Universidade do Minho
Escola de Engenharia
Departamento de Informática

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**Kiko, a lesson planner system
 to enhance classes**

December 2019

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Master dissertation
Master Degree in Computer Science

Dissertation supervised by
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December 2019

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I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

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ABSTRACT

This document presents and discusses the outcomes of a project in the area of Pedagogical tools to support teaching. This project is part of the work in the second year of the Master degree in Software Engineering and was accomplished at Universidade do Minho in Braga, Portugal. The main outcome of this Master project is an application that allows a teacher to plan his classes by describing in a text file the topics and subtopics of the school program that he has to teach in a lesson, linking to each concept the multimedia support materials and questions that he intends to do (orally, on paper, or on the computer). This application is based on a domain specific language (DSL) specially tailored to described easily lesson plans no matter the course or the teaching topic. The application contains all user-entered lesson plans, which are automatically processed to create a classroom presentation for each subject, supporting and guiding a given class. Whenever intended by the user, the application also processes all external resources, introducing hyperlinks to them in the various fields of the lesson plan. The application is publicly available at the Language-Processing Research group server.

Keywords: Lesson Plans; Teacher support tools; Technology-enhanced learning; Pedagogical tools integration; Domain-specific languages.

RESUMO

Este documento apresenta e discute os resultados de um projeto na área de ferramentas pedagógicas para apoiar o ensino. Este projeto faz parte do trabalho do segundo ano do Mestrado em Engenharia de Software e foi realizado na Universidade do Minho em Braga, Portugal. O principal resultado deste projeto de Mestrado é uma aplicação que permite ao professor planear as suas aulas descrevendo num ficheiro de texto os tópicos e subtópicos do programa escolar que ele deve ensinar numa aula, interligando a cada conceito os materiais de suporte multimédia e perguntas que ele pretende fazer (oralmente, no papel ou no computador). Esta aplicação é baseada numa linguagem específica de domínio (DSL), especialmente adaptada para descrever facilmente planos de aula, independentemente do curso ou do tópico de ensino. A aplicação contém todos os planos de aula inseridos pelo utilizador, que são processados automaticamente para criar uma apresentação na sala de aula para cada disciplina, dando suporte e servindo de guião para uma determinada aula. Sempre que pretendido pelo utilizador, a aplicação também processa todos os recursos externos, introduzindo links para eles nos vários campos do plano de aula. A aplicação está disponível publicamente no servidor do grupo de Pesquisa de Processamento de Linguagens.

Palavras-chave: Planos de Aula; Ferramentas de suporte ao Professor; Aprendizagem assistida por tecnologias; Integração de ferramentas pedaógicas; Linguagens de domínio específico.

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INTRODUCTION

This dissertation describes the Master's work developed in the context of Mestrado em Engenharia Informática held at Departamento de Informática, Universidade do Minho.

Education represents an enormous contribution to the evolution of humanity because it is a source of knowledge in several areas such as mathematics and medicine. Education is a fundamental and quite important phase for the development of a person and also of a country (Wikipedia, 2018a; Roser and Ortiz-Ospina, 2019). Every country gives considerable importance to teaching to prepare people to face problems and to find solutions for the most diverse lifestyles and in each country the plan of education is different (Freedom, 2018; Iddings, 2019).

This lesson plans are define for every ministry of education or the equivalent (Wikipedia, 2018b) in the start of every school year and are very important to the teacher because this plans give the aim and objectives of the course being taught to students, teaching and learning activities which means that the teacher should prepare different explanation methods for the students to understand the topic more easily, and also activities to check student understanding of the topic. With the additional time saved, a teacher can give additional attention and time to students that require additional help (Kean, 2019; Teachablemath, 2016; University, 2016). Also, there will be a sense of control and direction while teaching. Even if there is confusion among the students, the teacher will be able to guide them effectively as the teacher will be well versed with the subject matter and will be able to provide the questions without any stress. It can also help the teacher to focus more on the basic knowledge first then take the students towards the next step (Pages, 2010; Courses, 2018). The teacher will never stammer or mumble during the lecture because of the timely preparation of the lesson.

According to Benjamin Franklin (Franklin, 2018), "By failing to prepare, you are preparing to fail", and this means that if a person don't set goals or plan ahead nothing is going to be successfully achieved.

1.1 MOTIVATION

Since education is one of the most important things for the formation of an individual and that a part of the education is provided through a teacher, it is important to develop tools that help a teacher to improve the quality of his lessons. This improvement is provided through a Lesson Plan, but as the conventional plan is too complex to fill up many of the teachers fail to complete them. The main motivation for this project is to develop a teacher support tool that allows students to improve their knowledge enhancing the learning process through technology (technology-enhanced learning) (Dommett, 2018; Goodyear, 2010; Laurillard, 2008; Manouselis, 2011). The teacher support tool is a web application based on a processor for a specific domain language that receives and analyzes a Lesson Plan and transforms it into an interactive and user friendly system to use during a class with the objective of increasing the quality of education.

1.2 OBJECTIVES

This master thesis objectives are the following:

- Design of domain-specific language to write Lesson Plans;

- Develop an application that allows a teacher to plan their lessons and offers the possibility to access the materials to support the visualization of contents, and the questions to be answered (type of quiz or test).

As a final result, it is expected to have an application that can be easily used by teachers.

1.3 RESEARCH HYPOTHESIS

Is it possible to define a formal language to write a lesson plan that is automatically processed to build a classroom support web system.

1.4 THESIS ORGANIZATION

This document is organized in six chapters. In Chapter 2 is presented the State of the art of this master thesis that contains Lesson plans and existing lesson plan tools.The general architecture of the system to be implemented to accomplish the objectives and the KikoDL (the desired DSL for class plans specification) design are presented in Chapter 3. In Chapter 4 is presented and described the development approach of Kiko web application. In Chapter 5 a functional view of the Web application developed is presented. Finally, is the Chapter 6 where is presented the conclusion of this master thesis.

STATE OF THE ART

In this chapter the main areas involved in this Master Thesis will be introduced and re-viewed: Lesson Plans and existing tools for creating and presenting lesson plans.

The Lesson Plans are the most important part because they are the base and the main target of this project.

Searching for existing tools for creating and presenting lesson plans is also important in a view of studding identical lesson plans developing and presentation.

2.1 LESSON PLANS

The purpose of the Lesson Plan is to communicate, mentor and map a classroom organi-zation to help students achieve a teacher learning outcome. A Lesson Plan contains fields that clearly communicate what students are going to learn, why it is important and how it is going to happen. It also makes clear any behavioral expectations unique to a particu-lar plan and what is the lesson purpose and procedures (Farrell, 2002; Savage, 2014; Tesol, 2019). A good Lesson Plan contains a set of important elements that properly describe the process (Lika, 2017), but some of these elements vary as can be seen in Figure 4 [1], Fig-ure 1 [2], Figure 2 [3] and Figure 3 [4]. These elements are part of two main sections, which are the plan information and the overview of the class (Herman, 2015; Kubilinskien, 2010; TeacherPlanet, 2019; Tesolclass, 2019).

Figure 1 shows a lesson plan for the arts and crafts discipline where the main purpose of the class is to teach a painting style. This plan is quite simple to understand, containing all the necessary information as it has a well defined structure. This structure is a more traditional table-shaped structure that allows the user to get to the needed section of the plane faster.

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1 Available at http://hdl.handle.net/1822/57964. Consulted: 2018-12-13
2 Available at http://www.teach-nology.com/lessons/lsn_pln_view_lessons.php?action=view&cat_id=1&lsn_id=6791. Consulted: 2018-12-13
3 Available at https://www.wikihow.com/Sample/College-Lesson-Plan. Consulted: 2018-12-14.
4 Available at https://pt.scribd.com/doc/52704189/MODELO-de-plano-de-aula. Consulted: 2018-12-14.

Lesson Plan : Learning about Pointillism

Teacher Name: Cathy M. Storkamp

Grade: Grade 7-8

Subject: Arts and Crafts

Topic:	Students will learn about George Seurat and the style of painting known as Pointillism.
Content:	Art History/Pointillism project Vocabulary: Pointillism/Divisionism, George Seurat, blending, juxtaposing
Goals:	Students will learn about the work of George Seurat. Students will learn how to create a work of art using dots. Students will learn about color and how the eye sees color.
Objectives:	TLWD: applying by 1. formulating goals to complete tasks, 2. using sequenced procedures to complete art activity, 3. developing a logical sequence to complete an activity. TLWD: analyzing by examining and using imagination as a source of symbolic and abstract expression. TLWD: organizing by selecting and combining media and art tools that will produce a new result. TLWD: evaluating by 1. determining how aspects of history can be revealed through art, 2. predicting the main purpose for art in society, 3. by determining the decorative, functional and symbolic purposes in his or her own art.
Materials:	Biography on George Seurat, examples of Seurat's art work, 9x12 drawing paper, tempra paint, paint brushes, water, newspaper, containers for water and paint, paper towels, overhead, computer for biographical information, small drawings of apples, color pencils
Introduction:	Look at George Seurat and his style of painting. Read a biography on Seurat and study his painting "Sunday Afternoon on the Island of La Grande Jatte".
Development:	Explain how Seurat took several years to do his large painting. Remind students that this painting is composed of tiny dots of color placed next to each other. Talk about how Seurat used only primary colors and allowed the viewer's eye to do the mixing of color. Demonstrate by doing a small area of a painting using dots that are placed next to one another. Remember to explain that this art is supposed to be looked at from far away.
Practice:	Students will take a small picture of an apple and color pencils and color in the apple using small dots of color. Assist them in using more than just red to color the shaded areas of the apple.
Checking For Understanding:	Did the students understand how to shade using dots? Did the pictures they created reflect the style of Pointillism? Did the students learn the information about Seurat? Do they understand the vocabulary?
Closure:	Quick review of information about Seurat and Pointillism. How this style influenced the future of painting.
Evaluation:	Did students understand how the colors were mixed by the eye of the viewer and not the artist? Give a quick verbal quiz on the information covered to determine understanding.
Teacher Reflections:	Are students ready to move to the elements? Do they understand the concept that was being taught? Did they learn about how the artist influenced others during the time period and into the future?

Figure 1.: Lesson Plan - example 1

Figure 2 shows a lesson plan for the English subject. This plan has a slightly different structure which makes it confusing, and also does not contain much information, lacking some fields to transmit information to those who read it.

English 101 Lesson Plan: 10/22/2012

Objective: Take on Shakespearean prose from a different angle, begin preparation for midterm.

Time: 1 hour

Materials: Copies of Shakespeare's *Hamlet,* copies of Thomas C. Foster's *How to Read Literature Like a Professor*, pens, paper

Procedure:

1:00–1:05 → Assign a different line from the play to each student using the prepared list of good, analyzable lines.

1:05–1:20 → Students should think about the implications of their lines, both in context and standing alone. Then, write half a page of general notes analyzing the meaning of each line within its own scene *and* within the play as a whole, making connections to other literary works, etc.

1:20–1:30 → Once they've generated some original thoughts, students should look more thoroughly at the play itself and at Foster's *HTRLLAP* to get more ideas about their lines.

1:30–1:40 → Talk about a few of the lines as a class; students can offer each other insight and commentary on their respective lines. Remind them to continue taking notes throughout this discussion.

1:40–2:00 → Give them the remaining class time to begin writing essays, each pertaining to the one line only. The challenge of this assignment is in its specificity; the students must deconstruct a single line *without* explicitly quoting any others.

Homework: Finish and type up essays, read acts 1 & 2 of *A Midsummer Night's Dream* for next class. Start thinking about overall themes in Shakespeare to get ready for midterm paper.

Figure 2.: Lesson Plan - example 2

Figure 3 presents a lesson plan for the math discipline. This plan has a different structure from the previous ones, but it contains a lot of information where some of this information is presented by topics.

Plano de Aula

Data: 10/11/2010

Identificação:

Escola: SALESIANO
Professor: Welington Fraga Rizo
Disciplina: Matemática
Série: 1° ano – Ensino Médio
Duração da aula: 20 minutos

Tema: Progressão Aritmética (PA)

Objetivo geral:

Proporcionar ao aluno o estudo das sequências numéricas matemáticas por meio de Progressão Aritmética (PA), que faz parte dos conteúdos programáticos relacionados ao Ensino Médio, e de alguns métodos e técnicas essenciais para compreender e assimilar os conteúdos.

Objetivos específicos:

* Identificar uma sequência de números que obedecem a uma determinada lógica;

* Reconhecer a razão e os elementos que constituem uma Progressão Aritmética (PA);

* Calcular as propriedades de uma Progressão Aritmética (PA) por meio das fórmulas adequadas.

Recursos didáticos:

Quadro branco, pincel e apagador.

Avaliação:

Em sala de aula; discussão do assunto, exercícios; tarefas para casa.

Bibliografia:

GIOVANNI, José Ruy; BONJORNO, José Roberto. Matemática Completa, 1ª série Ensino Médio. São Paulo: Scipione, 2009 a 2011.

GENTIL, MARCONDES, GRECO, BELLOTTO, SERGIO. Matemática para o 2° Grau. São Paulo: Ática, 1998.

Figure 3.: Lesson Plan - example 3

Figure 4 presents a lesson plan for the discipline of information and communication technologies. This plan has an unusual layout which makes it difficult to read. The lesson plan also contains a lot of information, some of it unnecessary. Describing the various fields of the lesson plan makes it easier to understand and write.

| Disciplina | Tecnologias de Informação e Comunicação | Ano/Turma | 7.ºD | Ano Letivo: | 2017/18 | AGRUPAMENTO DE ESCOLAS MOSTEIRO E CÁVADO |

Plano de aula

Disciplina		Unidade de Ensino	Data	Horário	Sala	Período	Ano / Turma	aulas
Tecnologias de Informação e Comunicação		P7 - Produção e edição de documentos	03-01-2018	11h45 -13h15	Sala de informática 1	2.º	7.ºD	25 e 26

Introdução / Enquadramento	Sumário	Riscos (evitar / prevenir)
Introdução ao processador de texto O Processador de Texto (MS-Word) é um programa cuja função visa somente o tratamento de palavras, facilitando a edição de textos. É um programa usado para escrever no computador. Com ele, é possível criar documentos simples a documentos profissionais e que revelam alguma complexidade.	Introdução ao processador de texto. Ambiente de trabalho: área de trabalho, friso, separadores. Vantagens da utilização do processador de texto. Resolução de uma ficha de trabalho.	• Existência de alunos perturbadores e não colaborantes na turma; • Não cumprimento das regras da sala de aula.

Planificação das aulas

Conteúdos	Objetivos Específicos/Metas	Metodologia de trabalho	Tempo	Recursos educativos	Avaliação
Processador de texto (MS-Word): • Ambiente de trabalho e menus; • Vantagens da utilização do processador de texto; • Criar, abrir, guardar documentos; • Guardar documentos em vários formatos.	• identificar os elementos do ambiente de trabalho do MS-Word; • utilizar corretamente os menus do MS-Word; • criar, abrir e guardar documentos; • conhecer as vantagens da utilização do processador de texto; • guardar documentos em vários formatos.	• Efetuar chamada. • Apresentar sumário e objetivos da aula. • Recapitular com os alunos a aula anterior. • Visualizar um vídeo sobre os conteúdos da aula. • Apresentar conceitos teóricos e práticos da aula. • Realizar uma ficha de trabalho.	2min. 3min. 5min. 10min. 25min. 45min. Total: 90minutos	• computadores • projetor multimédia • quadro e canetas • software MS-Word • apresentação multimédia • ficha de trabalho • vídeo	• observação direta • empenho e participação • comportamento e atitudes • avaliação da ficha de trabalho

Figure 4.: Lesson Plan - example 4

The examples of lesson plans presented earlier (see Figure 1, Figure 2, Figure 3 and Figure 4) all have distinct structures and fields which served to understand which fields and structures are most commonly used and the easiest ways to structure a lesson plan so that it is easier to understand and write.

After the careful analysis of the Lesson Plans found in the research, the most common elements (information items) are:

- **Duration** of class;
- **Grade** or **level**;
- **Course**;
- **Subject**;
- **Date** when class will take place;

- **Topic** of the class;

- **Title** of the lesson plan;

- **Lecturer's** name;

- **Prepared by**.

The remaining elements are part of the overview of the class, which are:

- **Purpose**, **goals** or **objectives** of the lesson - specify skills and information that will be learned;

- **Resources** or **materials** needed for the class;

- **Procedure** - structuring of the class. This field can be presented in two ways:
    - Time-defined class procedure (WikiHow, 2012; Mladenovic, 2005);
    - Class procedure defined by topics (Ferreira, 2013; 0505mr, 2018);

- **Assumed** prior knowledge - pre requisites;

- **Evaluation** - how to register and carry out the evaluation;

- **Reflection** - registration of the important points of the lesson;

- **Activities** - independent description of the activities to reinforce the concepts learned in class.

Independent of the structural elements of a lesson plan as each teacher has different ideologies and ways of structuring a lesson plan. The most important thing is to prepare a class beforehand because the plan will include the content and activities to be applied in the course of a lesson. The lesson plan is also a guide for the teacher and is a good practice because it facilitates all your work helping in the management of class time.

2.2 LESSON PLAN TOOLS

In this section some educational support software with some similarities coinciding with the application proposed will be described. Only the most complete are going to be described like the portuguese software develop by the group Leya, "Aula Ditigal" [5], and the OneNote by Microsoft that you can make any notes and present them. A few notable mentions are also the portuguese software "Escola Virtual" [6] from Porto Editora (Editora), "My Lesson

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5 Accessible in `https://www.leyaeducacao.com/z_professores/i_28/ct_4/`, accessed in 2019-02-13
6 Accessible in `http://www.escolavirtual.pt/`, accessed in 2019-02-17

Planner" [7] and "Hellmansoft" [8]. All these tools have the same purpose, to help Educators prepare their lessons. Some of them are more capable to give that support, others are very simple or complicated, but they none of them have all the features, simplicity and freedom intended.

2.2.1 *Aula Digital - Leya*

"Aula Ditigal" [9] is a digital software published by Leya (LEYA, 2019) that gives support to a teacher providing a Library that has a set of multimedia books that make up the school project, resources, interactive classes prepared for projection, teacher support dossier with tokens, lesson plans, global plans and other supplementary materials (see Figure 5). The software also provides pre-made tests to the teacher edit in Microsoft's Word, downloadable content, and also an offline version in case there is no internet connection at the place of use of this application.
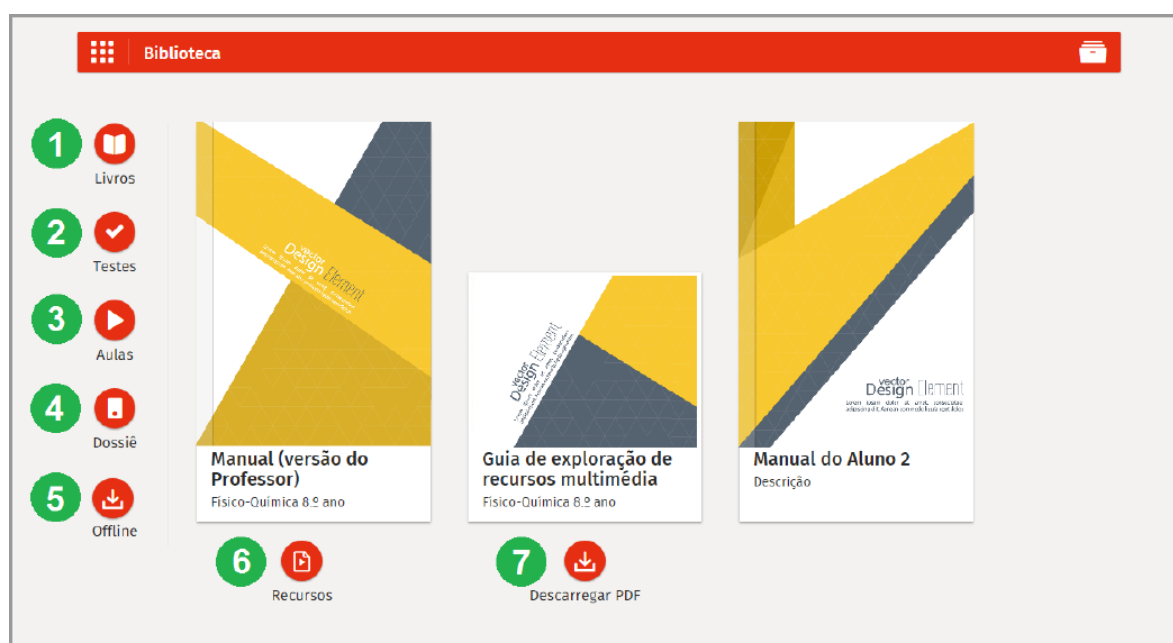

Figure 5.: Main page of the application Aula Digital

In Figure 5 we can visualize the main page that gives access to the section of the interactive books(1), pre-made tests(2), interactive classes(3), teacher support dossier(4), offline version of application(5), interactive features(6), and content download(7).

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7 Accessible in `http://www.mylessonplanner.com/`, accessed in 2019-02-19
8 Accessible in `http://www.hellmansoft.com/`, accessed in 2019-02-22
9 Accessible in `https://www.leyaeducacao.com/z_professores/i_28/ct_4/`, accessed in 2019-02-13

Regarding the lesson plans that are the main focus of this thesis, this application leaves much to be desired since the lesson plan, despite being editable in a Word file, is quite simple, covering only the duration of the lesson, the title, the summary of it and being able to add materials and resources needed to that class as seen in Figure 6

Figure 6.: Lesson Plans Library of the application by Leya

The Figure 6 shows the page to create a lesson plan where the teacher can create his lesson plan by completing the form: class title (2), summary (3 and all elements of formatting 3.1, 3.2, 3.3, 3.4, 3.5), the duration of class (4) or upload a lesson plan by pressing the button "Carregar plano de aula"(5).

The application is very good and has many features, probably being one of the most complete software found in this research, but the main problem is the lack of freedom of the teacher obliging him to follow the ideas and structures of the plans defined by the publisher responsible for the development of this application. This software is also payed and that is one of the main problem.

2.2.2 *Microsoft OneNote*

In some schools in England, teachers are using the digital note-taking app OneNote (Microsoft, 2019) produced by Microsoft [10]. The OneNote lets teachers create their own lesson plans fitting their developing ideas. There is an example of a lesson plan in Figure 7.

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10 Accessible in `https://www.microsoft.com/pt-pt/`, accessed in 2019-02-13
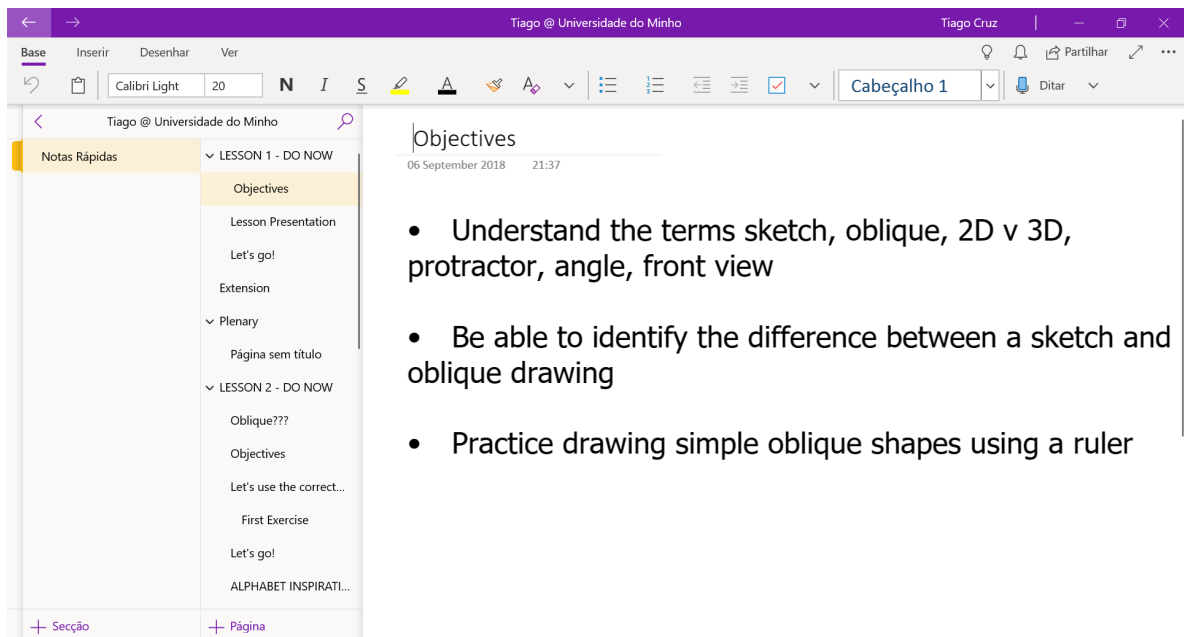
Figure 7.: OneNote Lesson Plan example

This software as some features like adding files, images, online videos and audio files. The teachers can improve their lesson by being creative adding several illustrations and examples to explain their ideas or simply to give a simple quiz to their students (see Figure 8).
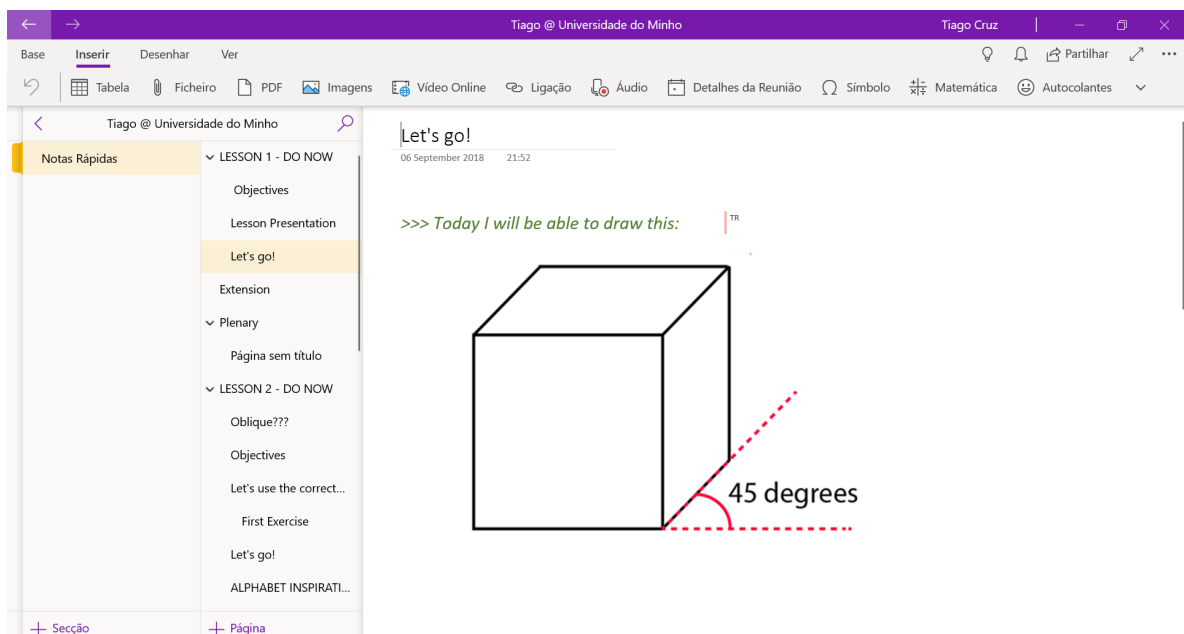
Figure 8.: OneNote Lesson Plan illustrations

As a result of being a Microsoft product, OneNote as the ability to be accessed everywhere, even offline by all devices or plataforms.

Worth to be mentioned is the feature "Connect the classroom" where the teacher can bring students together, organize lessons and distribute jobs (Microsoft, 2019).

2.2.3   *Escola Virtual*

"Escola Virtual" [11] is a class support software that provides various multimedia resources (see Figure 9) cataloged by year, subject and discipline. This application also provides interactive quizzes, lesson creation tools and custom testing (see Figure 11) (Virtual, 2019).

Figure 9.: Escola Virtual - example of a class presentation

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[11] Accessible in http://www.escolavirtual.pt/, accessed in 2019-03-19

Figure 10.: Escola Virtual - example of an interactive test

This software does not focus much on lesson plans, only in support of a teacher during the lesson, there being no possibility to register a summary or develop any lesson plan. The virtual school only serves as support for basic education, and there is no possibility of being able to use this at the university level.

2.2.4 *Hellmansoft*

Hellmansoft is a productivity software for educators. this software allows you to create lesson plans to which you can add links and files. This application also has the possibility to share online homework or documents used in class for all students and their parents (Hellman, 2019).

Figure 11.: Hellmansoft - a week of lesson plan

This application is basically a schedule where the teacher can take very basic notes about what he will do in his classes.

Concluding, "Aula Digital" software and the OneNote stand out as simple applications that contain a lot of content to support the classes. "Aula Digital" although it does not focus so much on the lesson plans compensates with the remaining features, but it does not have as much freedom of elaboration of a lesson plan as OneNote. The other two tools, "Escola Virtual" and "Hellmansoft", in spite of giving support to the classes do not have as many functionalists as the first two that clearly disregard.

2.3 SUMMARY

This chapter discussed the main areas of this Master Thesis: the lesson plans, its structure and elements as they are the focus of this project; and the existing tools for creating and presenting lesson plans. It was necessary to investigate and explore these two areas as they serve as the basis for the entire project.

3

KIKO APPLICATION: ARCHITECTURE AND APPROACH

In this chapter the proposed approach to build Kiko system is discussed, the DSL is presented and explained. This chapter also contains an example of a text file that is processed by the DSL (empty lesson plan) as well as some restrictions and cautions the user should take when filling out this file. Finally a series of wireframes that are developed to think and demonstrate the web application interface is also presented.

3.1 SYSTEM ARCHITECTURE

This section presents an approach for building the Kiko system. This proposal is defined at an abstract level so that the main architectural blocks and their interactions can be easily understood. The data flow and the main transformations will be emphasized without technological commitments.

The approach, illustrated in Figure 12, to build the Kiko system is: a domain-specific language processor responsible for processing the text file where the lesson plan will be described by a teacher; a data storage where all data will be stored; and for last but not the least, a web application where all the data will be displayed in a simple way and following the structure define in the domain-specific language to give support to the teacher during is lesson.
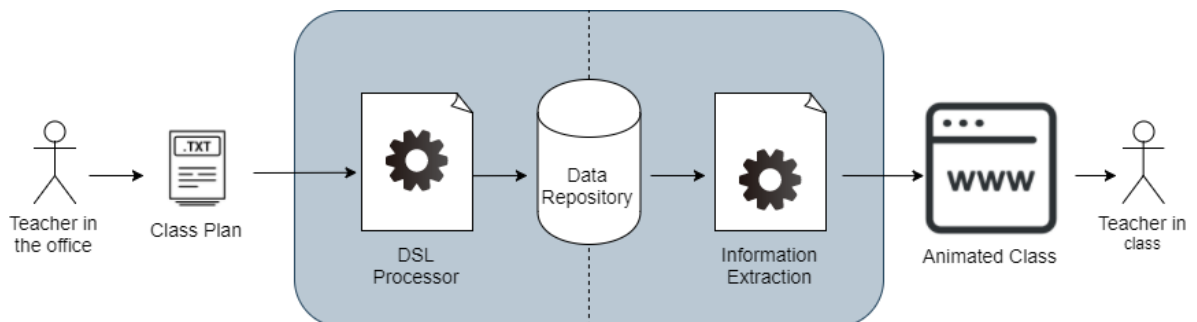
Figure 12.: System Architecture

A lesson plan developed by a teacher in a text file will be processed by the DSL processor and then storage in a Data Repository.

The information extractor will extract all the data from the repository referent to a lesson plan and present it in a web page, giving support to the teacher during is class and presenting the data needed.

3.2   KIKODL: KIKO DESCRIPTION LANGUAGE

During the bibliographic search, was found that the collected data of lessons plans contains some specific fields that are required in a lesson plan architecture. After visualizing a number of lesson plans, it was possible to elaborate an example of an empty lesson plan, only with the necessary structure so that it was elaborate and complete but at the same time appealing and simple to fill. This structure is presented in the following Listing 3.1

```
Disciplina de [Nome da Disciplina] para o Curso de [Nome do Curso]

Plano da aula sobre [Titulo do plano de aula]

Licao: número da aula
Data: 2019/05/10
Duracao: 3h00

Contexto:
+ Item 1;
#

Objetivos de aprendizagem:
+ Item 1.
+ Item 2 {Nome do recurso};
#

Conteudo:
+ Item 1.
+ Item 2;
+ Item 3 {Ficha3}.
+ Item 4 {Ficha1} Item 4 {Ficha2}.
#

Estrategias de Ensino:
+ Item 1 {Ficha1};
+ Item 2 {Ficha2} Item2 {Ficha3};
+ Item 3.
+ Item 4;
+ Item 5.
```

```
#

Recursos Educativos Complementares:
+ Nome [Link do recurso].
+ Ficha1 [Link da ficha 1];
+ Ficha2 [Link da ficha 2].
+ Ficha3 [Link da ficha 3].
#

Avaliacao:
+ Item 1.
+ Item 2;
+ Item 3 {Ficha3}
#

Notas:
+ Item 1;
+ Item 2.
#
```

Listing 3.1: Empty lesson plan example

Following this example all the principal fields will be detailed and explained, including the form and restrictions the user must have to use them.

- The **subject** taught (the subject must be entered by the user within straight parenthesis);

- The **course** where the subject belongs (this must be inserted by the user within straight parenthesis);

- The **topic of the lesson**, in other words, the title of the lesson (the topic or title of the lesson needs to be written within straight parenthesis);

- The **reference or number** of the class (the user must insert a number represented by digits to describe the number of the lesson);

- The **date** (the date of the lesson needs to follow the structure YYYY/MM/DD) and **length** (the duration or length of the lesson must be written following the format HHhMM, in which HH represents the hours in one digit and MM are the minutes, also in digits) of the class.

The rest of the elements can be described in items or topics and for that they need to follow a certain rule after initiating each element (field of a lesson plan). A element is opened using a special word (see Listing 3.1) and to close is necessary to use the number

sign (#). To start a new item, inside a element, is necessary to use the plus symbol (+), and to finish it is possible to use a period (.) or a semicolon (;), and it's up to the user selects which one to use.

- **Context of a lesson** for a correct understanding about the class;

- **Expectations or Student objectives**, that describe what students will be expected to learn by the end of the lesson;

- **Content** or principal ideas contained in the lesson plan;

- **Teaching or learning strategies** refer to the structure, methods, techniques, procedures and processes that are used by a teacher during instruction;

- **Materials and Tools or Resources** needed throughout the delivery of the lesson (to define a recourse the user must indicate the name of the resource in only one word does not contain comas (.) or underscores (_). After writing the name of the resource the hyperlink of the recourse needs to be inserted within straight parenthesis. The link should only indicate resources from the internet, such as resources hosted on the cloud or from websites, as links from resources hosted on the local disk cannot be processed due to some special characters that identify them.);

- **Evaluation** that indicates the topics being evaluated.

After describing the most common and important fields of a lesson plan, is also proposed to add the field:

- **Notes** needed by the teacher, where the teacher can take any notes or observations that the teacher finds necessary.

Subsequent to describing all the fields necessary in a lesson plan is proposed an description language (see Listing 3.2 and Listing 3.3 for a section of the language, and Listing B.1 to full language) developed in ANTLR [1], that is going to process all the lesson plans.

The context-independent grammar (see Listing 3.2) presents the main fields that compose a lesson plan ("plan"): the information section ("information" which is made up of various elements such as course, year, topic, lesson, date and duration), context, expectations, content, strategies, materials and resources ("materials"), method of evaluation ("evaluation") and notes. all these fields are made up of elements defined in the lexical analyzer (see Listing 3.3).

---

1 Accessible in `https://www.antlr.org/`. Consulted: 2018-11-13

```
grammar Kiko_DL;
plan : information context expectations content strategies materials
    evaluation notes
      ;
information : course grade topic number date lenght;
course : DISC DE TEXTO ;
grade : PCURSO TEXTO ;
topic : PLANO TEXTO;
number : LICAO ':' NUMERO+;
date : DATA1':' DATA;
lenght : DURACAO ':' NUMERO+ 'h' NUMERO+;
context : CONTEXTO ':' TEXTO1* STOP;
expectations : OBJETIVOS ':' TEXTO1* STOP;
content : CONTEUDO ':' TEXTO1* STOP;
strategies : ESTRATEGIAS ':' TEXTO1* STOP;
materials : RECURSOS EDUCATIVOS COMPLEMENTARES ':' (NAME LINK)* STOP;
evaluation : AVALIACAO ':' TEXTO1* STOP;
notes : NOTAS ':' TEXTO1* STOP;
```

Listing 3.2: Context-independent grammar from KikoDL

The lexical analyzer (see Listing 3.3) checks for each component whether there is the perfect match for each case, such as "DISC" which has to have "D" as input characters followed by "I" which is then followed by the character "S" and so on until it meets the condition that is the combination of all characters in the "DISC" field.

```
/*Lexical Analyzer*/
NUMERO: [0-9];
STOP : '#';
PCURSO: [Pp][Aa][Rr][Aa](' ')+[Oo](' ')+[Cc][Uu][Rr][Ss][Oo](' ')+[Dd][Ee](' '
    )*;
PLANO :[Pp][Ll][Aa][Nn][Oo][ ]+[Dd][Aa][ ]+[Aa][Uu][Ll][Aa][ ]+[Ss][Oo][Bb][Rr
    ][Ee][ ]*;
DISC : [Dd][Ii][Ss][Cc][Ii][Pp][Ll][Ii][Nn][Aa];
DE   : [Dd][Ee];
LICAO : [Ll][Ii][Cc][Aa][Oo][ ]*|[Ll][Ee][Ss][Ss][Oo][Nn][ ]*;
DATA1 : [Dd][Aa][Tt][Aa][ ]*|[Dd][Aa][Tt][Ee][ ]*;
DURACAO : [Dd][Uu][Rr][Aa][Cc][Aa][Oo][ ]*|[Dd][Uu][Rr][Aa][Tt][Ii][Oo][Nn][
    ]*;
CONTEXTO : ([Cc][Oo][Nn][Tt][Ee][Xx][Tt][Oo][ ]*);
OBJETIVOS:[Oo][Bb][Jj][Ee][Tt][Ii][Vv][Oo][Ss][ ]+[Dd][Ee][ ]+[Aa][Pp][Rr][Ee
    ][Nn][Dd][Ii][Zz][Aa][Gg][Ee][Mm][ ]*;
CONTEUDO :[Cc][Oo][Nn][Tt][Ee][Uu][Dd][Oo][ ]*;
ESTRATEGIAS:([Ee][Ss][Tt][Rr][Aa][Tt][Ee][Gg][Ii][Aa][Ss][ ]*[Dd][Ee][ ]*[Ee][
    Nn][Ss][Ii][Nn][Oo]);
```

```
RECURSOS :[Rr][Ee][Cc][Uu][Rr][Ss][Oo][Ss];
EDUCATIVOS: [Ee][Dd][Uu][Cc][Aa][Tt][Ii][Vv][Oo][Ss];
COMPLEMENTARES:[Cc][Oo][Mm][Pp][Ll][Ee][Mm][Ee][Nn][Tt][Aa][Rr][Ee][Ss];
AVALIACAO : [Aa][Vv][Aa][Ll][Ii][Aa][Cc][Aa][Oo][ ]*;
NOTAS : [Nn][Oo][Tt][Aa][Ss][ ]*;
NAME : '+' ' '+ [A-Za-z0-9]+ ;
TEXTO1: '+' ~('.'|';')*('.'|';')')'\r'?'\n';
LINK: '[' (~(']'))*']'('.'|';')')'\r'?'\n';
DATA : ('0'..'9')+'/'('0'..'9')+'/'('0'..'9')+ ;
TEXTO: (('[') ~('['|']')* (']'));
Separador: ('\r'? '\n' | ' ' | '\t')+  -> skip;
```

Listing 3.3: Lexical analyzer from KikoDL

From this grammar the processor will be generated automatically helping to build an animated lesson plan. The grammar developed in Listing 3.2 allows the web system to process text files that contain the structure of the lesson plan shown in Listing 3.1. The lesson plan keywords can also be written in English as the grammar is already ready to process them (see Listing B.1) in appendix B for viewing the full language developed) .

3.3 KIKO: AN WEB SYSTEM TO SUPPORT TEACHERS IN THE CLASSROOM

In this section is going to be presented some wireframes with the objective of demonstrate the design of the application. The design of this wireframes was developed in Balsamiq [2]. These are low-fidelity and their goal is to help establish what goes where, without consuming too much time on aesthetics, representing he most basic visuals involved in the user interaction. The purpose of wireframing is to map out concretely how the website should be designed. As described in the free Guide to Wireframing (Hamm, 2014), the main goals of wireframing are documentation and design structure, but can also be shown to clients and stakeholders to get feedback while changes are not painstakingly difficult.

The wireframe of initial page of Kiko's Web Application is present in Figure 33 and the rest of the wireframes are available at Appendix C;

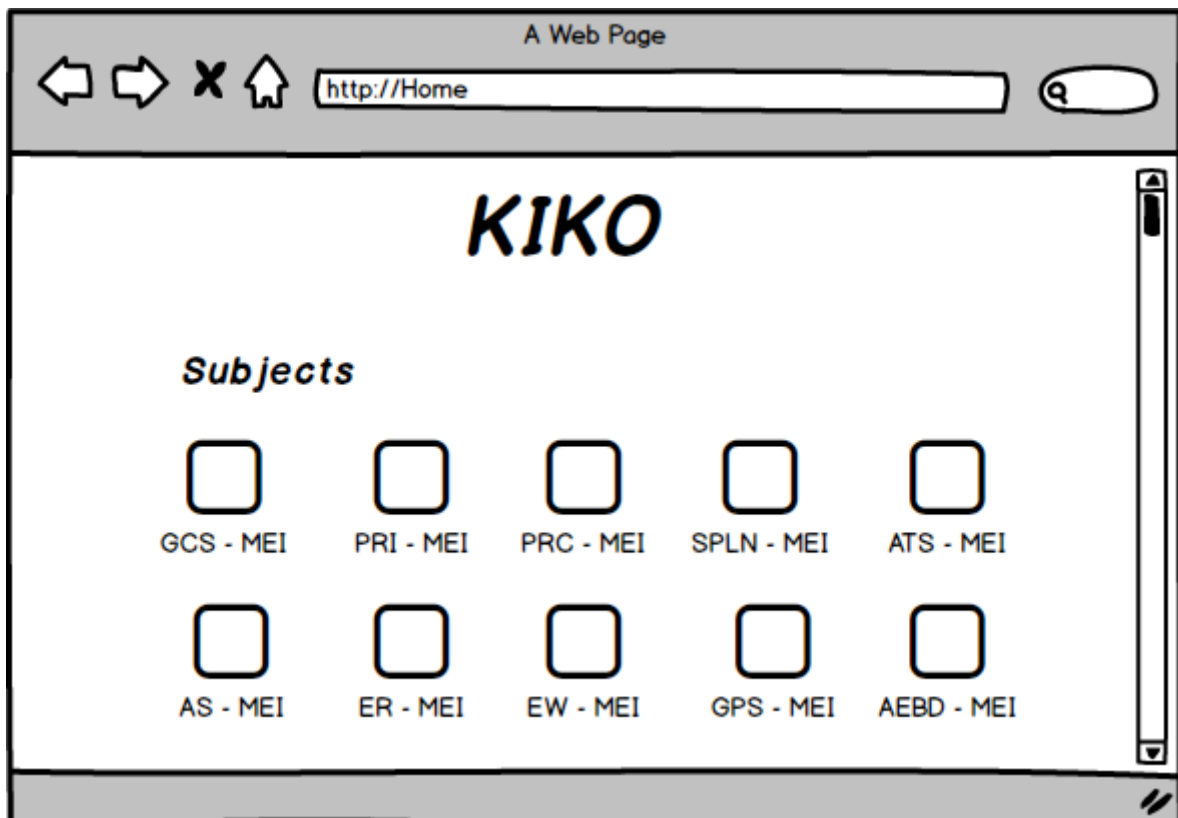2 Accessible in https://balsamiq.com/wireframes/, accessed in 2019-03-28

Figure 13.: Kiko's Initial Page Wireframe

3.4   SUMMARY

This chapter presented the architecture for the development of the Kiko application. KikoDL development also is presented in this chapter as well as the development of wireframes to start designing the application interface.

KIKO APPLICATION: DEVELOPMENT

This chapter presents the technologies and some procedures used to develop the Kiko web application backend, frontend and database, as well as ANTLR integration to process text files (lesson plans) added to the application by the user. This chapter also presents some precautions that have been taken in the development of the interface such as the colors, layout and symbols used, so that it would be an simple and easy application for everyone to use even in unrealistic classroom conditions.

4.1 BACK-END

Initially for web application development was used a web application framework Expressjs [1]. Express is a software framework that is designed to support the development of web applications including web services, web resources, and web APIs and provide a standard way to build and deploy web server applications in Nodejs [2].

Node.js is an open-source and cross-platform JavaScript runtime environment that helps in the execution of JavaScript code server-side. When discussing Nodejs, one thing that definitely should not be omitted is built-in support for package management using the npm [3] tool that comes by default with every Node.js installation. The idea of npm modules is a set of publicly available, reusable components, available through easy installation via an online repository, with version and dependency management. The application server was developed in node.js because it is easier to use and gives more options than other JavaScript servers. Node.js is used as a single programming language allowing to write both the front-end as well as the back-end web application in JavaScript using a runtime environment. It also makes the deployment of the web applications simpler because almost all the web browsers support JavaScript. Node.js is blessed to have a large and active community of developers who keep on continuously contributing towards its further development and

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1 Accessible in https://expressjs.com/, accessed in 2019-05-02
2 Accessible in https://nodejs.org/en//, accessed in 2019-05-02
3 Accessible in https://www.npmjs.com/get-npm, accessed in 2019-05-02

improvement. This advantage was perhaps the most important for the development of the application allowing the integration of Antlr4 [4] through a library available at npm.

4.2 ANTLR4 INTEGRATION

The integration of Antlr4 was done through the Antlr [5] and Antlr-tools [6] library. The first allowed the application server to process user-supplied text files by generating the tree which was required to process in order to remove unwanted characters.

The tree is only generated after using Parser and the Lexer generated by the Antlr-tools library. The Anltr-tools Library generates the Parser, Lexer, Visitor and Listener based on the Kiko Description Language developed previously. The Parser and the Lexer are used to process the text file content by constructing a tree (see Figure 14 for an example of the generated tree) and the Visitor is used to visit the tree in order to process the necessary information.

The Lexer is responsible for the first step, and it's only job is to create a "token stream" from text. It is not responsible for understanding the semantics of the Kiko description language, it is only interested in understanding the syntax of the language.

The Parser is used to extract meaning from a sequence of already lexed tokens.

For last the Visitor and Listener are used allowing to compute and save context information necessary for processing at various nodes.
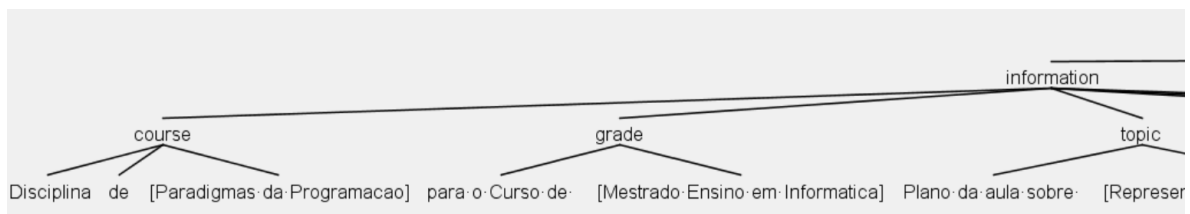
Figure 14.: Excerpt from the tree generated by KikoDL

4.3 MYSQL DATABASE

After processing all the information it is necessary to keep it. For this purpose a MySQL [7] database was developed to accommodate all data received by the web application. The

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4 Accessible in https://www.antlr.org/, accessed in 2019-05-02
5 Accessible in https://www.npmjs.com/package/antlr4, accessed in 2019-06-20
6 Accessible in https://www.npmjs.com/package/antlr4-tool, accessed in 2019-07-11
7 Accessible in https://www.mysql.com/, accessed in 2019-04-17

connection to the MySQL database was also facilitated using the library available at npm, the MySQL [8] library.

A database schema (see Figure 15) was developed to describe the relationships between objects and information in a database. The schema defines the infrastructure of the database needed to accommodate all the information received from the web application.

The course table contains the identification number, the name and the initials of the course. In the subject table there are the identification number, the name and the initials of the course.

A lesson plan (table Plano) is linked to a subject (table Disciplina) and that subject is linked to a course (table Curso). A course can contain multiple subjects and one subject can be associated with multiple plans, but one plan can only be associated with one course and that discipline can only be associated with one course, meaning there is a 1 to N relation between the course $\rightarrow$ subject and the subject $\rightarrow$ plan.

The main table of the database schema is the plan table (Plano). This table is the most important table as it contains all the information from the lesson plan file, uploaded by the user. This table is associated with it the table content (Conteudo), context (Contexto), objective (Objetivo), strategy (Estrategia), evaluation (Avaliacao), resource (Recurso) and note (Nota). All this tables associated with the table 'Plano' have a 1 to N relation between the plan $\rightarrow$ all the other tables, because a lesson plan can have multiple objectives, strategies, resources, context, content, strategies, evaluation methods and notes.

The lesson plan table (Plano) contains the identification of the plan; duration, date and lesson number of the class, plan name and title, the course and subject name. An identification number, the identification number of lesson plan associated, and a item or string are contained in table 'Conteudo', 'Objetivo','Estrategia', 'Nota' and 'Avaliacao'. The remaining table, Recurso, contains the identification of the resource, name of the recourse, a link to the resource and the identification of the plan associated.

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8 Accessible in `https://www.npmjs.com/package/mysql`, accessed in 2019-05-06

Curso
idCurso INT
nome VARCHAR
sigla VARCHAR

Disciplina
idDisciplina INT
nome VARCHAR
idCurso INT
sigla VARCHAR

Plano
idPlan INT
duracao VARCHAR
data VARCHAR
disciplina VARCHAR
curso VARCHAR
licao VARCHAR
plano VARCHAR
titulo VARCHAR
idDisciplina INT

Contexto
idContexto INT
contexto VARCHAR
idPlano INT

Estrategia
idEstrategia INT
estrategia VARCHAR
idPlano INT

Conteudo
idConteudo INT
conteudo VARCHAR
idPlano INT

Nota
idNota INT
nota VARCHAR
idPlano INT

Recurso
idRecurso INT
nome VARCHAR
link VARCHAR
idPlano INT

Objetivo
idObjetivo INT
objetivo VARCHAR
idPlano INT

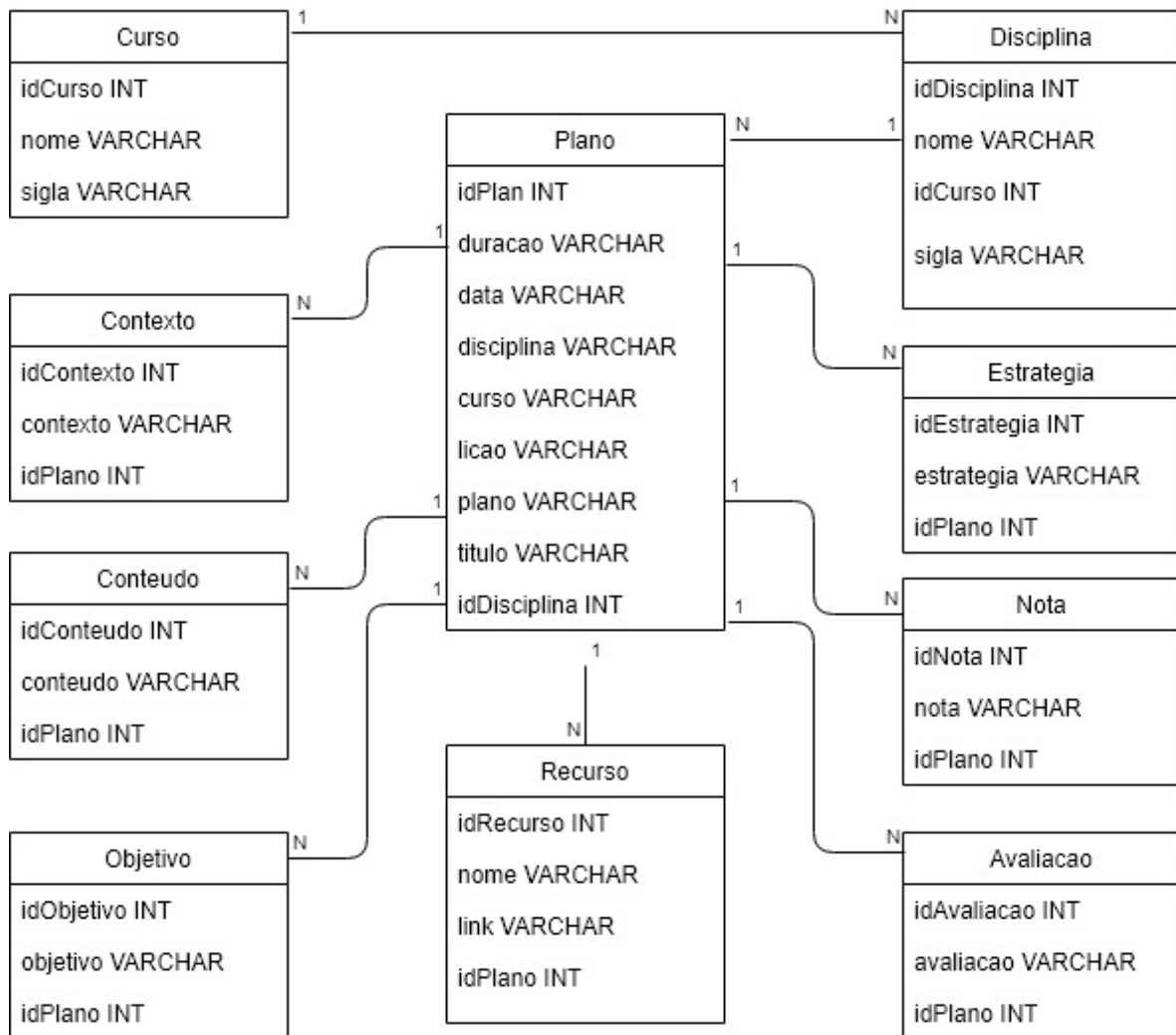| Avaliacao |
|---|
| idAvaliacao INT |
| avaliacao VARCHAR |
| idPlano INT |

Figure 15.: Database Schema

4.4 FRONT-END

The application design was based on the previously developed wireframes. The application front end was developed in HTML5, CSS, JavaScript and Bootstrap.

Hyper Text Markup Language (HTML) is the backbone of any website development process, without which a web page doesn't exist. Hypertext means that text has links, termed hyperlinks, embedded in it. When a user clicks on a word or a phrase that has a hyperlink, it will bring another web-page. A markup language indicates text can be turned into images, tables, links, and other representations. It is the HTML code that provides an overall framework of how the site will look.

Cascading Style Sheets (CSS) was used to control the presentation aspect of the site and allows the web application to have its own unique look. It does this by maintaining style

sheets which sit on top of other style rules and are triggered based on other inputs, such as button sizes, colors and positions, but for the main look was used Bootstrap and only after CSS was used for the last hits. For the main structural development of the application was used bootstrap which is a free front-end framework for faster and easier web development. Bootstrap includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and many other, as well as optional JavaScript plugins. Some of these templates were used such Pills with dropdowns. This template was used to develop the page on Figure16 and this allowed for the saving of computational resources by making only one request for information, receiving all data relating to a lesson plan, rather than making a request for each section of the lesson plan (context, content, objectives, assessment, strategies, resources, notes).

Figure 16.: Vertical Pill with Dropdown

For the development of the Kiko application we also used standard icons to keep the views cleaner and simpler. Some of the icons used were: o the add icon (see Figure 17); trash can icon associated with resource disposal (see Figure 18); and the pen or pencil associated with editing (see Figure 19).

Figure 17.: Plus Icon

Figure 18.: Trash Can Icon

Figure 19.: Pencil Icon

The colors chosen for the application were also chosen to have high contrast. Colors must have sufficient contrast between text color and its background (technically called luminosity contrast ratio). The objective of this technique is to make sure that users can read text that is presented over a background. The theme used is a white background and icons and black text because often the classroom environment is not the most ideal, there is too much light, or little in some cases. Brightness is also a variable as depending on the time of day and the mood of the classroom in relation to sunlight can affect visibility. As this application has the ultimate goal to be used in classrooms we all know that sometimes the available processing devices are not in perfect condition either, many of them with many years of use which degrade their perfect functioning and quality of the projection. Taking all this into account, we chose to use these two high contrast colors, black and white, to minimize these problems so that everyone has a view of everything that is projected in the classroom.

Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web. JavaScript enables interactive web pages and is an essential part of web applications. The vast majority of websites use it, and major web browsers have a dedicated JavaScript engine to execute it. JavaScript was needed to make a dynamic table to present the course and subject icons in the initial page and also to present the plans from some subject in another table on other view. This table is calculated through the total of existing plans to divide by the rest of the division by three, forming rows for the three allowed columns.

4.5 SUMMARY

Chapter 4 discusse the phases that make up the Kiko system, namely the backend, frontend, database and ANTLR incorporation. In each phase were explained some of the technologies used and also the care to be taken during their development.

KIKO APPLICATION: OVERVIEW

The main objective of this chapter is to give a overview of the Kiko Application user interface and all of is features.

The first page the user encounters when starting the web application is the initial page (see Figure 20). This page displays all subjects previously added by the user through a pivot table with an icon and the acronyms of the subject and acronym of the course to which the subject belongs.

Figure 20.: Initial Page of Kiko App

Still on the first page it is possible to add a new course through a modal (see Figure 22) by clicking on the first option (number 1 in blue on Figure 21). The user can click on the "More Options" icon (number 2 on blue color) to activate / show two options (see Figure 23). Finally, the user can navigate to the course page containing all the associated lesson plans by clicking on the desired course icon (number 3 in blue color).
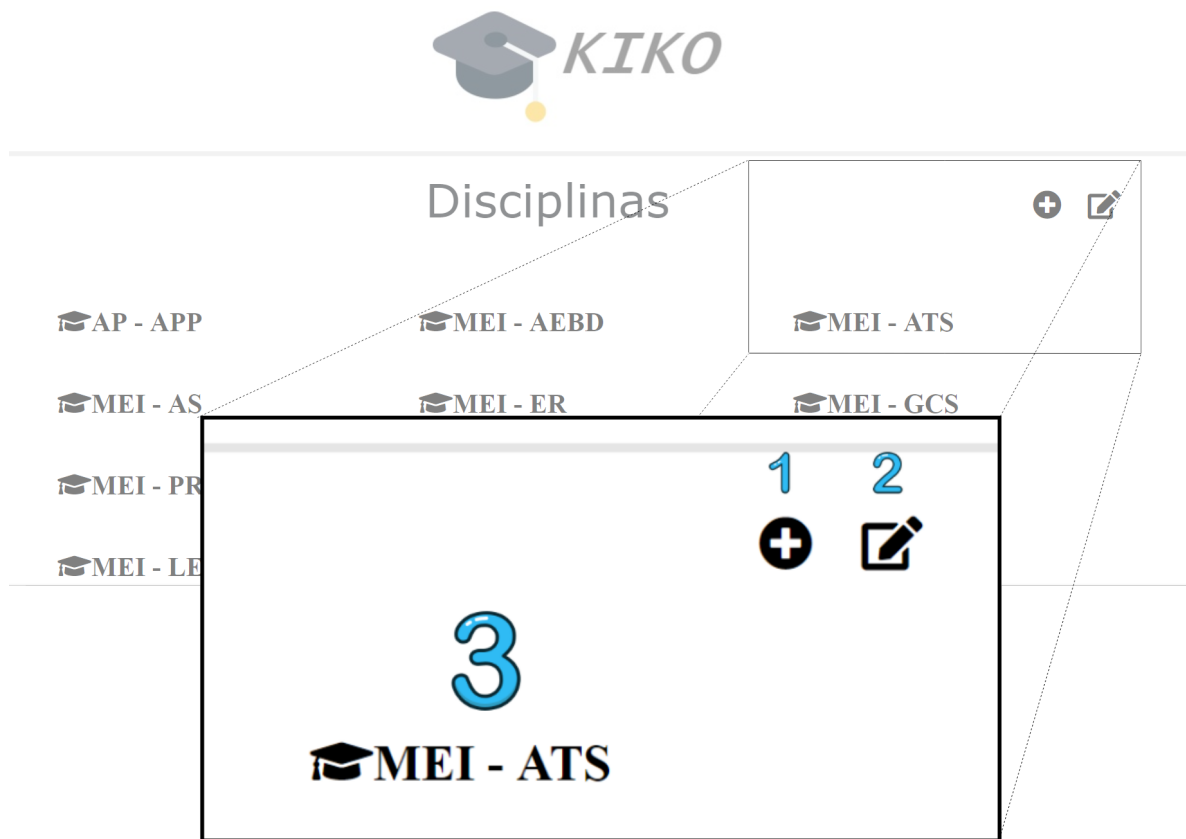
Figure 21.: Functionalities of initial page

In Figure 22 is shown the modal where the user can add a new subject by filling in all the form fields. These fields are all mandatory and if the user forgets to fill in any will be notified to do so, it is not possible to add the discipline if these conditions are met. The first form field is the name of the course being followed by the initials of the member. The third and fourth fields are the name and acronym of the subject, respectively.

Figure 22.: Modal to add new Course and Subject

If the user clicks on the "More Options" icon (number 2 on blue color, see Figure 21) to activate / show two options(see Figure 23). This options are:

- Number 4- The user is redirected to a new page to edit the course and subject data (see Figure 24 to see the web page);

- Number 5- This button lets user remove the course and subject plan permanently.

KIKO

Disciplinas ⊕ ✎

🎓AP - APP   🎓MEI - AEBD   🎓MEI - ATS
✏ 🗑   ✏ 🗑   ✏ 🗑

🎓MEI - AS   🎓MEI - GCS
✏ 🗑   ✏ 🗑

🎓MEI - PRI

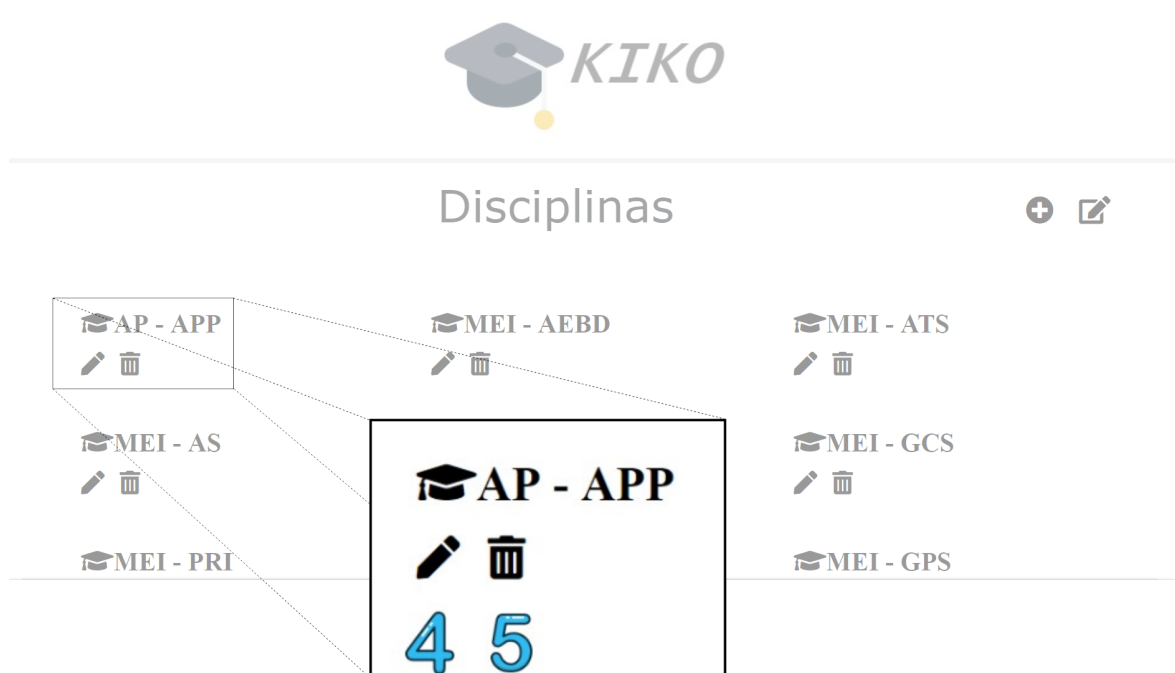🎓AP - APP

✏ 🗑

4 5

🎓MEI - GPS

Figure 23.: Functionalities of Initial Page - Enabled Options

Figure 24 corresponds to the course and discipline data editing web page. In this page the user can edit the name and acronym of the course, as well as the name and acronym of the subject. To validate the form the user cannot have any empty fields, that is, can not update with any form field to fill.

Editar o Curso e Disciplina

Nome do Curso

Mestrado em Engenharia Informatica

Sigla do Curso

MEI

Nome da Disciplina

Administração e Exploração de Bases de Dados

Sigla da Disciplina

AEBD

Cancelar Alterar

Figure 24.: Course and discipline data editing web page

The next page the course presentation is the listing of all existing plans for a given subject (see Figure 25). This page has a layout that is practically the same as the previous page, maintaining the same design and simplicity previously presented.

Voltar

Planos de Administração e Exploração de Bases de Dados

Plano 1   Plano2   Plano 3

Plano 4   Plano 5

Figure 25.: List of lesson plans from a subject page

In this assembly (Figure 26), the following features are highlighted:

- Number six - you can add a new plan by uploading the text file containing a detailed plan following the previously defined structure (see Figure 28);

- Number seven - pressing this button displays the trash can icon, where you can delete a desired lesson plan (see Figure 27);

- Number eight - redirects to a new page where all the lesson plan data already processed and available for viewing in a classroom setting will be displayed (see Figure 29).

Figure 26.: List of lesson plans from a subject page functionality

Figure 27.: List of lesson plans from a subject page - delete functionality

The modal in Figure 28, is a form for adding a new lesson plan. This form, to be submitted successfully, needs to have a name, which corresponds to the lesson plan, and a selected file, which is the text file pre filled with the structure previously defined. After the user submits the form successfully, all the information from the text file will be processed and will be available for viewing.
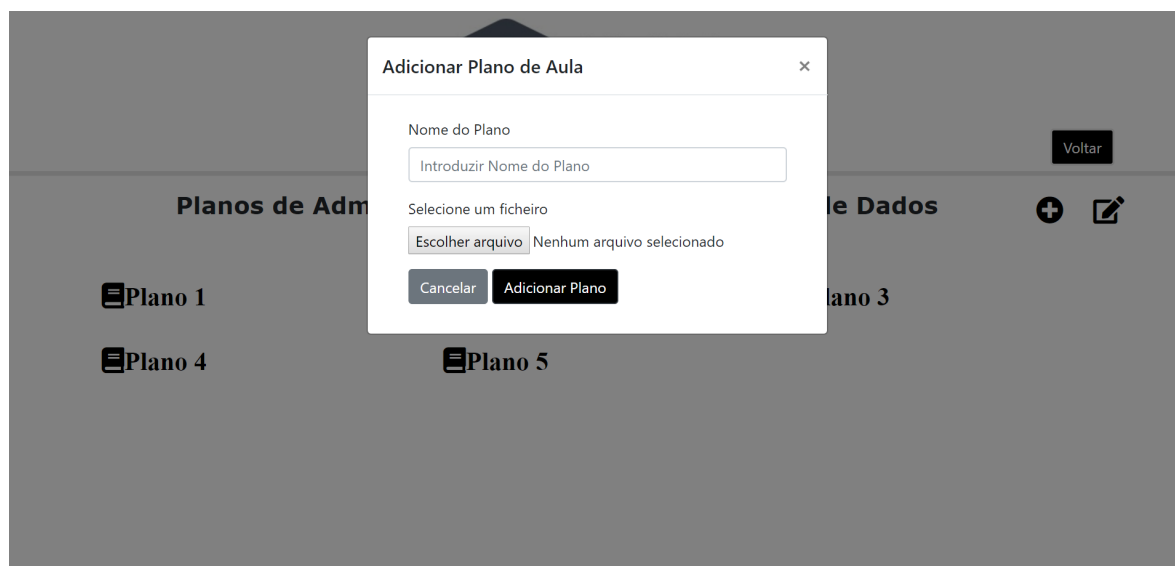

Figure 28.: Modal with a form to add a new Lesson Plan

In Figure 29 is presented the main interface used in the classroom to present the lesson plan. On the left is a column showing the main fields of a lesson plan, a kind of lesson guide. To the right each of these fields is presented in greater detail supporting one teacher and passing information to the students at the same time.

Figure 29.: Lesson Plan Presentation Page 1 - Lesson Information

One of the main features of the application is the reproduction of resources without having to switch to the "resources" tab. Whenever a resource is added while filling in the lesson plan fields, they are automatically linked with a link to open them throughout the lesson, such as "Ficha1" and "Ficha2" which are highlighted in bold (see Figure 30). These bold words are hyperlinks to the resource associated with them in order to simplify the course of the class.

Figure 30.: Lesson Plan Presentation Page 2 - Context

5.1 SUMMARY

In this chapter is presented the Kiko system and all the features present in the interfaces are explained. For more information and to use the Kiko Web Application see: `http://kiko.epl.di.uminho.pt:10101/`.

CONCLUSION

Because we recognize that "Lesson Plan" is a very important concept in the teaching/learning process to get more effectiveness, the ultimate goal of the project here reported is the development of a description language and the respective compiler capable of processing Lesson Plans written by teachers and then presenting them in a Web page for their actual support.

Initially, the essential concepts concerned with Lesson Plans, as well as the most used (paper) plans and related computer supportive tools, were studied and analyzed to be possible to propose a master Lesson Plan structure that contains the most common fields needed to define a complete lesson with all its moments. Based on that master structure a grammar was designed to define a convenient formal language to describe Lesson Plans. After this, the architecture of a computer-based system has been proposed. This architecture consists in a domain-specific language processor for Lesson Plans, a data repository to store the information extracted from each plan, and a Web application to display a given Lesson Plan with all its data, giving support to a teacher during his class. After reaching a master plan and is fields was developed a DSL to describe the lesson plan.

Afterwords some wireframes were developed to give a general idea of the application interface and also to include in the submission of an article for the Challenges 2019 Conference (Cruz et al., 2019). The next step was the development of the prototype, the Kiko Application, which involved the development of a frontend in HTML5, CSS, JavaScript and Bootstrap; and a backend on NodeJS. It was also necessary to develop a MySQL database to accommodate all data from the application and the text files containing the lesson plan loaded by the user. To proccess the lesson plan was also necessary to incorporate the ANTLR-4 and create a Parser and a Lexer generated through the developed Kiko Description Language (see Listing B.1).

Finally the application was deployed on the server of EPL Group (the research group on Language Processing at DI), where it can be accessed publicly through the URL: http://kiko.epl.di.uminho.pt:10101/.

During these months of development of the dissertation, some difficulties were felt mainly in the integration of ANTLR in the web application, as there is little information on

the internet, which led to delays and some troubles. After some research the obstacles were overcome and the initially defined objectives were attained.

6.1 CONTRIBUTIONS OF THE DISSERTATION

The two major contributions resulting from this work were KikoDL (the domain-specific language developed for writing a lesson plan) and the Kiko Web System designed to support and guide lessons by animating user-added lesson plans.

Additionally, an article, "Kiko, a Web System to enhance classes based on Lesson Plans" (Cruz et al., 2019) was written and presented in the Challenges 2019 International Conference[1], where it was possible to receive new opinions and discuss the project under development in order to improve the application.

6.2 FUTURE WORK

To improve the application it would be necessary to conduct more tests and experiments in real classrooms to to identify flaws, runtime errors or missing functionalities, along the course of a class and student interaction.

It would also be necessary to implement an authentication system so that all users could have their own desktop where all their information would be secure.

Another improvement of the web application would be its availability in several languages, especially in English, as it is the most widely spoken and used language in the world.

As future work, it would be interesting to connect this application to the application Micas (Azevedo et al., 2019), developed by Ana Cristina Azevedo (another Masters' work that will be discussed this year), aiming at the creation of a Repository of Learning Resources properly classified according to an ontology designed to describe the teaching process of Computtional Thinking and Programming (OntoCnE).

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1 Accessible in: https://www.nonio.uminho.pt/challenges/

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LESSON PLAN EXAMPLES

This are two examples of lesson plans, complementing the lesson plan example in Chapter 3, that the Kiko Language purposed can use as base to process.

A.1 LESSON PLAN ABOUT REPRESENTATION OF INFORMATION

The lesson plan presented next is an example for subject Paradigms of Programming of the course Masters Informatics Teaching, with the with the theme Presentation of Information - Annotation.

```
 Disciplina de [Paradigmas da Programacao] para o Curso de [Mestrado Ensino
     em Informatica]

Plano da aula sobre [Representacao de Informacao - Anotacao]

Licao: 1
Data: 2019/05/10
Duracao: 3h00

Contexto:
+ No contexto do Módulo 3 sobre Ontologias surge a necessidade de ensinar
    anotação.
#

Objetivos de aprendizagem:
+ Introduzir o conceito e a prática de Anotação XML tendo em vista a extração
    de dados.
#

Conteudo:
+ introdução ao conceito de anotação, de linguagem-de-marcação.
+ introdução breve à linguagem XML;
+ exemplos diversos usando as fichas de trabalho {Ficha1} e {Ficha2}.
```

```
+ resolução de um exercício concreto para praticar a anotação em XML com base
   na ficha desta aula {Ficha1} (1 parte).
#


Estrategias de Ensino:
+ Apresentar exemplos motivadores;
+ Apresentar a abstração/generalização via formalização dos conceitos;
+ Incitar à prática via resolução em grupo de problemas seguida de discussão.
#


Recursos Educativos Complementares:
+ Ficha1 [PP18-FichaExercicio1-AnotacaoDocumentos.pdf];
+ Ficha2 [https://docs.google.com/presentation/d/1
   lhM1p1GOM__6xi1hQgli3rW26IxF_OsVsqObvZt73s/edit#slide=id.p].
#


Avaliacao:
+ Avaliação continua baseada nas intervenções ao longo da aula.
#


Notas:
+ A aula terminou com grande animação;
+ Só houve tempo para 1 exercício de anotação.
#
```

Listing A.1: Lesson Plan about "Information Representation"

A.2   LESSON PLAN ABOUT "COMPUTER-SUPPORTED COOPERATIVE WORK"

This is an lesson plan example for subject Introduction to Informatics for the students of Archeology, with the theme Cooperative Web Tools to Support an Office Daily Work.

```
Disciplina de [Introdução à Informática] para o Curso de [Arqueologia]

Plano da aula sobre [Suporte ao Trabalho Quotidiano]

Licao: 4
Data: 2019/10/03
Duracao: 2h00

Contexto:
+ Suporte ao Trabalho Quotidiano de Planeamento e Gestão em Ambiente
   Colaborativo para organização das atividades de um arqueólogo.
#
```

```
Objetivos de aprendizagem:
+ Concepção de uma apresentação oral suportada num conjunto de slides.
+ Introducao ao GSlides para construção de apresentações {Ficha1}.
#


Conteudo:
+ Descrição de uma apresentação suportada em slides;
+ Preocupações a ter na concepção de cada slide.
+ Introdução ao GSlides;
+ Criação de um apresentação para solicitar patricinios para as atividade do
    arqueo-Turismo.
#


Estrategias de Ensino:
+ Apresentação teórica;
+ Proposta do exercicio 1-4 da {Ficha1}.
#


Recursos Educativos Complementares:
+ Ficha1 [https://docs.google.com/presentation/d/1
    lhM1p1GOM__6xi1hQgli3rW26IxF_OsVsq0bvZt73s/edit#slide=id.p];
#


Avaliacao:
+ Avaliação da apresentação oral.
+ Avaliação da concepção da apresentação (estrutura e conteúdo);
#


Notas:
+ A Ines não vem mais.
#
```

Listing A.2: Lesson Plan about Support for everyday work

B

FULL KIKO DESCRIPTION LANGUAGE

In this appendix is presented the entire Grammar developed, complementing the the little excerpt presented in the Chapter 3, used to generate the processor, that was added to the application so that it could process the text files with lesson plans.

```
grammar Kiko_DL;

@header{
        import java.util.*;
        }
/* Principal fields of a lesson plan */
plan : information context expectations content strategies materials
    evaluation notes
      ;

/* Lesson plan information that consist in: course(the subject or course
    taught),
grade(the grade or level of the class), topic(the topic of the lesson),
date, ime and leght( of the class), number(reference or number of the class)*/
information : course grade topic number date lenght
            ;

course : DISC DE TEXTO
       ;

grade : PCURSO TEXTO
       ;

topic : PLANO TEXTO
       ;

number : LICAO ':' NUMERO+
        ;

/* Date of the lesson */
date : DATA1':' DATA
```

```
      ;

/* Lenght of the lesson */
lenght : DURACAO ':' NUMERO+ 'h' NUMERO+
        ;


/* context of the lesson */
context : CONTEXTO ':' TEXTO1* STOP
         ;

/* expectations or student objetives that describe what students will be
    expected t learn by
the end of the lesson*/
/*zero ou mais texto1 seguido de #*/
expectations : OBJETIVOS ':' TEXTO1* STOP
             ;

content : CONTEUDO ':' TEXTO1* STOP
         ;

/* teaching or learning strategies used by a teacher during instruction */
strategies : ESTRATEGIAS ':' TEXTO1* STOP
           ;

/* materials and Tools or resources needed  */
materials : RECURSOS EDUCATIVOS COMPLEMENTARES ':' (NAME LINK)* STOP
          ;

/* evaluation */
evaluation : AVALIACAO ':' TEXTO1* STOP
           ;

/* notes that a teacher finds necessary */
notes : NOTAS ':' TEXTO1* STOP
      ;

/* DEF. DO ANALISADOR LEXICO */
NUMERO: [0-9];

STOP : '#';

PCURSO: [Pp][Aa][Rr][Aa](' ')+[Oo](' ')+[Cc][Uu][Rr][Ss][Oo](' ')+[Dd][Ee](' '
    )*
;
PLANO : [Pp][Ll][Aa][Nn][Oo][ ]+[Dd][Aa][ ]+[Aa][Uu][Ll][Aa][ ]+[Ss][Oo][Bb][
    Rr][Ee][ ]*
```

```
      ;
DISC : [Dd][Ii][Ss][Cc][Ii][Pp][Ll][Ii][Nn][Aa];
DE   : [Dd][Ee]
      ;
LICAO : [Ll][Ii][Cc][Aa][Oo][ ]*|[Ll][Ee][Ss][Ss][Oo][Nn][ ]*;

DATA1 : [Dd][Aa][Tt][Aa][ ]*|[Dd][Aa][Tt][Ee][ ]*;

DURACAO : [Dd][Uu][Rr][Aa][Cc][Aa][Oo][ ]*|[Dd][Uu][Rr][Aa][Tt][Ii][Oo][Nn][
    ]*;

CONTEXTO : ([Cc][Oo][Nn][Tt][Ee][Xx][Tt][Oo][ ]*) | ([Cc][On][Nn][Tt][Ee][Xx][
    Tt][ ]*);

OBJETIVOS : [Oo][Bb][Jj][Ee][Tt][Ii][Vv][Oo][Ss][ ]+[Dd][Ee][ ]+[Aa][Pp][Rr][
    Ee][Nn][Dd][Ii][Zz][Aa][Gg][Ee][Mm][ ]*
         | [Ll][Ee][Aa][Rr][Nn][Ii][Nn][Gg][ ]+[Oo][Bb][Jj][Ee][Cc][Tt][Ii][
             Vv][Ee][Ss][ ]*
         ;

CONTEUDO :[Cc][Oo][Nn][Tt][Ee][Uu][Dd][Oo][ ]* | [Cc][Oo][Nn][Tt][Ee][Nn][Tt][
     ]*;

ESTRATEGIAS: ([Ee][Ss][Tt][Rr][Aa][Tt][Ee][Gg][Ii][Aa][Ss][ ]*[Dd][Ee][ ]*[Ee
    ][Nn][Ss][Ii][Nn][Oo])
           | [Tt][Ee][Aa][Cc][Hh][Ii][Nn][Gg][ ]*[Ss][Tt][Rr][Aa][Tt][Ee][Gg
               ][Ii][Ee][Ss][ ]*
           ;

RECURSOS :[Rr][Ee][Cc][Uu][Rr][Ss][Oo][Ss]|[Rr][Ee][Ss][Oo][Uu][Rr][Cc][Ee][Ss
    ];

EDUCATIVOS: [Ee][Dd][Uu][Cc][Aa][Tt][Ii][Vv][Oo][Ss]|[Ee][Dd][Uu][Cc][Aa][Tt][
    Ii][Oo][Nn][Aa][Ll];

COMPLEMENTARES:[Cc][Oo][Mm][Pp][Ll][Ee][Mm][Ee][Nn][Tt][Aa][Rr][Ee][Ss]|[Cc][
    Oo][Mm][Pp][Ll][Ee][Mm][Ee][Nn][Tt][Aa][Rr][Yy];

AVALIACAO : [Aa][Vv][Aa][Ll][Ii][Aa][Cc][Aa][Oo][ ]*|[Ee][Vv][Aa][Ll][Uu][Aa][
    Tt][Ii][Oo][Nn][ ]*;

NOTAS : [Nn][Oo][Tt][Aa][Ss][ ]*|[Nn][Oo][Tt][Ee][Ss][ ]*;

NAME : '+' ' '+ [A-Za-z0-9]+ ;

TEXTO1: '+' ~('.'|';')*('.'|';')'\r'?'\n';
```

```
LINK: '[' (~(']'))*']'('.'|';')'\r'?'\n';

DATA : ('0'..'9')+'/'('0'..'9')+'/'('0'..'9')+ ;

TEXTO: (('[') ~('['|']')* (']'));

Separador: ('\r'? '\n' | ' ' | '\t')+  -> skip;
```

Listing B.1: Kiko Description Language purposed

WIREFRAMES

In this appendix the other wireframes not listed in Chapter 3 and developed for the Kiko Application are presented.
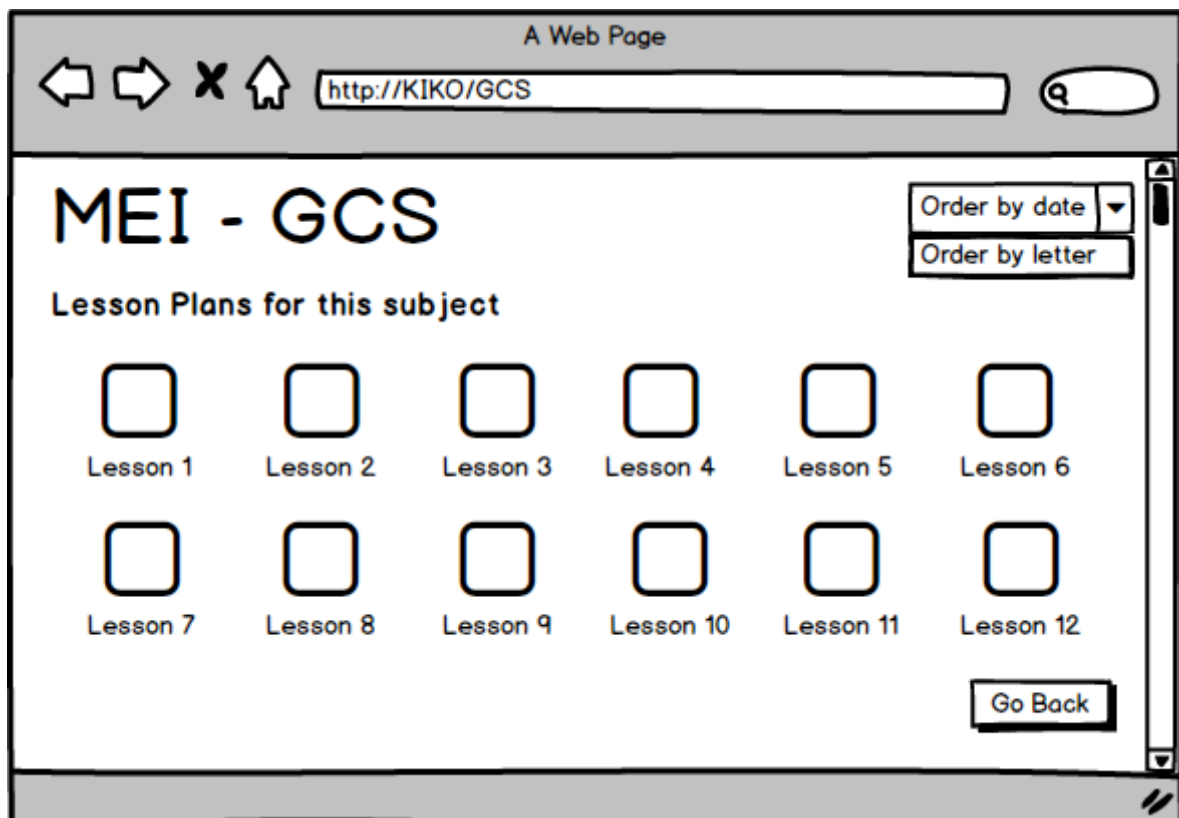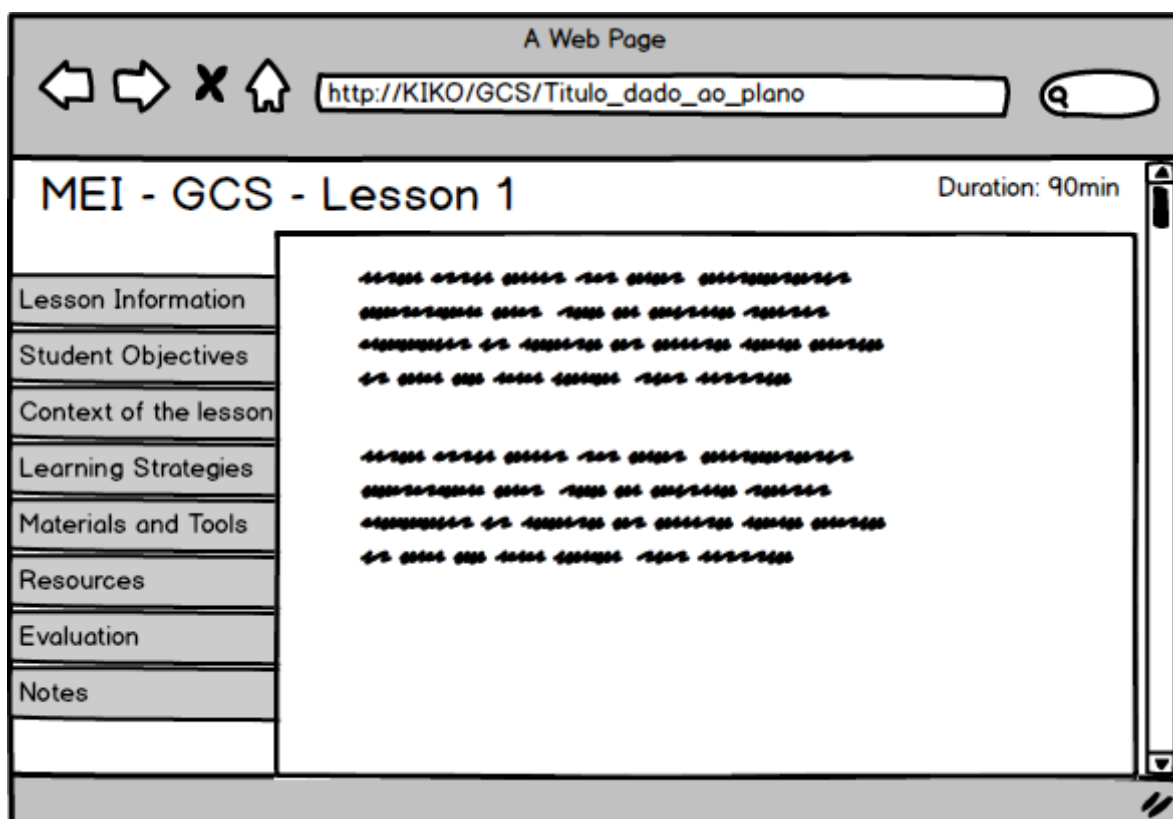

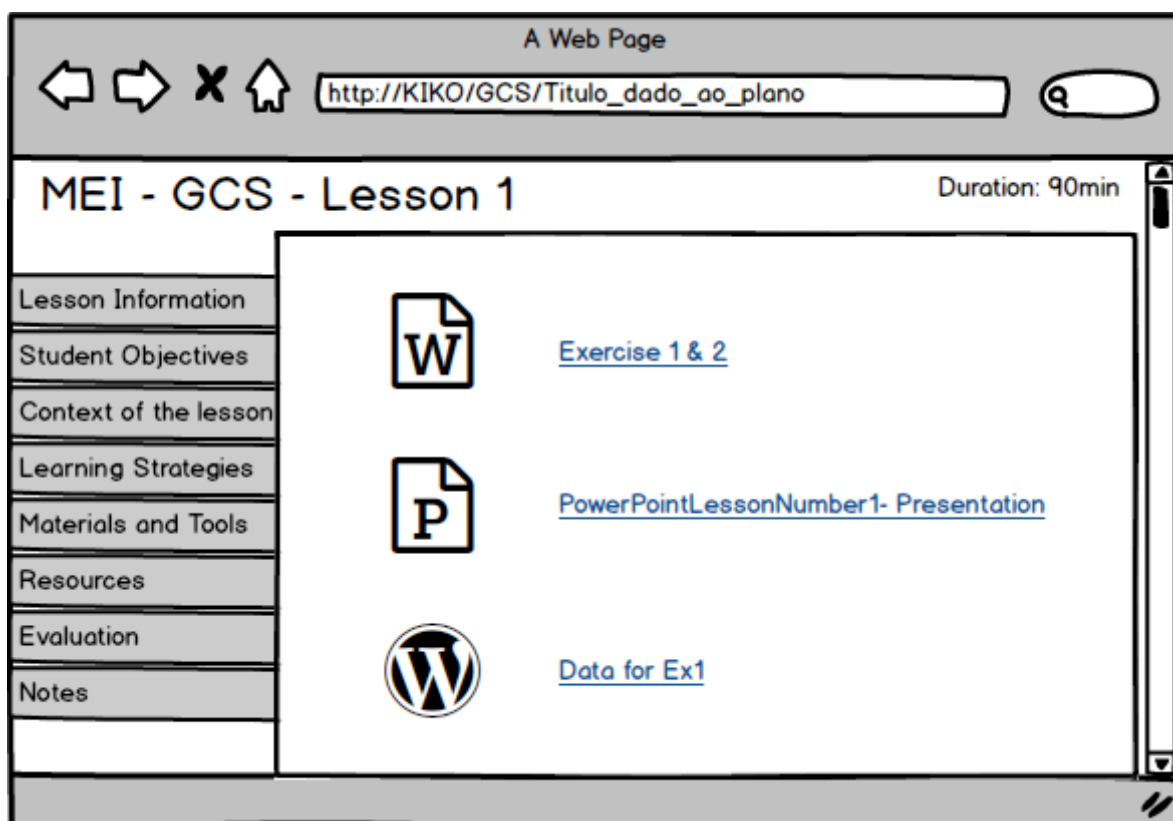Figure 31.: Kiko's Subject Page Wireframe

Figure 32.: Kiko's Presentation Page Wireframe

Figure 33.: Kiko's Lesson Plan Recourses Page Wireframe