

# A Web-based System to Manage Primary Students' Homework

## A Case Study for the Teaching of Portuguese

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**Abstract**—Technology has profoundly changed the way we learn and live. Internet provides a new paradigm, setting forth that education and communication approach is truly more complex than ever before. Here, we present a web-based system to support students' homework. In order to prove its usefulness, we present the results achieved with the application of a set of exercises to help improving Portuguese (mother tongue) language skills of 4th-grade primary pupils. This set of digital exercises proved to be the child's favorite, rather than their counterpart exercises in paper form, also showing a fair more positive attitude from the students' point of view. A simple survey also showed that students do prefer the use of the system here presented, when compared to other more traditional ways of practicing. We also believe that the prompt feedback about the exercises correctness, together with the training provided by the different exercises sets about the same subject, besides the exploitation of video, color, sound, etc., positively reinforce the diverse child's senses, definitely contributing to capture and motivate the child.

**Keywords**—Web-based homework system; improving mother tongue teaching/learning; primary education

### I. INTRODUCTION

Technology has profoundly changed the way we learn and live. This relationship appears to be quite complex, in that IT, and especially socially- and technologically-rich learning environments, seems to both require and foster skills and learning. Internet provides a new paradigm, setting forth that education and communication approach is truly more complex than ever before.

It is on the basis of such paradigm that we present a case study where a set of exercises were used in order to improve the Portuguese (mother tongue) language skills of 4th-grade primary pupils. Being part of a web-based system to support students' homework [1], a set of digital exercises proved to be the child's favorite, rather than their counterpart exercises in paper form, also showing a fair more positive attitude. To the best of our knowledge, there is no system like the one presented here available.

The paper is organized as follows. The next section is used to present some related work. Section III is used to present some of the advantages of using the web-based system presented here to help with the student homework, and related to the Portuguese mother tongue teaching/learning. In Section IV, we present the theoretical model used to support our research. In Section V, we present an overview of the web-based system, and also its developing context. In Section VI, we present some of the main characteristics of the set of templates available in the system and used to create the exercises offered to the

students during this study, and also the data and some of our main achievements. Finally, in Section VII, we present the major conclusions achieved with this work.

### II. RELATED WORK

As far as our knowledge, there are no systems using the same approach and ideas as those used in the system presented and discussed in this paper. However, there are many web-sites and tools available for helping the teaching of virtually everything.

Concerning the class of available web-sites we want to highlight the following ones. The "Coursera" site/system [2] offers free courses online from world-class universities. The topics are varied and lectures are formatted into series of 15-minute-long clips, and students can watch videos at their convenience and in their own time. "Learnist" is the "Pinterest" of learning [3]. The interactive platform allows users collect teaching materials and educational content that are grouped into "boards". The platform is equipped with the "Learn it!" bookmarklet, which enables picking images anywhere on the web and automatically shoots them to your "Learnist" board. The "Open Culture" [4] system is a high-quality cultural and educational media. A collection of 1,100 courses, online, for free, from Ivy League universities, such as Stanford, UCLA, Columbia and Oxford University is available. Courses run the gamut from science and art to math and economics. "Brazilian" Portuguese is one of the 48 languages available to learn for free. However, the type of contents available is completely different from the ones proposed here. "Udacity" [5] is free education web-site for brainy types, founded by four Stanford roboticists, and currently offers 11 courses, all of which are in science and math-related topics. According to the web-site, plans are underway to expand the curriculum. Udacity is free of deadlines, free of prerequisites, free of quizzes and other annoying school stuff. Courses are also free of charge. TED (Technology, Entertainment, Design), the powerhouse of jaw-dropping lectures needs no introduction. Now, they're bringing their talent into education with an offshoot, Ted-Ed [6]. A treasure trove of beautifully animated and gripping videos on a wide array of subjects, such as "The Power of Simple Words" and "How Many Universes are there", is available. All videos are under 10-minutes-long. Supplemental materials, such as quizzes and discussion questions, are also available. Unfortunately, we were unable to find any lessons on Portuguese in the 108,138 lessons available. Effortless learning based on three pillars science, fun and community is the basis for the "MemRise" site [7]. Based on scientific methods for implanting new information, "MemRise"

proves that what may seem impossible is in fact doable. The “Guardian Wallcharts” are mapped “MemRise” style, teaching you all about cheeses, herbs and other wonders of life. The “MentorMob” site/system [8] is like the “YouTube” of learning materials: users create learning “playlists” from first-rate web-sites. MentorMob is a community, whose members share and rank each others’ learning playlists.

There are many “educational web-sites” for kids/students available on the Internet. In the site “Wonderopolis” [9], a kid/student may discover a new wonder each day. Wonders are amazing facts and intriguing questions such as “Why are they called Lava Lamps?” or “What Badger has a sweet tooth?” can be answered. Surfing the web-site “Whyville” kids/students can learn through playing games and socializing [10]. J.K. Rowling created the site “Pottermore” so kids could read the books and do interactive features and games [11]. The site “National Geographic Little Kids” [12] features games, crafts and recipes, science, videos, and animal information. It is perfect for 5 years old and under kids. Math and reading video-like games like math baseball and Mad Libs Junior are available at the “Funbrain” web-site [13]. Kids/students can get into cooking on the “Spatulatta” friendly cooking web-site with lots of videos and recipes [14]. The “NGA Kids” web-site [15] gives users art adventures and activities from the United States National Gallery of Art. The “Yahoo Kids” web-site is the least educational of all the choices listed above, since the site includes both games and videos of all sorts. But, kids/students can find lots to learn on this interactive web-site like homework help, learning about science, and access to an encyclopedia.

Many more educational sites are available on the Internet; there are even sites with sorted lists of educational sites, such as those lists presented in [16]. However, all these sites offer exercises or sets of exercises, which can (and should) be solved by kids/students, but the teacher cannot change (customize) them to create her/his own exercises based on the existing ones, and then offer them to the kids/students. The web-based system presented here allows this.

The Learning Managements Systems (LMS), such as Moodle, Blackboard, Sakai, Desire2Learn, etc., possess their own tools for the creation and publication of exercises, and obviously should be included in the list of web-based systems and tools for helping building exercises. Also, there are other tools available on the Internet:

- “Hot Potatoes” [17] — This program is free to educators, although registration is required. There are six types of quizzes; JBC: multiple-choice exercises, JCloze: gap-fill exercises, JMatch: matching/ordering exercises, JQuiz: short-answer questions, JMix: jumbled sentences. After the creation of the quizzes, Hot Potatoes will convert the files to HTML, which the author must then (manually) upload to the server.
- “Quia! Create your own learning activities!” [18] — There are eight types of games and two types of quizzes to create at the Quia! site. The user must be registered before using Quia!. At the Quia! web-site the user enters the information and keeps track of the resulting URL. The user can create a quiz from any computer with Internet access, produce a page, and then access it again if the user remembers the

URL. All pages stay on the Quia! server. The user can choose a discipline on the main page to see what others have done with Quia!

- “QuizStar” [19] — The Quiz Star is an application that allows bringing together web pages for a series of lessons. The QuizStar quizzes remain on the TrackStar server. Registration is needed.
- “Charity Kahn’s JavaScript Quiz Creator” [20] — This tool creates the code for a simple multiple choice quiz. The user will need to copy the code and upload it to the server.
- “interactivetest.com” [21] — Here we can make online quizzes (up to 100 total questions) for free. For more than 100 and there is a charge. The quizzes stay on the interactivetest.com server.
- “Puzzlemaker” [22] — Is a puzzle generation tool for teachers, students and parents. The user can create and print customized word search, criss-cross, math puzzles, and more-using his/her own word lists. The user must choose a type of puzzle from the list of ten templates available and make her/his own puzzle online for classroom or home use.
- “Rubric Generator” [23] — Rubrics are intended to make grading quicker, clearer, and more objective. The site contains tools that guide the user through the process of creating the assessment tools for evaluating student performance. There are over five hundred printable rubrics on the web site.
- “Quiz your Friends” [24] — A very simple site that will guide the user through the creation of a quiz in four steps. In the final step the user chooses if the quiz will be sent via Email, Instagram, Facebook or Twitter, to the group of peoples/friends.
- A list of many more quiz builders can be found in [25].

The big differences, and main characteristics, of the system presented here and that makes it unique when compared to the systems/sites listed above are the following:

- the production/creation of exercises is based on existing templates;
- exercises can only be created based on the existing templates;
- anyone, whose access was granted by the administrator of the system, may create exercises;
- the publication of every exercise just created is done immediately and automatically after its creation, and it will be available for everyone registered in the system;
- the creation/production of a new exercise is based in three simple steps:
  - 1) choose a template from the list presented in the form of images containing all the exercises;
  - 2) change the customizable fields in the template;
  - 3) choose a name and save the new exercise in the exercises database;
- there is no need for any programming skills or experience.

As can be seen from the list above, the template dictates the “behavior” of the exercise. The exercise in “it-self” will run on the computer of the user, i.e., the exercise will not run in the “server-side” but in the “client-side”. As will be discussed in Section V (“Overview of the System”), the system was implemented using HTML 5, JavaScript, Adobe Flash, and ActionScript. The system will be used to create the exercises and store them in its internal databases. After that, the system will work as a typical web-server.

In fact, in seeking to meet the latest requirements and concepts used by leading standards in distance learning, we are making efforts to make it possible to download the exercises in a standard (SCORM and Common Cartridge) in order to make possible the execution of exercises off-line and subsequent communication of the results achieved by students at the time of reconnection to the Internet. However, at the moment, this is partially implemented.

### III. ADVANTAGES OF USING THE WEB-BASED SYSTEM

In the view of several authors it seems that we are moving to a “digital learning” (e.g., [26]–[28]). According to Weller [26], there are five factors that favor the use of the Internet in education: its social acceptance, it facilitates a sense of control and therefore ownership for educators far more than previous technologies, the web browser has become a generic interface, it is both an interactive (do something with the information rather than just being a passive recipient) and personal (all learners are not the same) medium, is a sustaining (e.g., a retailer that uses it to supplement its physical shops, for instance by home delivery from supermarkets) and disruptive (e.g., it does not intend web based shopping to displace its standard retail outlets, but rather it hopes the two will complement each other, and thus altering the organization in which it is implemented) technology.

Internet can be used to supplement face-to-face teaching; for example, many campus based universities use the Internet not to replace their traditional face-to-face mode of delivery, but rather as a means of supplementing it (e.g., web pages can be used to provide additional information, or e-mail be used as a means of contacting tutors of large courses). Of course that there are topics that better suit its use (an “Introduction to Information Technology” course, and a course for teachers wanting to learn about computer conferencing, are examples of courses where using the technology effectively forms an integral part of the academic content of the course) without forgetting pedagogic suitability (for example, the resource based learning, where students can be presented with a wide range of resources, often external to the university, where students derive their own learning experience from these resources within the overall framework of the course). Internet’s usage also leads to institutional benefit because institutions can benefit from the use of Internet in education, both on campus and in reaching new audiences, and from the fact that it can be seen as a Computer Assisted Learning delivery mechanism—many courses are using Internet to deliver simulations, visualization aids and interactive tools.

In order to become more accurate in their work, both in reading problems and in working out solutions, primary students need more practice to reinforce what they are learning, a process which traditionally takes place on paper, and traditionally are distributed in textbooks or tutoring books.

Unfortunately, these materials are usually designed for average learners, and it is often difficult to find the best-fitting content for students with differing abilities and skills. For example, in Portugal all the classes have only one textbook designed for all students, but literate students may need a higher-level tutoring, and illiterate may need a lower-level tutoring. Therefore, the depth and flexibility of ability gained from these textbooks are restricted. Some programs based on e-learning technology may provide personalized contents for learners by collecting the learning process. But primary students may become restless and unfocused when staying in front of computers during long periods of time. As putted by Warschauer, [27], “New technologies do not replace the need for strong human mentorship, but, indeed, amplify the role of such mentorship”. Obviously students must become into contact with the new teaching/studying tools progressively, in order for them to become a part of the learning environment as smoothly as possible.

Teachers, but also parents, have an important word to say in this process; as noted by Warschauer [27], “the teacher must be centrally involved, actively instructing and mentoring students, especially at the initial stages of work on a project. Unfocused instruction can leave students rudderless, and this is particularly harmful to at-risk students, such as those with learning disabilities, limited literacy, and language skills, or insufficient background knowledge”.

In general, after students have completed practice exercises or homework, very often they have to wait for their teacher to check it and provide feedback. These interruptions can reduce students’ interest in learning as well as learning efficiency.

We believe that the prompt feedback about the exercises correctness, together with the training provided by the different exercises sets about the same subject, besides the exploitation of video, color, sound, etc., positively reinforce the diverse child’s senses, definitely contributing to capture and motivate the child.

From the teacher point of view, one advantage of the system here proposed is time saving. Most of the times, the teacher writes in the exercise-book of each pupil (at least in the “blackboard”) the set of homework exercises that s/he should try to solve. This is a handy work, and consequently very time consuming. When students return with their homework, the teacher must read and correct, one-by-one, every exercise-book, in order to have and give feedback to the pupils. During this process, the teacher also analyzes each student’s work, in order to evaluate the student’s progress and potentially introduce some programme and/or pedagogical adjustments. Obviously, this analysis should also be made to the global class.

With the web-based system presented here the teacher can select different sets of exercises for each student or, alternatively, propose the same set of exercises to the whole class, and this simply by creating e-mail lists and maintaining these lists as needed. The system will then provide the teacher with statistical data concerning each student and the entire class. We believe that these data will greatly help the teacher in evaluating his/her work, and help with the mentioned adjustments. The selection of different exercises sets may not directly lead to a time reduction of the teacher’s work, but its automatic check and the statistical data do. We believe that

teachers can use this extra time to better understand where and why some children are having troubles.

#### IV. PEDAGOGICAL MODEL

The teaching and researching communities agree that it is through the use of exercises and games that learning becomes effective, regardless of the model or philosophy used. For example, proponents of sociocultural theory claim that learning is primarily a social process mediated through interactions using tools [29]–[31]. According to Vygotsky, mediation occurs through the use of ‘semiotic’ and ‘material’ tools. The semiotic tools include symbols, signs, and spoken languages. Material tools include such items as pens, spoons, and particularly networked (Internet) computers. These tools do not simply facilitate the set of activity that might take place, but they fundamentally shape and define the type of activities that might be developed [30]. Seymour Papert proposed the use of tools, particularly the computer “a mighty education tool”, in helping in the process of construction of knowledge (given rise to the “constructionist” theory), adapting the beginnings of the cognitive constructivism of Jean Piaget in order to a better use of technology, [32].

Traditionally, the dominant form of learning in schools has been teacher-directed learning or *guided learning*: “a trainer or teacher takes all the relevant decisions and the learner can and should follow him or her. He decides about the goals of learning, the learning strategies, the way to measure outcomes and he takes care of feedback, judgments, and rewards” [33]. Besides guided learning, Simons, Linden and Duffy, [33], distinguish two other ways of learning: *experiential* and *action learning*. To facilitate and support learners through the gradual and progressive acquisition of adaptive competence, novel classroom practices and cultures are needed. These practices and cultures should create the conditions for a substantial shift from guided learning toward experiential as well as action learning, resulting in a balanced and integrated use of the three ways of learning: constructive, self-regulated, and contextual or situated [34].

The constructivist view of learning has become common ground among educational psychologists (see, for example, [33], [35]). Constructivism implies that constructive learning is self-regulated. According to Zimmerman [36], self-regulation “refers to the degree that individuals are metacognitively, motivationally, and behaviorally active participants in their own learning process”. According to De Corte [34], “constructive and self-regulated learning processes should preferably happen and be studied in context”, and because learning is collaborative, the learning efforts are distributed over the individual student, its partners in the learning environment, and the (technological) resources and tools that are available [37].

As stated by De Corte [38], “starting as much as possible from tasks and problems that are meaningful and challenging for students, learning environments should initiate socially supported constructive learning processes that enhance students’ cognitive and volitional self-regulatory skills”. It is expected that students will be able to use their acquired knowledge and skills to solve situations and problems in everyday life, something that Bransford and Schwartz [39] call *preparation for future learning*.

This is the theoretical model supporting the web-based system presented here and this research.

#### V. OVERVIEW OF THE SYSTEM

Before start describing the system a word about its development context is in order.

In 2006, the “ESchool” Programme (e.escola— [40]) enabled the purchase of laptops by students, from the 5th to 10th grade, and teachers for a price of 150 euro. Later, the Portuguese government has developed a set of protocols with Intel, the leading telecommunications operators (Optimus, TMN, Vodafone, and Zon), Microsoft, “Magic Box” (Caixa Mágica), and the local members, allowing children of the primary schools access to portable computers “Magellan” (Magalhães), for a maximum cost of 50 euro [41]. Additionally, the classrooms have been equipped with interactive “blackboards”.

The existence of computers in the schools is of course necessary to integrate IT effectively in the learning process, but it is by no means sufficient. Setting-up infrastructures is a relatively simple process in comparison with their actual usage, since both the necessary training and the change of habits that lead to routine usage are the result of slow and gradual processes; the need to train, motivate and involve the teachers, pupils and the community in general towards a correct use of IT tools entails a number of technical and cultural difficulties [42], [43]. Additionally, several researchers claim that it is what teachers think and believe and students’ attitudes that ultimately shapes the activities in the classroom [44]–[46].

As usually happens, at least in Portugal, the lack of tools supporting the authoring and automatic checking of exercises for specific topics in primary education (e.g., check true or false sentences) drastically reduces the advantages in the use of e-learning/web-based environments on a larger scale. Some technical details of the web-based system presented here were presented elsewhere [47].

The web-based system presented here aims to contribute to the resolution of problems in two distinct classes: firstly, for the spreading, construction and sharing of educational resources, particularly those closely related to the teaching of Portuguese as mother tongue; secondly, to develop applications more “user friendly” in terms of the average user, trying to eliminate the necessary notions of programming that are currently required by the existing applications.

It is 100% visual (graphical) for the preparation of the exercises and games, which in turn are developed based on existing templates.

Obviously the need for using standards when designing and implementing tools to help in the creation of learning objects became evident. Only then the exercises and games (i.e., learning objects) will be truly available for reuse and sharing, no matter the platform the students/learners are using. In our view, SCORM (Sharable Content Object Reference Model) is the most complete standard to be used in the case presented here (Primary Students’ Homework), because in its specification it includes standards developed by various third parties, integrating various standard specifications that simultaneously enable better interoperability between systems and sharing of content, and it is widely accepted that it is the best standard to use with Computer Based Training [48].

The tool has two distinct modules: one related to the development and personalization of the templates; and another dedicated to the development and personalization of

the exercises and games. The main blocks of the application include: user's management (registration and authentication); templates' management (creation, modification, deletion, etc.); exercise's management (creation, modification, etc.); databases' management; exercises' and templates' downloading; configuring/customization; help; and exiting application. The databases block is able to manage distinct databases, including the templates' and exercises' databases, as well as all the information related to the registered users. Also, a special database containing all the images that can be used to produce templates and exercises is implemented; obviously, the user may add new images to the database. So, in its current version, the tool implements the following data tables: users, templates, exercises, images, classes (used to classify images).

The templates management block of the application is not fully operational in its current version. In its current version, only the exercises module is fully implemented. The templates module is operational but it cannot be used to create or change an existing template (i.e., it shows the existing templates to the user and let he/she choose one from the presented list). We have created only five templates, using other tools, for demonstration proposes. When a user/teacher wants to create a new exercise he/she must follow three main steps. First, choose a template or an existing exercise, from a list presented in the form of images containing all the exercises. Second, change the customizable fields in the template. Third, choose a name and save the new exercise in the exercises database; this will generate a XML file with information corresponding to the configuration options of the exercise (exercise wording, images, correct options/answers, etc.) that will be saved along with the rest of the exercise. The number of interactions during the second step will depend on the template. Typically, it will be necessary to customize the exercise wording (i.e., the text explaining what is expected for the student to do), the images that will be used/presented to the student, as well as the correct answers/options.

In the example presented in Figure 1, besides the fields listed above, it is also possible to change the text of the "Verify" and "Try again" buttons and the text displayed when the answer is correct and when the answer is wrong. Also, it is possible to choose the degree of help/difficulty the student will have during the execution of the exercise ("easy", "medium" or "hard"). When in the "ease" mode every time a student chooses an option or enters his/her answer, he/she will have immediate feedback about its correctness. When in the "medium" mode, only when he/she presses the "verify" button will get the feedback about the correct and wrong answers. In the "hard" mode only when he/she presses the "verify" button will get the feedback about the exercise correctness, but the student will have no feedback about the correct and incorrect answers (only that there are errors, or not). All these interactions are based on choosing elements from dropdown lists, check boxes, drag and drop objects/images, among other. In the example presented in Figure 2, the student is asked to fill in the missing words ("the gaps") in order to form correct sentences; this Figure shows the exercise seen by the student.

The system was implemented using HTML 5, JavaScript, Adobe Flash, and ActionScript.

We want that in the near future this system may be used in English-speaking countries, since the only thing that needs to be changed is its interface. From the exercises point of view,

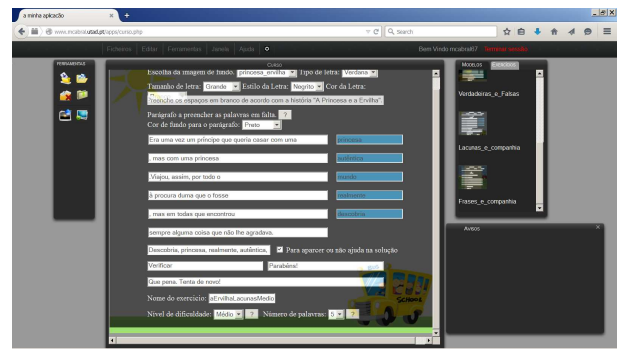


Figure 1. Creating a sample exercise a sample exercise—fill in the missing words ("the gaps") in order to form correct sentences.

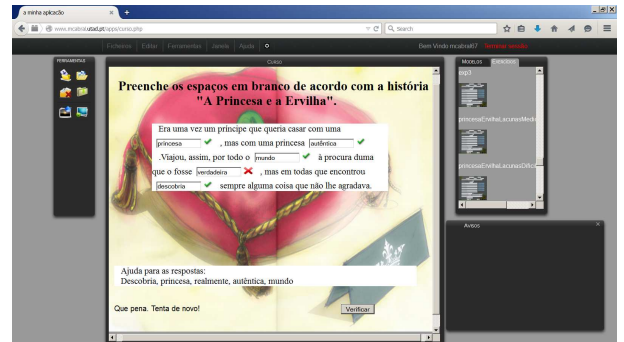


Figure 2. Solving a sample exercise a sample exercise—fill in the missing words ("the gaps") in order to form correct sentences.

they do not need adjustments, because it all depends on the templates (the templates should be designed in English, as well as everything they contain, such as video, images, text, speech, music, etc.).

## VI. SOME RESULTS

Currently, there are five templates that can be used in the system to create new exercises: three relate to the teaching/learning of Portuguese mother tongue, and the other two relate to the teaching of other concepts (notions of in and out, animals and fruits, count, etc.). Here we will present and discuss the results of first three templates.

The results presented in this section report to a set of exercises used to demonstrate the usefulness of the proposed web-based system. We follow the methodology proposed by Yin [49], where the researcher can conduct the research in its working context.

Bearing in mind the teaching and learning of Portuguese mother tongue, and the fact that the exercises should serve as homework for primary students, we have developed three specific templates: "fill in the gapes", "true or false", and "multiple choice". In the "fill in the gapes" template, the pupils are asked to fill the blank spaces in a sentence, or set of sentences, in order to form correct sentences. This template includes the possibility to present to the student the missing words, but not necessarily obeying the order in which they should be introduced in the sentence(s), i.e., the words are randomly presented, functioning as extra help. Also, the teacher can choose between one and five "missing words"; in

fact, the “gap” can be a complete sentence. In the “true or false” template, the students are asked to classify a sentence as being true or false. In the “multiple choice” template, the students are asked to select the best possible answer out of the choices from a list.

As presented above in Section V, the degree of help/difficulty the student will have during the execution of any of the exercises may be set to three different levels: “easy”, “medium” or “hard”. For our set, we have choose easy and medium levels.

We have also developed the corresponding counterpart paper format of the set of digital exercises. The exercises were presented to 4th-year (4th-grade) primary students during the months of January, February and March 2015, in the context of the project “Little Box of surprises” (*Caixinha das surpresas*). Basically there are sets of “little boxes”, each with a set of ten to twelve copies of the same story, and once/twice a month a story is chosen (by the teacher in conjunction with the librarian), and the students go to the library and read the story. At the end they are asked to respond to a set of questions, traditionally in paper form, of the types listed above (filling gaps, true/false, writing sentences/ordering words, and multiple choice). The sample exercise in Figures 1 and 2 was produced based on the fairy tale “The Princess and the pea” by Hans Christian Anderson. The full set is available in [1]. A “scanned” form of the corresponding counter-part paper format offered to the students is also available [50].

All the students have answered all the questions both in paper format and directly in the web-based system using the computers available at the library. Table I summarizes the results achieved by the 23 4th-grade students. The students have answered 12 questions of the type “True & False” (T&F), one question with 5 “gapes” in the template “fill in the gapes”, and 6 questions of the type “multiple choice”. This table presents the number of correct answers. During the application process of the web-based exercises we gave the students the possibility to answer correctly all the questions and registered the number of tries. However, due to space limitations and because in the paper form students have only one chance to answer (correctly or not) all the questions, here we present the results of the first answers (i.e., here, we consider that an answer was correct only if it was correctly answered during the first attempt). As can be seen, for the “T&F” exercises the average value is the same both for paper and web-based types. For the “gapes” and “choice” types the results were slightly better for the exercises in paper format. Note that the mode is the same for the “gapes” exercises, is better for the “choice” exercises in paper format, and is better for the “gapes” when using the web-based system.

We also presented the students a very simple survey with the following questions:

- 1) The web-based system was easy to use.
- 2) It was easy to understand.
- 3) I would have liked more in class use.
- 4) It was helpful because I had prompt feedback.
- 5) I would have preferred more homework questions using it (in place of other assignments).
- 6) I would have liked more contents of this type on it.
- 7) It was easier to answer the questions in it.
- 8) I felt better responding using the computer.

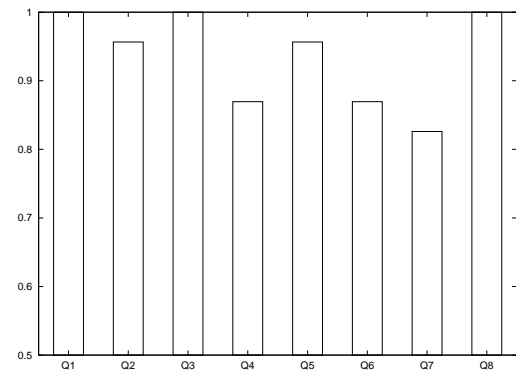


Figure 3. Survey results: average answer to each question.

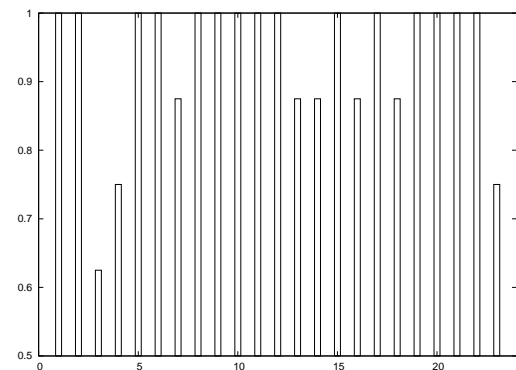


Figure 4. Survey results: average answers from each student.

Figure 3 shows the mean responses to each question of this survey. The Portuguese version of the survey (actually applied) can be downloaded [50]. As can be seen from the plots in this Figure, questions #1, 3 and 8 drew the highest responses, indicating that students found the system easy to use and feel comfortable using it. However, question #7 had the lowest response, showing that they don't feel that it was easier to answer the questions using the computer, or at least they don't feel that the questions were not of lower difficulty degree. This seems to be reinforced by the responses to questions #4 and 6. Average answers for each survey participant, presented in Figure 4, show that some responses seemed to be either too low or too high, i.e., showing dissatisfaction/satisfaction with the class/subject itself and not specifically with the web-based system.

Students' comments were overall positive. The less positive comments point to a need to have more homework examples, and more time in order to gain experience in using the system and computer. Next are listed some of the comments. “I think we should use more often the computer”. “I really enjoyed doing this on the computer where everything was cool and made me learn a lot.” “I think it was easy to use the computer because almost hit all the questions at first!”. “I learned to write on the computer.” “I really enjoyed! It was great fun!”. “The computer is cool!”. “He liked to use the computer more often”. “It was fun and also spectacular”. “I wish I had more time to do so”. “I liked using the computer because it was fun to learn on the computer”.

TABLE I. EXERCISES' RESULTS SUMMARY FOR THE 23 STUDENTS (T&F—TRUE & FALSE; GAPES—FILL IN THE GAPES; CHOICE—MULTIPLE CHOICE; AVG—AVERAGE; STD—STANDARD DEVIATION; MOD—MODE).

		Student																							Avg	Std	Mod
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
Paper	T&F	10	8	10	10	8	12	11	11	11	8	9	10	10	11	10	10	10	9	7	10	11	11	11	9.9	1.2	10
	Gapes	5	5	3	5	0	5	5	5	4	5	5	5	5	5	5	5	5	4	5	5	5	5	4.6	1.1	5	
	Choice	6	6	6	6	5	6	6	6	6	6	6	6	6	6	5	6	6	3	6	6	5	5	6	5.7	0.7	6
Internet	T&F	11	10	8	9	9	11	8	8	8	11	11	10	10	11	12	10	10	11	9	11	11	9	9.9	1.2	11	
	Gapes	4	5	5	4	3	5	4	4	3	5	3	4	5	5	5	5	5	3	5	5	5	5	4.4	0.8	5	
	Choice	4	4	4	3	4	5	4	5	4	5	5	4	4	5	5	6	4	2	3	5	6	6	4.5	1.0	4	

In conclusion, we could see that there are no big differences in the results achieved by the students. However, during the answers to the exercises students showed a more positive attitude, happiness and greater openness to the use of the web-based system.

VII. CONCLUSION AND FUTURE WORK

We have presented a web-based system [1] to support students' homework. In order to prove its usefulness, we have built a set of exercises to help improving Portuguese (mother tongue) language skills of 4th-grade primary pupils. This set of digital exercises proved to be the child's favorite, rather than their counterpart exercises in paper form, also showing a fair more positive attitude from the students' point of view. A simple survey also showed that students do prefer the use of the system here presented, when compared to other more traditional ways of practicing.

We believe that the prompt feedback about the exercises correctness, together with the training provided by the different exercises sets about the same subject, besides the exploitation of video, color, sound, etc., positively reinforce the diverse child's senses, definitely contributing to capture and motivate the child.

Students with disabilities are known for possessing a set of unique characteristics that hinder their integration in school and consequently their learning. We believe that students with disabilities can be the first benefitting from using a system like the one proposed here.

As stated by Warschauer, [27], "New technologies do not replace the need for strong human mentorship, but, indeed, amplify the role of such mentorship". Obviously that the students must become into contact with the new teaching/studying tools progressively, in order for they to become a part of the learning environment as smoothly as possible.

From the examples above, we could easily concluded that the presented templates may be used to teach/learn other subjects. For example, based on the "true or false" template a teacher can build a set true or false questions for the teaching of chemistry. Obviously, the "multiple choice" template may be used to build exercises for the teaching of any subject.

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