

PEDAGOGIC SOFTWARE EVALUATION PROTOCOL: ANALYZING A DIGITAL EDUCATIONAL GAME FOR PORTUGUESE LANGUAGE TEACHING

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- **ABSTRACT:** As consequence of Communication and Information Digital Technologies advancements, and in order to complement teaching, interactive digital tools (including digital pedagogic games) have been highly present in Brazilian schools. Thus, nowadays in classrooms printed and digital didactic materials (henceforth DDMs) compete. DDMs, as well as printed materials, need to undergo rigorous evaluation. Therefore, this work proposes, based on Bakhtin / Volochinov (2009); Geraldi (2011); Halliday et al. (1974) and Koch (2002), how to evaluate the quality of digital pedagogical games for mother tongue teaching. Regarding the main purpose of the research, it is proposed an evaluation of didactic, pedagogical and ergonomic quality of digital pedagogical games available online, taking into account the Evaluation Protocol of Pedagogic Software developed to carry out the research. In this descriptive research a digital pedagogical game intended to teaching Portuguese language is evaluated. The analysis revealed that, although it was a high-quality digital educational game, the object presented inadequacies in didactic, pedagogic, as well as ergonomic aspects.
- **KEYWORDS:** Portuguese language teaching and learning. Digital educational games. Evaluation Protocol.

Introduction

During the 1990s, more precisely from the second half of that decade on, there was the so-called Technological Revolution, a consequence of the arrival of the internet in society.

Since then, the use of computers and more recently, cell phones, tablets and other devices has become commonplace and sometimes indispensable in social interactions. In this context, software and other forms of user-friendly content have been widely

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developed. In a survey about the use of ICTs by teachers over school activities in 2015, 39% of teachers stated that they use, for example, cell phones with internet access to perform activities with their students (CETIC.BR, 2016).

In the school context, even if there is still some resistance of teachers and other professionals of the pedagogical area, technological tools aiming to support teaching have become part of computer laboratories, also achieving space in classes of several disciplines, including Portuguese language (henceforth PL). In the Digital Era, using those tools to aid teaching and learning processes has been no longer a differential, turning into a key element and enabling people to belong to the networked information society, or cyberculture (LÉVY, 1999), where all individuals are connected.

In this context, digital interactive games¹ (popularly known as video games) are considered very useful for the development of linguistic, social and cognitive aspects of students/users. The use of educational software (games) could help students, using simulated reality for example, to create hypotheses and test them, along with socio-discursive interactions with the game² itself, with classmates and the teacher. This process provides a more dynamic, interesting and motivating learning³.

Similar to other didactic materials, game-based pedagogical software need to undergo evaluation as to their teaching adequacy. The software may be stored in so-called educational object repositories, functioning as vast virtual libraries, where Learning Objects⁴ (henceforth LOs) in different media are available to users. However, as printed materials, LOs demand evaluation before their application. In the case of those intended for Portuguese language teaching, these materials may lead to inaccurate teaching perspectives, for example. Thus, it is necessary to propose evaluation criteria in order to enable teachers who wish to apply LOs in the form of digital pedagogical games to choose from digital material repositories that adopt a perspective of language as interaction. After all, as Bakhtin / Volochínov (2009) says, “[...] every word admits two faces. It is determined both by the fact that it comes from someone and by the fact it is addressed to another one. It is precisely the product of interaction from the speaker and the listener.” (BAKHTIN; VOLOCHINOV, 2009, p.117)⁵.

¹ Especially in the Engineering and Education fields, there is significant scientific production with regard to serious games. For example, the 5th International Conference on SGames, held in Italy in 2015 (CARVALHO et al., 2016) and the First Joint International Conference on Serious Games, held in the United Kingdom, also in 2015 (GÖBEL et al., 2015).

² Considering as equivalents, in this work, the terms: digital pedagogic game, digital educational game, game-based pedagogic software and game-based educational software.

³ Malone (1980), in founding text, points out three characteristics that make computer games intrinsically motivating: challenge, fantasy and curiosity.

⁴ Learning objects are digital didactic resources, created in varied media, conceived in their origin for educational purposes and able to be reused in different teaching situations.

⁵ The original text: “[...] toda palavra comporta duas faces. Ela é determinada tanto pelo fato de que precede de alguém, como pelo fato de que se de que se dirige para alguém. Ela constitui justamente o produto da interação do locutor e do ouvinte.” (BAKHTIN; VOLOCHÍNOV, 2009, p.117).

Regarding the quality analysis of produced games available in web repositories, this work suggests an Evaluation Protocol of Game-Based Pedagogical Software (EPPS) and analyzes a digital educational game for teaching Portuguese, as well as investigates how digital educational games for the teaching of native language should be evaluated.

With reference to didactic, pedagogic and ergonomic evaluation of serious games⁶ aimed at PL teaching, and from the analysis as the one done in this work, teachers will be able to make use of EPPS to select quality digital didactic games for their students.

Diving into concepts: concepts of teaching and language

In this topic, there are some important theoretical aspects in the contents on the game evaluation protocol created in this research, EPPS. As follows, language and teaching conceptions adopted in didactic materials will be briefly discussed.

a) Language as expression of thought and as mental activity

This conception of language corresponds to what Bakhtin / Volochinov (2009) call⁷ idealistic subjectivism. According to the authors, “[...] the first tendency is interested in the speech act, of individual creation, as the foundation of the language (in the sense of all language activity without exception)” (BAKHTIN; VOLOCHINOV, 2009, p.74, highlighted by the authors)⁸.

The movement of language performance, in this conception, happens from inside (individual) to outside (collective), that is, the speaker is the owner of the language. The individual decides how to use it. In this regard, each person speaks as he or she wants, there is no stability. The individual is the language artist.

For some authors, prescriptive teaching would derive from this conception of language, which “admits the right / wrong dichotomy as base”⁹ (ARAÚJO, 2013). Halliday et al. (1974) argue that this is teaching based on substitution of “unacceptable linguistic activity patterns by other acceptable ones”:

Prescriptive teaching means, therefore, to select patterns at any level that are favored by some members of the linguistic community, including the most influential, and to use standardized teaching practices

⁶ According to Abt (1970), serious games are the ones that “[...] hold an explicit educational purpose, carefully thought out and which are not intended to be played essentially for amusement.”

⁷ Due to difficulties regarding the authorship of *Marxismo e Filosofia da Linguagem* [Marxism and the Philosophy of Language], the work of Bakhtin/ Volochinov was adopted, and whenever there is any reference to it, the verbs will be presented in plural form.

⁸ The original text: “[...] a primeira tendência interessa-se pelo ato da fala, de criação individual, como fundamento da língua (no sentido de toda atividade de linguagem sem exceção).” (BAKHTIN; VOLOCHINOV, 2009, p. 74, destaque nosso).

⁹ The authors have reviewed the relation between language origin and teaching type during recent research. The original text: “[...] admite como base a dicotomia certo/errado” (ARAÚJO, 2013).

to persuade learners to comply with those standards. (HALLIDAY et al., 1974, p.261).¹⁰

The prescriptive teaching of the language is restricted to what one could or could not say / write accepting as a parameter the traditional grammar. Consequently, based on the right / wrong dichotomy, this conception of language points to a teaching and learning approach that favors a single use of language: the norm of standard variety.

In this conception of language the text is understood, on the other hand, as “[...] a logical product - of the author’s thoughts, leaving nothing else to the reader / listener but ‘capture’ this mental representation, along with the producer’s intentions (psychological ones), thus acting an essentially passive role¹¹” (KOCH, 2002, p.16). That is, the text would be the representation of the thought of who produced it, and it would be conceived as a finished product, closed in itself, as well. Then, it would not be suitable for the listener to fill it with his own knowledge and experiences, but to receive its information passively.

b) Language as an instrument of communication and as a structure

The conception of language as an instrument of communication is, according to Geraldi (2011, p. 41), “[...] linked to the theory of communication and it sees the language as a code whose function is to transfer messages from a sender to a receiver.”¹² This perspective of language corresponds to what Bakhtin / Volochinov (2009) called the second orientation of philosophical and linguistic thought, named by the authors as abstract objectivism. This guideline opposes to all the ones declared in the first conception. Observing the excerpt in which they describe the abstract objectivism:

What are, then, the laws governing this internal language system? They are purely *immanent and specific*, irreducible to ideological, artistic, or any other laws. All forms of language [...] are indispensable to one another, mutually complement themselves, and make language a structured system obeying specific linguistic laws. (BAKHTIN; VOLOCHINOV, 2009, p.81, emphasis of the authors).¹³

¹⁰ The original text: “O ensino prescritivo significa, portanto, selecionar os padrões, em qualquer nível, que são favorecidos por alguns membros da comunidade linguística, inclusive os mais influentes, e usar práticas padronizadas de ensino, para persuadir aprendizes a se conformarem àqueles padrões.” (HALLIDAY et al., 1974, p. 261).

¹¹ The original text: “[...] um produto – lógico – do pensamento do autor, nada mais cabendo ao leitor/ouvinte senão ‘captar’ essa representação mental, juntamente com as intenções (psicológicas) do produtor, exercendo, pois, um papel essencialmente passivo.” (KOCH, 2002, p. 16).

¹² The original text: “[...] está ligada à teoria da comunicação e vê a língua como código, cuja função é transportar mensagens de um emissor a um receptor.” (GERALDI, 2011, p. 41).

¹³ The original text: “Quais são, pois, as leis que governam este sistema interno da língua? Elas são puramente *imanes e específicas*, irredutíveis a leis ideológicas, artísticas ou a quaisquer outras. Todas as formas da língua [...] são indispensáveis umas às outras, completam-se mutuamente, e fazem da língua um sistema estruturado que obedece a leis linguísticas específicas.” (BAKHTIN; VOLOCHÍNOV, 2009, p. 81, grifo dos autores).

As presented, language is understood in this perspective as a system of rules governed by specific laws (in other words, it is a system of phonetic, grammatical and lexical characteristics obeying fixed rules).

Within this guideline, texts are simple encoding products of a sender to be decoded by a listener / reader, where only the knowledge of the code is necessary by the last ones (KOCH, 2002). The subject is passive, it is “determined by and submitted to the system¹⁴” (DORETTO; BELOTI, 2011) of the language and its role is only to receive the information passed to him and to decode it.

c) Language as a form of interaction and as a social activity

The third conception – language as a form of interaction – developed in the Bakhtin Circle was disseminated in Brazil in the 1980s, but it was only established, regarding mother tongue teaching during the following decade. From this perspective, language is understood as the place where meaning exchanges and negotiations occur. It is within/through language that actions are executed, considering the social, historical, political, cultural and ideological context involved in the communicative act. In other words, with reference to the dialogical perspective, language is a set of social and cognitive practices, historically based.

The subjects are, in this concept, social agents who exchange experiences and knowledge among themselves through enunciations, and still according to Bakhtin / Volochínov (2009, p.128, added emphasis), language “[...] lives and develops historically in *concrete verbal communication, not in the abstract linguistic system of the language forms nor in the speakers’ individual psychism.*”¹⁵

Concerning the language interactionist approach, the word revolves around the interlocutor. Bakhtin / Volochínov (2009, p.117) state the importance of the other subject in the discourse:

Every word functions as an expression from one to another. [...] The word is a kind of bridge between others and me. If it leans over me at one end, in the other it leans over my interlocutor. The word is the common territory of the speaker and the interlocutor.¹⁶

For Bakhtin / Volochínov (2009), every statement is addressed to someone (this is what the authors call social audience). Its meaning is particularly constructed when the other replies, which is to say that the meaning of utterances in a dialogue

¹⁴ The original text: “[...] determinado e assujeitado pelo sistema” (DORETTO; BELOTI, 2011).

¹⁵ The original text: “[...] vive e evolui historicamente na comunicação verbal concreta, não no sistema linguístico abstrato das formas da língua nem no psiquismo individual dos falantes.” (BAKHTIN; VOLOCHÍNOV, 2009, p. 128).

¹⁶ The original text: “Toda palavra serve de expressão a um em relação ao outro. [...] A palavra é uma espécie de ponte lançada entre mim e os outros. Se ela se apóia sobre mim numa extremidade, na outra apóia-se sobre o meu interlocutor. A palavra é o território comum do locutor e do interlocutor.”

is established only when the interlocutor has, in relation to the speaker's discourse, a responsive attitude.

In this perspective, texts are no longer a finished product, since they hold gaps so the interlocutor may fill with his own knowledge, with his experiences. The text is a coproduction of meanings. The teaching of PL that takes into account this language conception is based on the analysis of linguistic, textual and discursive phenomena.

Halliday et al. (1974) name this teaching perspective - based on social interaction - as productive teaching, where the student learns the language more efficiently, using the language in real contexts. According to Halliday et al. (1974), inside the perspective of productive teaching, the focus of teaching should be on the development of abilities regarding the use of language in different situations or, as the authors affirm, to learn "uses and registers of language"¹⁷, as seen in the following excerpt:

The child needs to [...] learn the varieties of language appropriate to different situations, [needs to learn] the extent and the use of their restricted registers and languages. [...] is the extent and the use of different varieties of mother tongue rather than the actual introduction of new patterns and elements which forms the focus of productive language teaching. (HALLIDAY et al., 1974, p.277).¹⁸

In the context of productive education, for meaningful learning, it is fundamentally important that teachers consider the language as interaction and therefore see it as something constantly changing, since it is the fruit (and the seed) of interactions. The didactic resources for language teaching (dealt with within this work) should contain marks which demonstrate this is the conception these resources are based.

Evaluation Protocol of Pedagogic Software (Game-based) - EPPS

The designed evaluation protocol proposed in this research attempts to reach any Portuguese language teacher¹⁹, so it varies from the commonly found models in literature²⁰, usually very technical or, regarding pedagogical aspects, highly generic.

¹⁷ The original text: "[...] uses and registers of language" (HALLIDAY et al, 1974, p. 277).

¹⁸ The original text: "A criança precisa [...] aprender as variedades da língua adequadas a diferentes situações, [precisa aprender] a amplitude e o uso de seus registros e línguas restritas. [...] é a amplitude e o uso das diferentes variedades da língua materna, mais do que a real introdução de novos padrões e elementos, que constitui o foco do ensino linguístico produtivo." (HALLIDAY et al., 1974, p.277).

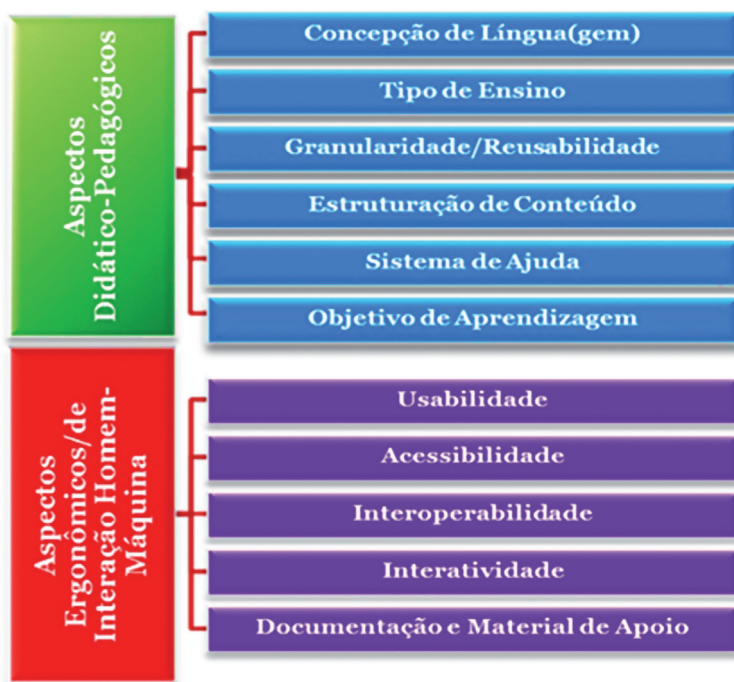
¹⁹ Although it is an important aspect, the ludic dimension was not considered in this EPPS version. During a research currently developed along with teachers who are testing the EPPS, this dimension is considered as a requirement pointed by the participants.

²⁰ In this case, it is literature in the education or software engineering fields, not in applied linguistics, since the EPPS proposition is innovative in the area.

In the EPPS, the didactic and pedagogic aspects prevail over the ergonomic aspects²¹ (which relates to the use of technology - or to the digital pedagogic games, in this case - in a safe, comfortable and productive form), once the knowledge concerning those last mentioned aspects exceeds linguistic field and consequently restrains its use. Thereby, aspects related to programming were not included in the evaluation protocol, for example, as it was considered unnecessary for the suggested model.

Then, the evaluation protocol prioritized the criteria that considered the content approach, as the teaching and learning process. For this reason, the Evaluation Protocol of Pedagogic Software - EPPS developed to analyze digital educational games aimed at teaching PL was structured as follows:

Figure1 – EPPS Evaluation Criteria.



Source: Ribeiro (2013, p.72).

Moving to the definition of each criterion referring to didactic and pedagogical aspects, as mentioned earlier, these criteria relate to the language conception present in games, to types of teaching possibly adopted from the proposed activity, to granularity / reusability, to content organization, to support systems so as to learning goals underlying

²¹ An evaluation model of software may consider the aspects related to ergonomics, so a possible problem from a LO of this type do not hazard learning.

the digital educational game. It is important to emphasize that these criteria were thought exclusively for PL teaching, as presented below:

a) Language conception

The language conception criterion refers to conceptions of language underlying the digital pedagogic game, briefly discussed in the previous section.

The formulated Protocol presents questions that teachers should ask “to the game” during the analysis. In order to support the didactic and pedagogic analysis of a digital pedagogic game, regarding the criteria conception of language, the proposed questions are:

- ✓ Does the digital educational game intended to PL teaching offer activities whose fundamental/primary purpose is to teach the norms and the structure of the language or does it consist of activities that promote the development of language skills²²?
- ✓ Does the digital educational game of Portuguese Language consist of activities in which the basic unit of analysis is the word, the sentence or the text?
- ✓ Within the texts (oral and written) which compose the PL teaching digital pedagogic games, are discursive genres or text types considered?
- ✓ In the proposed activities based on written texts, is it valued the concept of extracting single or multiple meanings from a text?
- ✓ What is the role of subjects (users) within the digital pedagogical game intended to teaching and learning Portuguese (The subject - the other – are they considered? Is it a message decoder? Is it a co-producer of meanings?)?

b) Teaching type

The teaching type criterion, as well as the language conception one was also explored in the first section of this article. Thus, there is no necessity of repeating concepts here; however, some questions to support the analysis of this criterion were raised, as follows:

- ✓ In relation to the Portuguese language pedagogic software, game-based, and to activities involving texts, does it value a right x wrong Manichean point of view or the concept of adequate and inadequate enunciations, depending on the context, objectives and circumstances?
- ✓ Do the activities present in the digital educational game deal with grammar as a set of rules, which must be followed, or as a compendium in which the rules

²² The concept of linguistic skills is equivalent here to the PCN (BRASIL, 1997). About this question, what is expected from teachers is that beside grammar and normative dimensions, the text-based game could allow some considerations on semantic and pragmatic components of language, within discourse level.

the speaker masters and uses with interlocutors in real communication contexts are registered?

- ✓ In the digital pedagogic game for PL teaching, do the activities stimulate memorization of linguistic elements or reflection about the function of these elements inside the text?

c) Granularity/ Reusability

Granularity and reusability are criteria proposed by Mendes, Sousa and Caregnato (2004), separately. According to the authors, while reusability refers to the capacity of using the software several times in various teaching and learning contexts, granularity is a digital pedagogic game characteristic defined as “[...] to present an atomic content [divided into smaller units], to facilitate reusability” (MENDES; SOUSA; CAREGNATO, 2004, p. 3).²³

However, granularity is what facilitates (or not) the reusability of a Learning Object (in this case, game-based pedagogical software). For this reason, these criteria are placed together here, so the more atomic the content of the software is, the easier it will be to combine it with other objects and other contents. Thus, it may be reused more times, in several teaching and learning contexts.

In order to support the didactic/ pedagogic analysis of a digital pedagogic game, related to the granularity / reusability criterion, the following questions are proposed:

- ✓ Does the game have an atomic content if considered the totality of Portuguese language contents (reading and writing teaching, oraly and linguistic analysis)?
- ✓ Could the content be combined with other PL contents in different teaching situations?
- ✓ Could the digital pedagogic game be used in different teaching and learning situations?

d) Content organization

According to Silva (2002, p.169), “[...] the content organization must generate the main logical connections, the important relations among several elements and the fundamental articulations present within the content.”²⁴

In game-based educational software, content organization may be represented by the interconnection among the component parts of the game, also between that game content and the intended grade/ level.

²³ The original text: “[...] apresentar um conteúdo atômico [isto é, dividido em unidades menores], para facilitar a reusabilidade.” (MENDES; SOUSA; CAREGNATO, 2004, p. 3).

²⁴ The original text: “[...] a estruturação do conteúdo deve fazer aparecer as principais ligações lógicas, as relações importantes entre diversos elementos e as articulações essenciais presentes no interior do conteúdo.” (SILVA, 2002, p. 169).

To support the didactic pedagogic analysis of a digital educational game with regard to the content organization criterion, the following questions are suggested:

- ✓ How is the content divided in the game?
- ✓ Is it possible to know if the atomic content is part of a larger one? What is the relevance of the content of the game for PL teaching?
- ✓ Are the created activities taking into account the age group and the level of students/ users for whom they are intended?
- ✓ Are the essential points of the content presented in evidence? (SILVA, 2002, p.169).²⁵

e) Support systems

The support systems criterion proposed by Silva (2002) involves the support possibilities the user of an educational game could receive to understand the software content or operation.

According to Silva (2002), there are two types of support: the human, performed by in-person or distance tutors and facilitators as the online support, available on the internet. As the model also includes games played without internet connection (games that allow downloads to the user's machine, for example), the term "online support" was replaced by "software support".

Regarding the support systems criterion, a few questions suggested by Silva (2002), to aid the didactic pedagogic analysis of game-based pedagogic software are displayed as follows:

- ✓ Does the support facilitate the task performance?
- ✓ Are there any assistants (animated or static) who suggest questions to users in order to accompany and guide them on their task performance?
- ✓ Do the explanations accompanying the tasks demonstrate to users the different steps to complete a task with simple operations, as simply clicking to continue? (Adapted Silva (2002, p.170)).²⁶

f) Learning goals

The learning goals criterion was also originally proposed by Silva (2002). According to the author, this criterion refers to "[...] pedagogic intentions translated into aims, general and operational goals" (SILVA, 2002, p.170).²⁷ It is important to mention that

²⁵ The original text: "Os pontos essenciais do conteúdo são apresentados em evidência?" (SILVA, 2002, p. 169).

²⁶ The original text: "As demonstrações explicativas que acompanham as tarefas mostram ao usuário as diferentes etapas para completar uma tarefa com operações simples, bastando clicar para continuar?" (Adaptado de Silva (2002, p. 170)).

²⁷ The original text: "[...] às intenções pedagógicas traduzidas em fins, objetivos gerais e operacionais." (SILVA, 2002, p. 170).

the teaching objectives underlying digital pedagogic games focused on PL teaching and learning may be extracted of national education guidelines, such as the National Curriculum Parameters (PCNs).²⁸

Additionally, the goals suggestion “[...] must be clearly stated in the educational process and it constitutes the fundamental element in effective action towards any problems” (SILVA, 2002, p. 170-171).²⁹

To collaborate with the didactic pedagogic analysis of game-based educational software, related to learning goals criterion, there are suggested questions such as the following:

- ✓ What language skill(s) (understanding: reading / listening, production: speech / writing) is / are explored in the game?
- ✓ In relation to reading abilities, does the software propose activities favoring the autonomous reading of different genres expected for the level of education for which it is intended?
- ✓ In relation to writing abilities, does the software provide activities that allow the production of coherent and adequate texts, for the different situations of use, according to the learner’s school level?
- ✓ Regarding orality (speech / listening), do the activities provided by the software develop skills on differentiating different speech registers, discourse planning, recognition of intentions / purposes in oral texts?
- ✓ In relation to spelling³⁰, does the software present activities such as working with the stability of common regular and irregular spelling words in writing or using scoring resources with syntactic and semantic value?
- ✓ Regarding linguistic analysis, do the activities proposed in the software allow the analysis of linguistic phenomena within texts and for the texts?

Moving forward to the criteria called ergonomic / human-computer interaction.³¹ After all, according to Gamez (1998 apud ANDRES, 1999), it is in the Human-Computer Interface (IHC) that “[...] theoretical and methodological bases are offered, capable of finding the difficulties related to the man and the machine, aiming to achieve [...]

²⁸ In the scope of this research, to elaborate the guiding questions of the criterion analysis, it was only considered these parameters. Verify Brasil (1997, p. 68).

²⁹ The original text: “[...] deve ser claramente explicitada no processo educativo e constitui o elemento fundamental em toda problemática de ação eficaz.” (SILVA, 2002, p. 170-171).

³⁰ Although spelling is language analysis content, this specific question is proposed due to the fact it is content worked separately along elementary school, the target of the game analyzed in this article.

³¹ Both terms were considered equivalents, considering that in specialized literature, ergonomics has been associated, for some time, to the study of human-computer interaction.

efficiency in the use of digital tools and products” (GAMEZ, 1998 apud ANDRES, 1999, p.5).³²

Within the ergonomic / human-computer interaction aspects of the EPPS there are the ones concerning usability, accessibility, interoperability, documentation and support material and interactivity of the digital educational game, all explained along the topics below:

a) Usability

According to ISO 9241-11 (1998)³³, usability is characterized by the use of a product by specific users to achieve specific objectives with effectiveness, efficiency and satisfaction in a specific context of use. In other words, usability could be the facility of use. On the usability concept in serious games, Gurgel et al. (2006 p.02) state that “[...] without good usability the player will not reach the content to be taught and will not learn.”³⁴ According to Nokia (2003) and Laitinen (2005 apud GURGEL et al., 2006, p.03):

If the player is not able to overcome the usability problems from the interface, [...] such as handling menus, inventories, quickly restarting a game among other actions, the game will certainly be discarded without a second chance.³⁵

Besides the interface, other usability characteristics are also important: the game mechanics (how the game develops from its rules), its plot, its architecture, and gameplay, which tells how a digital game is designed and the skills that users may have to play it.

To assist the ergonomic / human-computer interaction analysis of a digital educational game with regard to the usability criterion, the following questions are presented:

- ✓ Do the game screens have an overall graphic coherence (layout, location of the buttons, colors, for example)? Is the time between two screens enough for reading and assimilation?
- ✓ Is it easy and fast to move from one screen to another within the game?

³² The original text: “[...] são oferecidas bases teóricas e metodológicas capazes de encontrarem as dificuldades relacionadas com o homem e a máquina, tendo como objetivo alcançar [...] eficiência na utilização de produtos ferramentais informatizados.” (GAMEZ, 1998 apud ANDRES, 1999, p.5).

³³ ISO 9241-10 (International Organization for Standardization) refers to studies on software ergonomics (and human-computer interaction), particularly about usability.

³⁴ The original text: “sem uma boa usabilidade o jogador não alcançará o conteúdo a ser ensinado e não aprenderá.” (GURGEL et al., 2006, p. 2).

³⁵ The original text: “Se o jogador não for capaz de superar os problemas de usabilidade da interface, [...] como manusear menus, inventários, reiniciar rapidamente uma partida, entre outras ações, o jogo certamente será descartado sem direito a uma segunda chance.”

- ✓ Are orientation and metaphors buttons effective and easy to understand?
- ✓ Are the task icons representative and meaningful?
- ✓ Are the pieces of information and the services / resources consistently structured, promoting the understanding of the game organization?

b) Accessibility

Accessibility is a criterion suggested by Mendes, Sousa and Caregnato (2004) which is, although originally thought to evaluate LOs in general, described here as a specific criterion for digital educational games. Accessibility refers to two factors: a) the availability of the digital pedagogic game on the internet so students may access it anywhere and b) the presence of elements, within the software, for users with special needs.

To help the ergonomic / human-computer interaction analysis of a digital educational game with respect to the accessibility criterion, it may be important to ask:

- ✓ Is it possible to increase and decrease the font size in the pedagogic game?
- ✓ Does the digital pedagogic game enable the listening and reading of texts simultaneously?
- ✓ Is the digital educational game available on the internet?

c) Interoperability

Interoperability is another criterion suggested by Mendes, Sousa and Caregnato (2004). According to the authors, interoperability states the possibility of a software to function through various hardware, operating systems and browsers. A digital pedagogic game needs, among other factors to be considered good, to perform well its function regarding hardware, software and different browsers³⁶.

To support the ergonomic / human-computer interaction analysis of a digital pedagogic game regarding the interoperability criterion, the following questions are offered:

- ✓ Is the digital pedagogical game executable on different operating systems (as Windows, Linux and Mac OS)?
- ✓ Is the digital pedagogical game executable in different browsers (as Mozilla, Explorer, Chrome and Safari)?

d) Interactivity

The interactivity criterion was proposed by Silva (2002) originally as a communicational criterion. In the proposed model, this criterion is classified as ergonomic / human-computer interaction and concerns the dialogue established within

³⁶ It is important to note that there are digital pedagogic game available online which allow download to users' machine, being able to function offline. In this case, it is not considered the game performance in different browsers, once internet is not necessary to operate them.

the user-content, user-teacher, user-machine relations. According to Silva (2002, p.191), the interactivity criterion refers to the degree of control by the learner / user over the system, when faced with the possibility of “taking shared initiatives in order to reorganize interaction”.³⁷ In other words, the moment when the learner / user realizes that he/she has autonomy and that he/she could interfere and control the course of the software activities.

In order to aid the ergonomic / human-computer interaction analysis of a digital educational game, regarding the interactivity criterion, Silva (2002) suggests that:

- ✓ Does the learner have access to any support, at any time, during the interaction?
- ✓ May the learner spend as much time as he/she wants in different parts of the program?
- ✓ May the learner skip lessons, modules, chapters, activities or any part of the program and choose an exercise among others proposed?
- ✓ May the learner easily erase or correct his mistakes when he is not sure of the answer and choose different paths according to levels of difficulty?
- ✓ Does the program provide adapted and differentiated feedback?³⁸ (Adapted Silva (2002, p.191-192)).

e) Documentation and support material

The documentation and support material criteria suggested by Silva (2002) concerns the information regarding the game-based pedagogic software and their conditions of use. In the author’s words, the documentation and supporting material “[...] should contain information on technical specifications so as configuration of the program, content description, detailed target audience (such as age group), requirements and objective description of the program.” (SILVA, 2002, p.189).³⁹

In order to help the ergonomic / human-computer interaction analysis of a digital pedagogical game regarding the documentation and supporting material criterion, Silva (2002) suggests these questions in his model:

- ✓ Does the program accompany printed or online material?
- ✓ Does the support material accompanying the program include the identification data such as title, language, field of knowledge, typology, technical specifications and program configuration?

³⁷ The original text: “tomar iniciativas partilhadas, a fim de reorientar a interação” (SILVA, 2002, p. 191).

³⁸ The original text: “O programa fornece *feedbacks* adaptados e diferenciados?” (Adaptado de Silva (2002, p.191-192)).

³⁹ The original text: “[...] devem conter informações sobre as especificações técnicas e de configuração do programa, descrição do conteúdo, especificação do público-alvo (como faixa etária), pré-requisitos e descrição dos objetivos do programa.” (SILVA, 2002, p. 189).

- ✓ Does the support material provide the goal description and contents of the program as well as provide didactic instructions of use for the teacher / learner?
- ✓ Does the manual specify age group and requirements of the target audience, as well as suggested time to apply the activities?
- ✓ Does the manual present examples, exercises, simulations or instructions regarding the use of the program? (Adapted Silva (2002, p.189)).⁴⁰

Therefore, in this work, a digital pedagogic game that is in accordance with these previous proposed questions could be considered appropriate to the teaching of Portuguese Language.

Presented and described in this section, the evaluation protocol of pedagogic software for Portuguese language teaching provides the necessary tools to assess, from an ergo-pedagogical point of view, the digital educational game named *One point changes a tale*, selected to compose the corpus of this research. The game will be described next.

Description of the digital pedagogical game *One point changes a tale*

The digital educational game described and analyzed within this work is *One point changes a tale*, created under the CONDIGITAL / Brazil Language Project and sponsored by the National Fund for the Development of Education (FNDE). The project was an initiative of the Ministry of Education and Culture (MEC) and the Ministry of Science and Technology (MCT), in partnership with the Agora - Cooperative of Professionals in Education⁴¹.

The game-based pedagogical software *One point changes a tale* presents itself in the form of digital comics – eComics– and it is available in the website of the research group the authors participate⁴².

The game’s home screen setting refers to the sea and brings the title “One Point Changes a Tale” in the shape of a shell. In this screen, it is possible to control the sound (to keep the sounds or silent them) and to click on the start button to begin the presentation of the game, as seen on the following picture:

⁴⁰ The original text: “O manual apresenta exemplos, exercícios, simulações ou instruções de uso do programa?” (Adaptado de Silva (2002, p. 189))

⁴¹ The Agora – Cooperative of Professionals in Education - is a non-profit civil society created by a group of educators specialized in several knowledge fields and from different educational institutions: Basic Education Secretariat of Ceara (SEDUC), Ceara Teleducation Foundation (FUNTELC) Former *Educativa* TV (TVE), now Ceara TV, Federal University of Ceara (UFC) and State University of Ceara (UECE). [Text extracted from the website: <<http://www.coopagora.com.br/>>]. Agora ended its activities in March 2013.

⁴² The link for the research group website was removed.

Figure 2 – Home screen. *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

After clicking the start button, a mermaid appears with a laptop, inviting the game user to get in touch with “the true story of the Little Mermaid” and challenging him to identify different textual genres that will appear in the course of reading the eComics. The picture below shows the opening screen of the game, in which it is possible to return, to continue, to pause and to move forward the character’s speech:

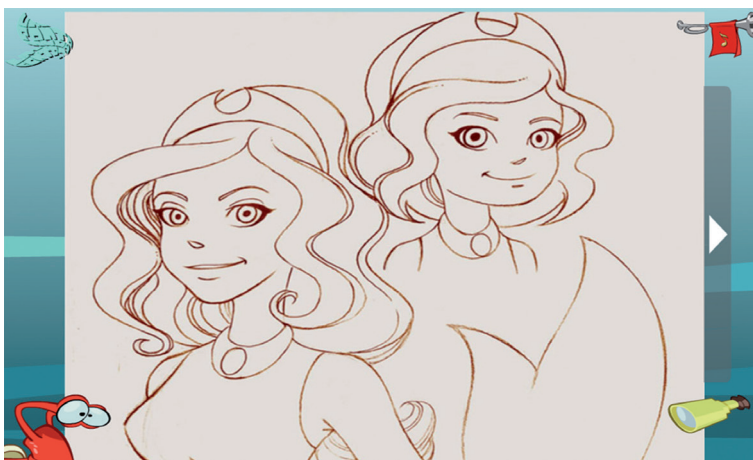
Figure 3 – Opening screen. *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

Then, the next step is to click once more on the start button and wait for the menu screen, where it is possible: to choose between more information about the original story of the Little Mermaid (*Learn More* icon) or the several adaptations this tale underwent over the years; to go directly to the digital comics; to see a simulation of how to play and how to leave the game. There is also the possibility of choosing, in the lower right corner of the screen, to increase the font size, by clicking on the telescope icon.

Figure 4 – Game menu. *One point changes a tale.*

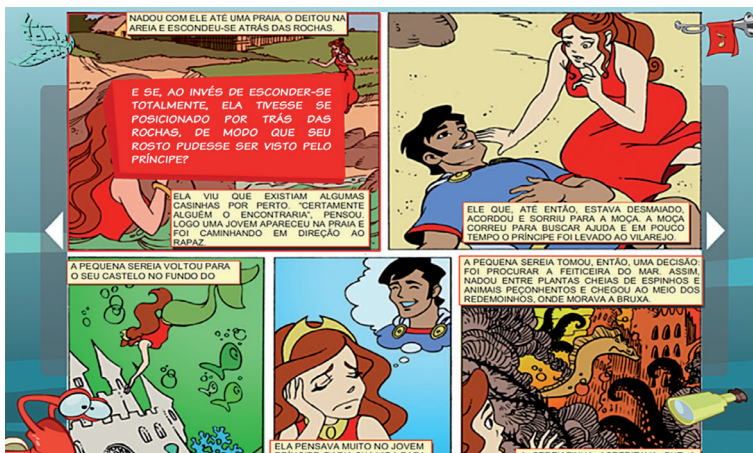


Source: Leia Cruz de Menezes production (ÁGORA, 2009).

By clicking on *HQ* (digital comics), the story of the Little Mermaid is available for reading⁴³. During its reading, some links appear so that the user may “be inserted” in the electronic text and may go to the activity regarding textual genres. The intention here is to allow the student / user to choose other endings for the story, one of the characteristics of eComics. By clicking on the path that leads to a different end, the student / user finds another textual genre other than eComics. In the following example, if the user chooses to click on the link, and to choose another ending to the story, it is presented an interview, whose content deals with the happiness lived by the Prince and Muriel, the mermaid:

⁴³ The version presented in the game is the original one, written by Danish poet Hans Christian Andersen, in 1837.

Figure 5 – An example of a link appearance. *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

By clicking on the red square represented at the image, the first discursive genre appears. According to the picture below:

Figure 6 – Intertextuality: interview genre. *One point changes a tale.*

ÁGUA VIVA

MURIEL: A PRINCESA DOS MARES E DA SUPERFÍCIE

Muriel, filha caçula do Rei Tritão, conta como ficou príncipe da superfície e reabre polêmica quanto à união entre diferentes espécies.

**Garoupa Oliva*

Garoupa Oliva: Quando você viu o príncipe pela primeira vez?

Pequena Sereia: Em meu primeiro passeio à superfície, eu avistei um navio. Aproximei-me, vi pessoas dançando e, entre eles, um lindo rapaz que se encaixava direitinho nos meus sonhos.

GO: E como vocês se conheceram?

PS: Uma tempestade fez o navio naufragar e eu salvei a vida do príncipe. Levei-o até uma praia e fiquei atrás de algumas rochas esperando que ele acordasse.

GO: Qual foi a reação dele ao ver que uma sereia salvou a vida dele?

PS: Quando ele acordou, pois estava desmaiado; ele viu apenas o meu rosto por trás das rochas. Eu deixei meu colar de pérolas na areia como prova de que eu era real e fugi. Como ele estava muito fraco, não compreendeu bem o que aconteceu, mas quando ele ficou legal, pode ver que tinha uma prova de minha existência com ele. Sabe como é; a gente tem de ser difícil para ser valorizada.

GO: É verdade! Mas como o namoro foi pra frente?

PS: Eu retornei ao mesmo rochedo, no mesmo horário, no dia seguinte. E ele fez o mesmo. Eu exigi que ele ficasse a certa distância. Assim, ele só via o que eu queria, meu rosto e meus cabelos.

GO: Então ele não sabia que você era uma Sereia?

PS: Não. Até o dia em que, percebendo que ele estava encantado por mim, eu revelei o meu segredo. Se eu tivesse feito isso antes de ele ter a oportunidade de me conhecer, talvez o choque o fizesse desistir.

GO: E como ficou o namoro depois disso?

PS: Melhor do que nunca! Só por fora nós somos diferentes, mas, por dentro, nós somos almas gêmeas.

GO: Na sua opinião, há barreiras para o amor?

PS: As únicas barreiras para o amor são a não-correspondência e a intolerância. Se o príncipe não ligasse para os meus sentimentos ou não me aceitasse do jeito que eu sou, eu pulava fora. Mas o fato de sermos, por fora, de espécies diferentes é besteira da grossa. A gente tem que se amar primeiro, depois a gente consegue ser amada.

**Garoupa Oliva é diretora editorial da revista Água Viva*

MOLTAR PARA LÍZ

QUE GÊNERO TEXTUAL É ESSE?

Source: Leia Cruz de Menezes production (ÁGORA, 2009).

After reading the new text that appears, the user must click on the metageneric question “what kind of text is this?” and identify the genre and its characteristics. If the response is considered inaccurate, there is some feedback suggesting a new attempt by the user. However, no points are generated. If the appropriate alternative is selected, the user scores points and advances to another phase, to discover the particular characteristics of that genre. On picture 7, the negative feedback screen:

Figure 7 – Discovering the genre (software feedback – wrong answer). *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

In the following picture, the screen with the most common characteristics of some text genres may be visualized. The user should choose only the characteristic corresponding to the text read previously – in the case, the interview.

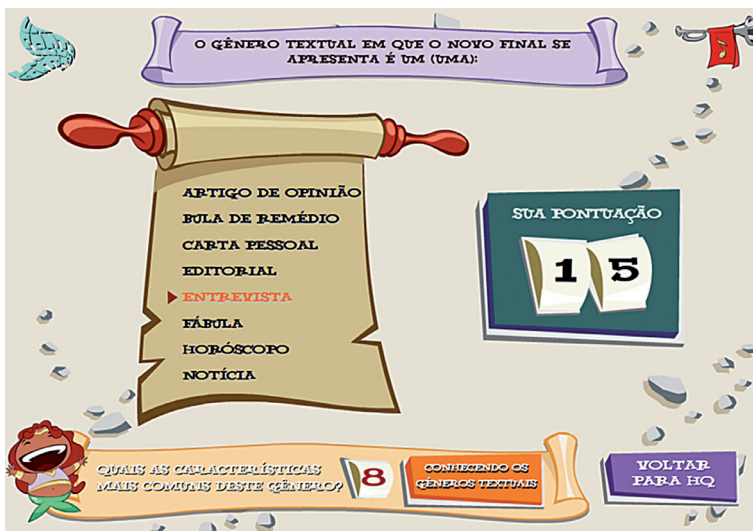
Figure 8 – Most common characteristics of the genre studied in the activity. *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

Once the main characteristic of the interview genre is identified and recognized, the overall score is provided for this particular activity. These points will be added to others obtained during the exploration of other genres:

Figure 9 – Overall score on the activity about the interview genre. *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

Finally, after the user has explored all the genres of the game, namely: interview, news, fable and personal letter, his global score is generated, as seen below:

Figure 10 – Software feedback (final result). *One point changes a tale.*



Source: Leia Cruz de Menezes production (ÁGORA, 2009).

Once this game-based pedagogical software is described, the next sections will explore the methodology and finally the analysis, before arriving at the conclusions of this work.

Methodological procedures of this research

This research is a qualitative descriptive study, which aims to evaluate qualitatively a game-based educational software, intended to teaching Portuguese Language for primary education. Regarding the procedures, firstly, a survey was made on digital pedagogic games for teaching Portuguese Language in elementary school, available in online repositories. Then, a careful selection of games was done, taking into account relevant aspects that characterize game-based educational software (it should allow one or more players, be interactive and playful, present rules to be followed and pedagogic objectives to be fulfilled, provide successful and unsuccessful experiences), so as the level of learning (targeted to elementary school students)⁴⁴. After the selection, the analysis of the chosen game was carried out using the Evaluation Protocol of Pedagogical Software.

Following, the analysis of results is presented.

Analysis of the digital pedagogic game *One point changes a tale*

About the digital educational game *One point changes a tale*, regarding didactic and pedagogic aspects, it is possible to affirm that:

a) Language conception

The perspective adopted in the digital pedagogic game *One point changes a tale* is the language as interaction, since the real use of the language (aiming at users) and the purposes / intentions / characteristics of the text genres are well explored along the reading activities. The subject (interlocutor) is active (reflects every moment on the decisions taken along the course of activities) and part of the real / concrete text, from which multiple meanings may be extracted, to understand the connections among the elements of the language. The form in which the activities were constructed suggests that the text is never finished and that the readers should complete, using previous knowledge and personal experiences, the gaps inherent to all texts; also, the readers attribute other meanings to them, beyond those intended by the author / enunciator.

⁴⁴ At the Master Thesis of Ribeiro (2013), which is the base for the present article, three digital pedagogic games were evaluated: *Reading is needed*, *Alphabet Soup* and *One point changes a tale*, available, respectively, in the repositories: a) Internacional Bank of Educational Objects (BIOE); b) School Games; and c) on research group website the authors participate.

b) Teaching types

Considering that the activities proposed in the analyzed digital educational game aim, through linguistic and extralinguistic relations, to teach student-users to understand that different situations of communication demand different ways of enunciation, the teaching type underlying the game *One point changes a tale* is considered productive. The game allows the student / user to know the genres eComics, interview, fable, news and personal letter, regarding their structure, purpose, situation of discourse and interlocutors. The constitutive dialogism of language permeates the content approach. Along this learning process, the students / users apply their experiences as readers to complete the meanings of the texts.

c) Granularity/Reusability

The analyzed digital pedagogic game, considering the totality of Portuguese Language contents, presents content segments; in this case, reading activities aiming to teach the student / user to identify and to recognize particular characteristics of four text genres, which refers to a part of text comprehension studies. Thus, this game is recognized as granular and may therefore be associated with other LOs (of all types). As already known, because it is considered an atomic software, it is also reusable, since content atomicity facilitates the use of this digital educational game several times in different teaching and learning situations.

d) Content organization

The activity contents (recognition and characteristics of text genres) were approached through eComics, so it was not divided into modules, units or sections. The fundamental point of the content proves the activities privilege the teaching of reading ability. It is assumed, from the level of the proposed activities, that the content was intended for students in the final grades of elementary school. The content approach holds the attention of the students/ users and encourages reflection on their path chosen throughout the game. The teacher may also work on other contents such as intertextuality and retextualization of stories. From the LO, there are several possibilities for teaching content related to reading, writing and speaking.

e) Support systems

The digital pedagogic game *One point changes a tale* provides in the lower left corner of the screen, when clicking on the image of a snail (if the student / user wants to know the game before starting the activities), a section called “simulation”. There, it is simulated gradually, and in a very playful way, the steps students / users should follow to perform all activities correctly. Choosing interactive simulators instead of written texts in a “learn more” section, for example, could attract students’ attention more significantly and could stimulate them to use the software, since digital generation prefers the dynamics of multimodal texts to static ones, transposed from paper to screen.

f) Learning goals

Although the digital educational game analyzed does not provide clear information about the aimed goal, it is believed this pedagogical software intends to develop the reading ability regarding the recognition of textual genres referring to structure and purpose in a playful and contextualized form. In order to achieve that development, activities related to this ability were formulated to explore text genres (concerning their characteristics, especially those related to form and function of the interview, news, fable and personal letter genres).

With regard to ergonomic / human-computer interface aspects, it is possible to state the following:

a) Usability

The digital pedagogical game *One point changes a tale* presents graphic coherence with reference to color harmony on the screen and how the buttons / icons are distributed (play, pause, pause, go back, advance, start, exit, return to eComics, *Learn more* and simulation - available on all screens of the game); scrolling from one screen to another is easy and fast. However, concerning the game interface, although considered intuitive, in general, there are some observations about the presentation form of the eComics. During the evaluation process, the discussed digital educational game was tested several times and it was concluded that the entire pages of the eComics do not fit the screen.

Therefore, to read the entire page content, the student should scroll the text by clicking on an arrow at the bottom of the screen. However, the student may not see the arrow, which appears as a feature called *mouseover*, only enabled if the mouse pointer reaches the lower part of the screen. This can lead the student to click on a side button that allows him to move to the next page without having finished reading the present one. If this happens, the student will surely come across comics that do not follow the sequence of the narrative from the previous page. Probably, the next step of this student would be to return to the previous page to try reading the comics that, by deduction, would be missing. Then, on the first page of the eComics, the reader could slide down the mouse pointer on the screen, but again, he would not succeed. After a few attempts, the user is likely to realize that by taking the mouse pointer to the bottom center of the screen, an arrow would appear, suggesting that by clicking on it, the missed parts of the comics would be revealed. Despite the mentioned problem, in general, as already stated, the game *One point changes a tale* presents good usability.

b) Accessibility

In addition to being available online on the website of the research group the authors participate, the digital educational game *One point changes a tale* was elaborated taking into consideration the use by students/ users with special needs. It provides on the opening screen the oral version of the written text in the speech bubble over the mermaid head who presents the game, as well as allows the student/ user of the game

to increase the size of the comic strips, which includes increasing the images and texts. For these reasons, this game is considered to be fully accessible.

c) Interoperability

Although there is no information about the operating conditions of the pedagogic game *One point changes a tale*, a performed test concluded that, to be executed, it is necessary that the software *Adobe Flash Player* (plug-in) is installed in the computer. Also, the analyzed game runs well in Windows and Linux operating systems and in different browsers: Mozilla, Explorer and Chrome. Thus, the game *One point changes a tale* is executable in any operating system and in any browser.

d) Interactivity

In this digital pedagogic game, the autonomy degree of the student in relation to the system is high. The dialogue between students/ users and contents is continuous (they are encouraged to reflect about the activity and the choices made to complete the proposed task, from the moment they choose a new direction to the story - clicking on the links, until the moment they need to evaluate characteristics inherent to a specific genre of discourse, to which they had already been presented during the activity itself). Although there is no guidance on how teachers / tutors / facilitators should explore this game, the educational tool suggests that even if it is used outside the classroom context, students/ users should dialogue with their teachers, for example, to learn the elements which compose each genre and the discursive domain to which they belong, beyond the activity contents. Finally, the dialog between students/ users and computers is considered excellent, as they receive adequate and differentiated feedbacks (in some comic strips that allow insertion, it is possible to read a message such as “and if she had left a farewell message?” or “what if, instead of resigning, the mermaid fought for her love?”). There are also the text messages appearing on the screen, indicating whether the selected alternative was adequate or inadequate considering the genre read, allowing good interaction with the system.

e) Documentation and support material

The digital educational game *One point changes a tale* does not present documentation or supporting material, either in print or digital form. This is a negative characteristic of the game, since the goals and other possibilities of use referring to the LO could be presented in a teacher’s guide, for example.

From the analysis, it is possible to affirm that the game-based educational software studied has an excellent quality and, if used in the classroom or outside it, as a complement along with activities developed by the teachers/ tutors/ facilitators, it may contribute positively to PL teaching in a contextualized situation.

The following section presents the final considerations of this research.

Conclusion

This work had as main goals to develop an evaluation model and to analyze a game-based pedagogic software with reference to didactic/ pedagogic and ergonomic / human-computer interaction aspects. For this, an Evaluation Protocol of Pedagogical Software (EPPS) was proposed and applied to the analysis of the digital educational game *One point changes a tale*, aiming at the teaching of Portuguese Language.

Regarding the evaluation of pedagogic software, although there are several learning objects of this kind available online and offline, not all of them are carefully analyzed on their quality. In this investigation, it was suggested the Evaluation Protocol of Pedagogical Software (EPPS) as a tool with the purpose of assisting the didactic/ pedagogical and ergonomic evaluation of educational softwares, especially the game-based ones, aimed at PL teaching. The developed criteria of this protocol prioritized the specificities of the knowledge field to which the authors are linked, the Portuguese Language. It also took into account the work routine of teachers / tutors / facilitators who probably would not use models, methods or evaluation protocols for LOs which might demand some expertise in other knowledge fields (such as computing, for example) or might require a lot of time to apply them.

The proposed evaluation protocol of pedagogic, game-based pieces of software (EPPS) was suitable for the evaluation of digital pedagogic games, since it allows the evaluation of particular didactic and pedagogical aspects without leaving aside ergonomic / human-computer interaction aspects, which may impair the game operation and its use as additional didactic material. The application of the EPPS, however, demonstrated that, although the recommended questions for each item guide the teachers within the analysis, these teachers are not exempted from being familiar with Portuguese language teaching, conceptions of language, verbal interaction, among other topics.

The results of this research indicate that the evaluated game (*One point changes a tale*) has a good didactic, pedagogical and ergonomic quality. Besides exploring the actual use of the language (concerning the users), it presents excellent usability and high degree of interactivity.

ARAÚJO, N.; FREITAS, F. Protocolo de Avaliação de *Softwares* Pedagógicos: analisando um jogo educacional digital para ensino de Língua Portuguesa. *Alfa*, São Paulo, v.61, n.2, p.467-494, 2017.

- *RESUMO: Como reflexo dos avanços das Tecnologias Digitais de Informação e Comunicação, e visando complementar o ensino, ferramentas digitais interativas, entre as quais podemos citar os jogos pedagógicos digitais, têm estado muito presentes nas escolas brasileiras. Assim, concorrem, hoje, na sala de aula, materiais didáticos impressos e digitais (doravante MDDs). Os MDDs, assim como materiais impressos, precisam passar por uma avaliação rigorosa. Sendo assim, neste trabalho, que foi embasado em Bakhtin/Volochinov (2009);*

Geraldi (2011); Halliday et al. (1974); e Koch (2002), propomo-nos a responder como se deve avaliar a qualidade de jogos pedagógicos digitais destinados ao ensino de língua materna. Quanto ao principal objetivo da pesquisa, pretendemos, a partir do Protocolo de Avaliação de Softwares Pedagógicos, que desenvolvemos para realizar essa investigação, avaliar a qualidade didático-pedagógica e ergonômica de jogos pedagógicos digitais disponíveis online. Na pesquisa, de caráter descritivo, avaliamos um jogo pedagógico digital destinado ao ensino de Língua Portuguesa. A análise revelou que, embora se tratasse de um jogo educacional digital de qualidade, esse objeto apresentou inadequações tanto quanto aos aspectos didático-pedagógicos quanto aos ergonômicos.

- **PALAVRAS-CHAVE:** Ensino-aprendizagem de Língua Portuguesa. Jogos educacionais digitais. Protocolo de avaliação.

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