.

Schedule of teachers has the same structure as students schedule. A sheet for each teacher (figure 7). First sheet is a Table of contains and allows users to navigate through document.

![Figure 7. Timetable of one teacher.](image)

File contains the following data:

- Each sheet is a bidimensional matrix: rows are timelines and columns are dates;
- Name of each sheet is name of the teacher; informatic application concatenates all courses on the same schedule, differentiating them by colour code;
- Each cell (a class) contains: abbreviation of course, type of activity, teacher name, student group index, room.

4. Informatic application analysis

Informatic application has a user-friendly interface, multi-management schedule and is a time-saving informatic instrument.

From type of actions point of view, application is structured as follow:

- Main timetable is done by the user, manually, based on input data. In this step, all checking process (not to exceed the number of hours on each type of activity, not to correlate some discipline to other teacher, not to overlap activities in the same room or for one teacher) are automatically done;
- Students’ timetable, teachers’ timetables, teachers reports timetables, courses’ timetables, rooms’ timetables (figure 1) are automatically generated by application. These timetables are generated based on the main timetable. Design of output documents are according to Romanian standards for distance learning programmes.
5. Conclusion

To evaluate an informatic application it is mandatory to compare two possibilities. In Transilvania University case, there is no application oriented on distance learning study-programs that may help coordinators to create schedules of any type, but there is an application designed for full-time study-programs (called here classical application). In the following there are results of time-analyse and error-analyse done by authors, obtained by simulating a schedule for one semester (four study-years and two or three groups of students/ study-year) using classical application and authors’ informatic application.

Thus, regarding time-analyse there was simulated full schedules (students, teachers, courses and rooms) and all times were computed reporting to informatic application from Transilvania University for full-time study programs (figure 8). In figure 9 is compared time spent to check error and to correct those errors. In figure 8 and figure 9, in actual informatic application there is no instrument that helps teachers to generate, based on specific schedule, the course scheduling (so, it was considered Not Appropriate).
Based on these analysis, design time, for all type of schedules (authors’ information application vs. classical application) reduces with around 55%. From checking error process point of view, time dedicated for these actions (authors’ information application vs. classical application) is reduced with more than 80%. From these data may be concluded that authors’ informatic application is a time-saving instrument, containing a dynamic real-time error checking thus the schedules are from the beginning free from errors. This is the main advantage of the developed application. From errors point of view, in the case of informatic application, there will be no error for timetables that are automatically generated (teachers, courses, rooms). There are still errors in input data (the same error because all the process in manually done by user). Students’ timetable design process is error less than classical method because the checking for error steps are dynamically done (real-time): when user select a course, automatically appears the already timetable for the course (the same happened for teacher or room).

Authors’ informatic application was developed to control high complexity of interconnected documents in high-education management of study programs.

References
[1] Garechana G, Río-Belver R, Bildosola I et al 2017 Effects of innovation management system standardization on firms: evidence from text mining annual reports Scientometrics 111(3)
[2] Singh H 2019 Top 10 Free and Open Source Document Management System Medium on-line Journal
[3] *** 2019 ARACIS Standards. On-line publication, available on https://www.aracis.ro/invatamant-la-distanta-online/
[4] Troelsen A and Japikse P 2015 C# 6.0 and the .NET 4.6 Framework (New York: Apress)
[5] Thareja R 2018 Data Structure using C (London: Oxford University Press)
[6] Ostrovsky I 2014 Reading Excel Data with C# and OpnXML (New York: Amazon – kindle edition)