

Blended Learning Environments, Flipped Class and Collaborative Activities to Teach Databases in a Secondary Technical School

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The report describes some learning and collaborative activities, some tools and an on-line environment created to teach Databases to secondary technical school students. The on-line course, created by using the Learning Management System Moodle, realizes a blended learning environment to support daily classroom activities. The environment increases dynamically with the contribution of the teacher and the students and “wraps around” the class during the learning process. The course allows “Flipped Classroom” and collaborative activities, it supports discussions and exchange of information. It also enables students to have personal/sharing areas for files and supports the main cloud services to upload/download files. Topics of the course: modelling a database using the Relational Model, designing Entity/Relationship diagrams, SQL Language, Case Studies based on real life and the students’ scenarios.

1 Introduction

The “**Fundamentals of Databases**” is a course designed for Italian Secondary Technical School students (aged 17-18, specializing in Computer Science and Telecommunications). The Computer Science subject has 99 hours per year for the first, third and fourth years of the five provided. An Italian Technical School year has 32 hours per week; Computer Science occupies 3 hours per week for the whole school year.

In the first year of this specialization, students, aged 14-15, have an introduction to the basic concepts of ICT and digital literacy, to develop digital skills and key competencies. These goals are achieved by using Office Automation tools, searching for information on the web, evaluating sources, organizing data and presenting them. They also study computer architecture, numbering systems and Boole’s algebra. The approach is very often problem solving based. During the second part of the year, teachers introduce algorithms, flow charts and coding. This is possible by using one of two different approaches: easy and informal with icons and graphic environments (like “SCRATCH” [1] and “CODE.org” [2]) or more formally using a common Integrated Development Environment for a high level language, e.g. C++ Language. During the entire third year, students, aged 16-17, study programming languages, algorithms, flow charts and code. At 17-18, students complete their route in Computer Science by studying Website Design and Databases; this last module contains the course described.

It is possible to highlight some features of the course. The first is connected with **topics and skills**: students are introduced to some important topics of ICT such as modelling a database, designing Entity/Relationship Diagrams, building the schema in a MySql database, using SQL Language; all of this topics are connected to the Problem Solving key competence.

Some other relevant characteristics are connected with **didactic methodology**. The whole path of the course is composed by common daily class activities (in the classroom) and some on-line activities (in the classroom or at home); some activities are synchronous, while others are asynchronous. The e-learning environment is “BLENDED” and hybrid; the on-line structure was created by using the Learning Management System Moodle [3]. The Moodle course is a scaffolding and supports all daily class activities, it uses a mix of different approaches and is flexible.

The course increases dynamically with the contribution of students as well as the teacher, the e-learning model is ACTIVE and “wraps around” the class during the learning process [Calvani, 2008]. The course allows “flipped classroom” and collaborative activities (on-line and in the classroom); it supports discussions and sharing of information from teacher to students but, mainly, through peers who are the basic actors of the learning process.

Concepts are learnt by practical and collaborative activities connected to real cases, through team works and group discussions (on-line and in classroom). Using flipped classroom scenarios and a blended learning environment the teacher supports learning inside the classroom but he/she is also a TUTOR in the on-line course and a scaffolding for the whole learning process. This enables students:

- to help each other in the on-line forums;

- to discuss in threads, as well as to share and suggest shared solutions;
- to write collaboratively on a wiki page, an open document written inside the Moodle course, like the famous "Wikipedia" site;
- to share knowledge working in a teamwork of pairs with the guide of the teacher.

Teacher handouts and textbooks are expanded with the best student's homework: conceptual maps, summaries and insights are often discussed/modified and shared in the classroom. The on-line environment also enables students to have personal/sharing areas for files and supports the main cloud services to upload/download files such as Google Drive or Dropbox.

The last feature is connected with **students' motivation**. The student's interest is enhanced using case studies taken from their daily life; this allows them to share and discuss personal observations about reality in order to identify one or more possible solutions. Furthermore, in order to increase motivation, at the end of each term the teacher best evaluate collaborative and useful interaction in forums, inside wiki pages or other common areas.

The outcomes of all the features are that each year the course is different: enriched with the contribution of peers, not static but dynamic and open to personal styles and student's needs.

2 Contents and Topics of the on-line course modules

2.1 Common Area Module

The Moodle course uses the "standard topic" format, organized with sections that each teacher can give titles to. Each section consists of activities, resources and labels. At the beginning of the on-line course there is one section, called "Common Area", with short presentation and some relevant activities used very often during the whole year.

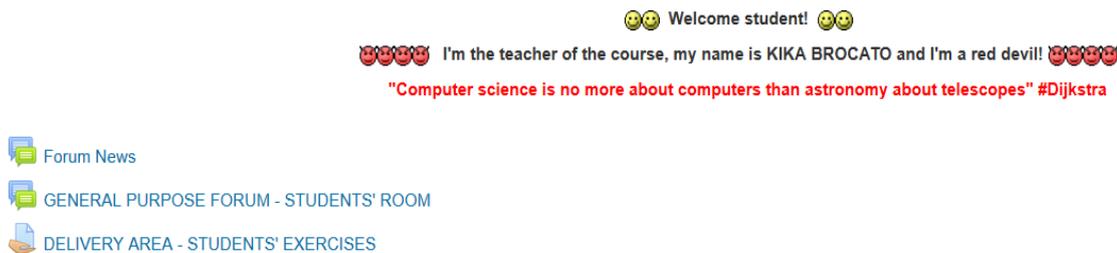


Fig.1: Common Area Module – the icon  identifies a Forum, the icon  identifies student's cloud personal area

As presented in figure 1, at the top there is the **News Forum**; it is managed only by the teacher for communications such as the presence of new material in the course, respecting deadlines, important conferences, etc.. Just below there is the **General Purpose Forum – Students' Room**. In this forum everyone (students and teacher) can open a new discussion, ask or answer each other; it is used for general topics not related to specific topic. At the bottom of the section there is the **Delivery Area**. Inside this area each student can upload files or exercises, like a cloud personal area inside the course. The contents of this area is visible to the teacher but not to other peers; the upload files manager supports the main cloud services.

In the whole course the teacher uses a communication mode related to students such as icons like "Smileys" or "Red Devils" as the common social emoticons. In order to engage the student's attention, the teacher uses the hash symbol "#" to reference a main topic and the symbol "@" to reference to a student, like on Twitter.

2.2 Module 1 - Theory of Modelling a Database (Study and Learn)

The Module 1 is the theoretical section of the course in which students study and learn basic concepts of Databases. It contains four distinct areas. As presented in the following figure 2, at the top of the section there is a **Database Forum**. A dedicated one, only for the theoretical Database framework. Everyone can open a new discussion inside the forum, ask or answer questions each other about materials or about lessons performed in the classroom. As well as each student could share personal notes, maps, diagrams, summaries, links and so on in a thread.

Just below (red color text in figure 2) there is a short **Summary** that helps students to understand right way to study the module and to perform the final test. It contains reference pages from the textbook, a quick index of different kinds of files and short, clear instructions on how to use the materials.

The section contains also some **Booklets** about the “Theory of Databases”. All the files are written by the teacher in order to explain the basic terminology and symbols of the module such as: Fundamentals of Relational Model, Conceptual, Logic and Physical Levels, Entity/Relationship Diagrams, SQL Language syntax for query, manipulate and create a database in a MySQL Environment. The best student’s homework, showing great valence to be studied, can be published in this section. Contents written on the whiteboard could be shared inside this area.

At the bottom of the section, as in the following figure 2, there is the **Final Test**, and individual on-line assessment. The on-line test is composed of different types of questions such as open, multiple choice, radio button, cloze, gapped text, fill the blank, etc..

THEORY OF DATABASES

Relational databases: introduction and basic concepts.

 Forum about the Theory of Databases

Module 1:

- Read the textbook from page 10 to page 30
- Read the handouts number 1, 2 and 3 (shared in the section)
- Read and analyze examples of data in the Excel files
- Follow all the threads and the notes published in forums (by the teacher and the students).

 DATA BASE 1 - Introduction

 Example 1 - Data Redundancy using asynchronous files

 DATA BASE 2 - Fundamentals and basic concepts

 Example 2 - Historic passages and models

 DATA BASE 3 - Insights

 Assesment test

 Collaborative correction of the Assesment

Fig.2: Module 1 – the icon  identifies the dedicated forum, the icon  identifies a theoretical file, the icon  identifies an Excel file, the icon  identifies the final test and the icon  identifies the wiki page

Below there are some observations about contents. In Module 1 the concepts are introduced through “**real cases**”, by means of simple problematic situations and related to a student’s daily life. The materials contain diagrams that help students to understand the historic passages in Database Theory. For example, to motivate the Relational Model and the use of a DBMS, the teacher, using distinct and not synchronous files, can highlight errors connected with types of databases not managed with a Relational DMBS.

Data redundancy, a relevant topic connected to Relational Databases, is introduced through a case study, for example: “A bank database has to memorize and manage some current accounts, memorizing name, surname, address, account number, amount, deposits, withdrawals and bank transactions”. Redundancy errors are highlighted using one of the Excel files (figure 2) which contains different and not synchronized folders for “bank details”, “clients” and “transactions”. The teacher, in classroom, may ask the students for information connected to the problem and can store them in folder’s cells (total amounts, one or two transactions, ecc.). After a short talk, the teacher can modify the cells of the transaction folder by adding, deleting and altering data. Immediately errors may be detected by reading the asynchronous folder of the current amount.

Files, numbered from 1 to 4 in figure 2 contain detailed and technical contents, terms and definitions with connected examples such as Entity/Relationship Diagrams, real life case studies, screenshots from MySQL or PhpMyAdmin, as well as queries and commands of SQL Language.

About the methodology connected with the evaluation of **on-line test**: the teacher has to evaluate by himself all the open answers, the other ones are evaluated automatically by Moodle LMS. At the end of the test, the system instantly gives students a **feedback** for each close question; these feedbacks are written, by the teacher, before the test starts but can be modified also during the revision. Students can read questions, feedbacks and answers during the whole school year.

Once the on-line test is finished, a key collaborative activity is performed as a homework task; students have to write down the solutions for each question of the on-line test, writing on a **Wiki Page** (figure 2 - last activity). For each question, they have to work in collaboration resulting in a clear and exhaustive answer. Teacher suggested also to

write, for each question, reference page numbers of the textbook or other useful electronic materials (in the course or on-line, written by the teacher or students). The purpose and the relevance of this last activity is connected to the features described in the introduction of the report but, moreover, this methodology **helps to enhance the level of knowledge of the whole class**: the best students disseminate how much they know, the less able students learn by collaborating and by reading writing of companions. The result of the whole process is, very often, a better comprehension of mistakes, knowledge turns around and competence level rises up.

2.3 Module 2 - Design a Database and Write a Project (Apply and Collaborate)

Module 2 involves the application of the theoretical concepts using an Entity/Relational Design Tool and some graphic tools for MySQL Environment. Students work in pairs, because the task "*Design a database and write a Project*" needs some different and transversal key competencies. Final work is a detailed project of a relational database containing the E/R Diagram, logical and physical levels and a technical report file containing all the choices made with motivations. The Module contains, as presented in figure 3, the following sections:

- **Case Studies**: three or more different case studies, close to real life, are presented in the course; one of them is randomly assigned to each couple of students;
- **Creating Groups and Logbooks**: working groups are not chosen by teacher or by students, but by a software called "Team Up" Sw [4]. This on-line tool is developed by Aalto University and allows teachers to create random groups. Each group may also use the tool to record an on-line voice logbook for the teacher, registered weekly, daily or as often as students desire;
- **Steps and Final Delivery of Teamwork**: the activities of the module are described and organized in steps, this helps each group to perform the teamwork, to deliver their weekly activity and to report each step as well as to build the final project;
- **Collaborate and Improve with Wiki**: after the delivery of the teamwork, all students collaborate writing a dedicated Wiki Page, one for each of the three case studies. Each student discusses the two case studies that were not performed in pairs; students have to read all the teamwork projects connected to the case studies and identify an improved common solution. The comment section, of each wiki page, could be used to discuss.

Module 2: Teamwork "*Design a database and write a project*"

Groups and Logbooks are visible at link: http://teamup.aalto.fi/?class_key=1415_4TELA

STEPS

1. creation of working groups, read and discuss the assignment
2. design the E/R Diagram
3. write the project with the explanations,
4. use the vocal logbook and record the process
5. deliver the project in the dedicated area
6. collaborate in the wiki page of the case study



Delivery Area for the Project of each Teamwork



[CASE STUDY 1](#)



[CASE STUDY 2](#)



[CASE STUDY 3](#)

Fig.3: Module 2 - the icon  identifies the delivery area for the group, the icon  identifies wiki pages

Below there are some observations about the scheduling and the places of the activity. The first part of the module, which needs group activities, is developed during:

- **classroom activities in an ICT laboratory**: students collaborate and use the net to search for information, take notes and share documents using Google Tools [5], (Docs, Sheets, Slides) or other collaborative Tools; students could design of the E/R schema with a simple graphic Tool like "Diagram Designer" [6], or others more technical, like "Raise Editor" [7];
- **extra scholastic time**: to observe a real case connected to the case study (for example to interview people connected with the case).

The second part of the module needs some individual activity and it is developed at home or during class activities; students use an asynchronous interaction to encourage autonomous reflections.

Adopted solutions are thoroughly evaluated by the teacher, if supported by photos from real life or from information from the web, if photos are well connected to the problem and if the choices made are well reinforced by them.

Before the activity, students know the evaluation scale that contains **quantitative indicators** (wiki writings, forum posts, peers support, number of real photos or interviews) and **quality indicators** (complete and clear E/R schema, correct logical and physical level, types of errors, correct technical descriptions, clear motivations).

2.3 Module 3 - SQL Language (Apply Autonomously)

Module 3 involves the application of the theoretical concepts inside the PhpMyAdmin environment. Students work alone. The activity, in the first part, continues the teamwork of Module 2: students could write observations versus the common solution presented in Wiki (for the two cases not analyzed in pairs). Later, each student must write, in text words and not in SQL Language, almost one need of information connected to the reality and post them in a forum. In the final delivery, students have to write a project containing observations and some queries in SQL language (choosing the text of the query from the dedicated forum). They also have to write some Data Definition Language commands, in order to create the database with tables and fields. The Module contains:

- **three forums**, one for each case study; each student has to write a post, in two different forums, that contains at least one query written in text words (not in SQL); within the forums there are **different threads**, one for each text query posted by students; students must reply to at least one post, writing the SQL query connected to the text; students can correct each other's solutions;
- **the delivery area** for final personal project file.

The collaborative activity of writing queries in a forum allows students to discuss, in an on-line environment, during homework activities; students have to read all the threads connected to the case study and find a good response to the solution. The teacher observes the behavior of students in forums, reads posts and corrects them; the teacher uses communication mode familiar to students such as "Smileys" or "Red Devils" icons and also the "@" symbol may be used to reference a student like in a social.

3 Methodology - Wrap Around Environment, Flipped Teaching, Collaborative Activities

3.1 Wrap Around Environment and Flipped Teaching

All the modules, materials, activities and tools used in the course are collected and available in an on-line environment, created using the Learning Management System (LMS) Moodle - version 2.9.2 as well as some plugins developed by Moodle's Community. The on-line course is used as a "blended learning environment" that collects and shares all the materials used and produced by students as well as the teacher (links to important web sites, all kinds of documents, discussions in Forums, Wiki Pages), so **it supports every daily class activity** and it is the "core" of the whole didactical action. The course allows flipped teaching by using collaborative tools, by sharing Google for Education documents or by using cloud tools such as Dropbox and Google Drive. The environment expands dynamically during the year and wraps around the whole class.

During the classroom activities the teacher uses the interactive whiteboard and a PC, connected to the net, in order to use documents saved through the course or in order to immediately save the lesson just performed. Students can choose to use their personal devices (BYOD) in order to feel more comfortable, to add personal notes in their reserved areas or to share information and relevant files.

Instead, during ICT lab lessons, each student uses a PC in order to use uploaded materials, to execute exercises, to add personal files in their reserved areas or to share information or files with the rest of the class. In the ICT lab there is often an alternation of plenary discussion moments and group activities.

During the on-line home activities the teacher publishes materials in the on-line course, uploads files, organizes modules and sections, plans and explains the steps of each activity, prepares on line assessments and quizzes. Students use or download materials shared in the on-line course by the teacher, read, write and collaborate in forums and on Wiki pages, use collaborative tools and perform exercises and assessments. Everyone could contribute to the forums of the course, ask or answer questions. There is peer collaboration under the supervision of the teacher, who is also an on-line tutor.

There is a fluid interaction because classroom and home activities do not follow fixed schemas. The learning process alternates presence and physical distance; interactions, through media and technologies, can be synchronous or asynchronous in a "liquid succession". **Technology is integrated into lessons, but does not substitute them:** textbooks, personal devices, files, exercise books and notes should be used together.

Part of the lesson moves from the classroom to the web, students come in the class having already read the theoretical contents prepared by the teacher and shared in the LMS of the school. The lesson is flipped because the students have just seen the lessons, so the class time could be more active and becomes a workshop. **Concepts take shape in the virtual classroom** with the support of the teacher who guides, traces the path, checks, facilitates and gives sense to the home activity. Each student prepares themselves at home for classroom activities.

There is an **overcoming of the hierarchical rule from teacher to student** during the creation of materials: not only does the teacher create and publish materials, students perform a co-creation and post files, maps or links. Also **interaction** is more easy because the course improves peer education and discussion in forums or wiki as well as during classroom activities.

In a flipped class, before lessons the teacher uploads selected contents and files (choosing between ready materials and/or self-produced) in an on-line environment (LMS or on-line Tools). Instead students perform activities like reading contents in the on-line environment, create personal maps and study; students can communicate with each other (peers) and with the teacher through forums and messages in the on-line environment.

In a flipped class, during classroom lessons, teacher and students, together or in groups, perform active actions: real time discussions, negotiations of meaning, depth study, collaborative learning, synchronous learning, group activities. There is an instrumental use technology: ICT Tools and LMS, LIM or whiteboard are used to elaborate and share them.

3.2 Collaborative and Group Activities

The activity in the classroom becomes more focused to problem solving: a discussion of possible solutions rather than an explanation from one channel, the teacher, to students like passive spectators. It is more dynamic: not only one channel of communication, but two or more. The collaborative activity is possible also using some tools like:

- **TeamUp** on-line Tool [4]: allows the teacher to randomly create groups with a dedicated vocal diary for each group; the diaries are managed and maintained by the students. The single registration records one minute for each voice, but groups could record more entries. The teacher can listen to the recordings before the lesson, this may alert the teacher of any problem areas;
- **Padlet** on-line Tool [8]: it is a virtual board to tap personal notes or to exchange notes for group work, it is often used in a recent MOOC [9];
- **Cmap Tool** [10], famous concept map Sw, is used collaboratively to revise theoretical concepts; it is useful as a homework task which is enriched in the classroom, for example from a previous lesson of an assessment. Students create a map at home and deliver it on the Moodle platform, before the lesson the teacher displays maps and identifies the most complete. Those identified are discussed in the classroom, often are integrated and published in the course; this allows all students to perform a better preparation for the final assessment. This action allows good results on the checks.

3.3 Evaluation

How can we assess the students' skills in these types of activity? Of course, different types of activities must have different evaluation indicators. Obviously, as for others activities, the student's assessment must always carried out through observation grids: to allow uniformity and objectivity.

Through technology there could be more complete evaluations, very often technology is useful to understand behaviour not evident during the normal interaction in presence and during classroom activities. For example, studying logs and automated reports of on-line students' activities (all LMS provide them, Moodle included) teachers could easily perform assess about:

- **the process in quantitative terms:** time dedicated to each online activity, enjoyment of each online booklet, number of forum posts (in response or support to other students), new discussions opened in a forum, number of wiki writings;
- **the product in quantitative terms:** number of shared conceptual maps, number of delivered exercises, number of delivered logbooks, number and size of files delivered, number of photos or interviews to motivate, etc.

Instead, observation grids remain tied to traditional methods and must be measured and compiled by teacher for quality evaluation indicators, like:

- **the process in terms of quality:** final achievements related with those of departure, interest and motivation of students, collaboration among peers and peers support;
- **the product in terms of quality:** the results achieved, suitable with the school level like complete and clear E/R schema, complete levels, types of errors, complete descriptions, clear motivations.

Computer Science could help teachers also during this last activity: the quality evaluation phase; indeed the ALTEC group of the University of Kansas, an American University, has created a free tool called "Rubricstar" [14]. This on-line tool allows teachers to write skills rubric, teachers could choose items from some fundamental models or could write new items and indicators. The tool allows to export rubrics into files (like pdf or Excel files) and to print them. As example, in following text there is one **rubric for the evaluation** of Computer Science skills for the case study activity planned.

Rubric for the evaluation - Case study - Database Project				
Group/Student Name:				
CATEGORY	Level 4	Level 3	Level 2	Level 1
Database Concepts	<i>Explanation shows complete understanding of the Database concepts used to solve the problem(s).</i>	<i>Explanation shows substantial understanding of the Database concepts used to solve the problem(s).</i>	<i>Explanation shows some understanding of the Database concepts needed to solve the problem(s).</i>	<i>Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s).</i>
Database Planning and Reasoning	<i>Complex and refined Database Planning reasoning.</i>	<i>Effective Database Planning reasoning</i>	<i>Some evidence of Database Planning reasoning.</i>	<i>Little evidence of Database Planning reasoning.</i>
Database or SQL Errors	<i>90-100% of the steps and solutions have no Database and SQL errors.</i>	<i>Almost all (85-89%) of the steps and solutions have no Database and SQL errors.</i>	<i>Most (75-84%) of the steps and solutions have no Database and SQL errors.</i>	<i>More than 75% of the steps and solutions have Database and SQL errors.</i>
Working in Group	<i>Students are engaged partners, listen to suggestions of others and work cooperatively throughout all the lessons.</i>	<i>Students are engaged partners but have trouble listening to others and/or working cooperatively.</i>	<i>Students cooperated each others, but needed prompting to stay on-task.</i>	<i>Students did not work effectively with others.</i>
Plan for Organizing Information	<i>Students have developed a clear plan for organizing the information as it is gathered and in the final product. All students can independently explain the planned organization of the research findings.</i>	<i>Students have developed a clear plan for organizing the information in the final product. All students can independently explain this plan.</i>	<i>Students have developed a clear plan for organizing the information as it is gathered. All students can independently explain most of this plan.</i>	<i>Students have no clear plan for organizing the information AND/OR students in the group cannot explain their organizational plan.</i>
Neatness and Organization	<i>The work is presented in a neat, clear, organized fashion that is easy to read.</i>	<i>The work is presented in a neat and organized fashion that is usually easy to read.</i>	<i>The work is presented in an organized fashion but may be hard to read at times.</i>	<i>The work appears sloppy and unorganized. It is hard to know what information goes together.</i>
Diagrams and Sketches	<i>Diagrams are clear and greatly add to the reader's understanding of the procedure(s).</i>	<i>Diagrams are clear and easy to understand.</i>	<i>Diagrams are somewhat difficult to understand.</i>	<i>Diagrams are difficult to understand or are not used.</i>
Completion	<i>All problems are completed.</i>	<i>All but one of the problems are completed.</i>	<i>All but two of the problems are completed.</i>	<i>Several of the problems are not completed.</i>

Database Terminology and Notation	<i>Correct terminology and notation are always used, making it easy to understand what was done.</i>	<i>Correct terminology and notation are usually used, making it fairly easy to understand what was done.</i>	<i>Correct terminology and notation are used, but it is sometimes not easy to understand what was done.</i>	<i>There is little use, or a lot of inappropriate use, of terminology and notation.</i>
Strategy Procedures	<i>Efficient and effective strategy to solve the problem(s).</i>	<i>Effective strategy to solve the problem(s).</i>	<i>Sometimes uses an effective strategy to solve problems, but does not do it consistently.</i>	<i>Rarely uses an effective strategy to solve problems.</i>
Information sources and motivations	<i>Students independently locate reliable and interesting information sources and motivations for EACH of their ideas.</i>	<i>Students independently locate reliable information sources for EACH of their ideas.</i>	<i>Students locate reliable information sources for the most of their ideas.</i>	<i>Students do not locate reliable information sources for their ideas.</i>

3.4 Other useful Sw and Tools for teachers

- “Prezi” an on-line Tool [11]: to design collaborative and multimedia presentations;
- “Google Apps” Tool [5]: to store files in cloud, to share and write files, to assess, to hand out questionnaire;
- “Socrative” on-line Tool [12]: to easy create quizzes (close);
- “Learning Designer” Sw [13]: is a specific on-line graphic Tool used by teachers to plan class activities with simple drag and drop actions, small text descriptions and check lists. An example of a lesson, planned with the Sw, is contained in the following screenshot:

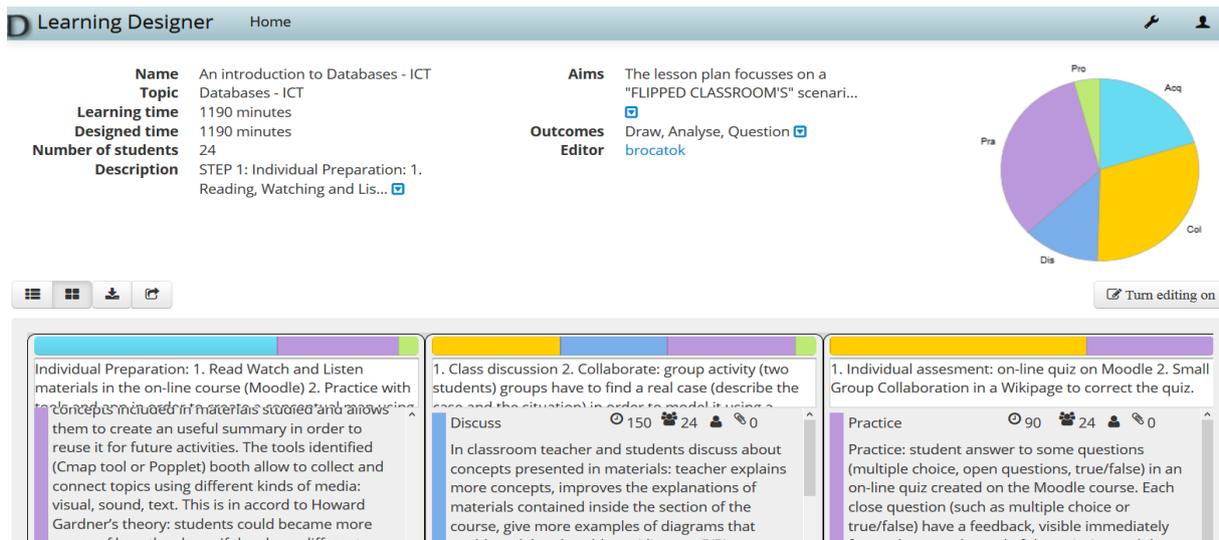


Fig.3: Learning Designer Web Site - Lesson Plan Home Page

As example, in following text there is the beginning of the resulting plan (it is possible to print a pdf file of a plan directly from the site) containing, only the general part and the first step of the lesson planned.

Context

Topic: Databases – ICT Total learning time: 1190 Number of students: 24

Description:

- **STEP 1: Individual Preparation:** 1. Read, Watch and Listen materials in the on-line course (Moodle) 2. Practice with tools and app in order to create a conceptual map using tablets 3. Produce a file or a link, with the map, and upload it in the Moodle course of the class.
- **STEP 2: Collaboration:** 1. Class discussions 2. Collaborate: group activities; groups have to use a real case (describe the case and the situation) in order to model it using a database 3. Produce: group activities; groups have to project the conceptual schema of the database (diagram E/R) and the model of the database connected to the case of the previous step 4. Share the collaborative description and the project of the Database schema connected with (diagram E/R) in a forum in Moodle.
- **STEP 3: Assessment:** 1. Individual assessment: on-line quiz on Moodle 2. Small Group Collaboration in a Wiki page to correct the quiz.

Aims

The lesson plan focusses on a "FLIPPED CLASSROOM" scenarios; it describes some activities to introduce an important concept for ICT students in a secondary school: "Introduction to projecting a Database with E/R schema". Flipped activities are shared in the on-line course of the class in the Moodle environment of the school. During school activities students and teacher can use: an interactive whiteboard and a PC connected to the net in the classroom, a personal tablet for each (BYOD) and a fast wifi connection provided by the school. During home activities students use tablets to access materials shared in the on-line course by the teacher, to collaborate in forums and in wiki pages as well as using tools.

Outcomes

- Draw (Knowledge): draw a map
- Analyse (Analysis): analyse a real case
- Questions (Comprehension): Answer questions

Teaching-Learning activities (TLA): TLA 1 - Individual Preparation:

- Read Watch and Listen materials in the on-line course (Moodle)
- Practice with tools and app in order to create a conceptual map using tablets
- Produce a file or a link, with the map, and upload it in the Moodle course of the class.

Read Watch Listen 240 minutes 24 students Tutor is not available

At home, each student logs into the Moodle on-line course and reads, watches and listens to the materials shared by the teacher.

Practice 120 minutes 24 students Tutor is not available

At home, students use their own tablets to write a conceptual map using: Cmap tool or Popplet on-line Sw or Popplet App for tablets (the choice is free). This activity helps students to identify the main concepts included in materials studied and allows them to create a summary in order to reuse it for future activities. The tools identified (Cmap or Popplet) both allow students to collect and connect topics using different kinds of media: visual, sound, text. This is in accord to Howard Gardner's theory: students could become more aware of how they learn if they have different kinds of learning activities.

Produce 20 minutes 24 students Tutor is not available

When the conceptual map has ended, each student logs into the Moodle on-line course of the classroom and uploads a map (a link, a file) in the area dedicated to the delivery.

3.5 Final Reflections about the use of technology in school lessons

Some motivations about the didactic choices are connected with importance of technology in the future: it will improve its importance in our lives. **So technology has to be integrated to what students do at school** with the guidance of teachers because **teachers don't prepare students for today but for tomorrow**. This way of teaching helps students in their future jobs and lives. If this integrated process starts at school, it could have better positive effects: it could produce better long life learners that consciously use technologies, not only for access information and for a quick consumption, but people that could also produce personalized contents, could share and collaborate with others through modern instruments.

The learning environment described and created through technology is useful for:

- student support: students retrieve videos and different types of multimedia files, perform self-assessment tests, write questions in a moderated forum. Students must not accumulate deficiencies because they have different types of interactions to solve problems. Moreover, studying with contexts and environments that offer diversified media, students can achieve the **customization of the learning process**; this helps those who have difficulty and is in accord with Multiple Intelligences Theory [Gardner, 1983];
- teacher support: the teacher can **understand and investigate the student's level before the lesson**. This allows the teacher to prepare effective lessons: mainly discussing unclear arguments to students. Moreover the teacher uses forums as an on-line tutor to support students outside the class.

Technology will improve a **personalized learning**: students can use and reflect on materials shared or created by teachers using different media and collected in virtual class environments; they can review them in different and asynchronous times, they can easily personalize materials adding notes, links and voice. They can learn with more flexibility and reflect about what they produce, in differentiated ways.

The use of technology is also a **solution to include**: the teacher can positively use peer collaboration in classrooms, have feedback from these activities that sometimes are not visible in the classroom. Moreover students can easily work in small groups and collaborate inside and outside the school in fluent ways.

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