

Using Virtual Environments Adapted to Individual Capacities of Build Knowledge: an Approach to Distance Learning Courses

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Abstract

This article presents some results of a PhD research that tries to find a solution based on learning styles and adapted to e-learning programs, using virtual environments and the possibilities of their adaptation to individual learning capacities. This software solution shall be applied in e-learning virtual environments turning them able to publish contents adapted to individual ways of building knowledge. This solution will be incorporated to Moodle for the use of teachers as well as other professionals. This paper will present two steps of the system development. The first step consists on the solution that is able to identify the user's learning style. This function is incorporated to the student's profile on Moodle and is based on three learning styles theories: Felder and Silverman, Alonso and Gallego, and Kolb. The system was adapted to three theories and a later analysis of results. The second step consists on presenting the model chosen to develop storyboards able to deal with different contents, adapting them to the many ways used to build knowledge, and also presents the pre-selected theory that based this process. It will be also shown in this paper, the case study where the solution will be applied, the adopted educational institution, the teaching modality and the program that is being structured. All the steps focus on answering the question that guides the research: How learning styles may turn the learning process more effective when associated to virtual environments used on distance education? To help answering this question, a large bibliographical research was developed, as well as other kinds of investigation, searching for studies and experiences that focus on the use of learning styles in distance programs. It is expected that this research bring results that may help to create stimulating learning environments that upgrade the student's performance and help the development of distance courses.

1. Distance Education and Virtual Learning Environments

The great development of Information and Communication Technologies are creating new types of interactive learning environments. Through them, anyone may, at any moment, share information with a network link, build new meanings, articulate ideas individually and collectively, as well as to share new knowledge with all the users of a network. Social networks are a proof that the people are changing the way they communicate.

In distance education we cannot use the traditional concept of a classroom, with students as mere spectators lining in front of a teacher who is a specialist of a knowledge the students don't know. In distance education we need a learning environment that focus on interaction among students and teachers, that uses a constructionist approach and that privilege knowledge co-building, as well as the development of ethical and critical conscience throughout dialogue and interaction [1].

According to Behar [2], a Virtual Learning Environment (VLE) may be defined as a space on internet composed by the subjects and their ways of communication throughout a platform, with the objective to learn. The VLE offer many resources such as to post a simple document to the students or more complexes elements as an online questionnaire. The VLE also offer conditions to synchronous or asynchronous permanent interaction, for they are based on connectivity and guarantee a quick access to information and interpersonal communication at any moment or place, allowing the development of cooperative projects and the coordination of many activities.

2. The structure of Moodle

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a software mainly developed on Javascript [3] and PHP [4] destined to the development and implementation of learning virtual environments as a support to online programs. Many institutions, though, have been using this VLE to

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face-to-face education, for it contains many tools to post and receive reading materials, communication and interaction (synchronous and asynchronous).

A proper use of the resources from Moodle allows collaboration and criticism among their users. Teachers may, in an easy way, share material of study, keep discussion, apply tests and do researches, receive and revise activities and register evaluation.

Moodle's acceptance is very large in Brazil and all over the world. According to Moodle's community statistics [5], there are 69.375 registered sites in 224 countries using Moodle. Brazil is in third place on this ranking with 4083 registers.

A few elements put Brazil on the third place on this ranking. One of them is the fact that Moodle is a free software and open source. It means that its source code is available when having a license that allows any individual to study, modify or distribute the software freely to anyone with any objective without legal impediments [6]. It permits that teaching institutes adopt this system and adapt it to their specific needs and contexts.

Another motif is that Moodle was based on a social constructivist approach that proposes sharing information and collaboration in activities and criticisms among all their users. This approach focuses on the student and its individual learning, promoting the ideas that new knowledge is built up based on previous knowledge and that each student has control of its own learning [7]. Through this point of view, the student's skills are built inside the context where they will be used.

Moodle has a crescent and active community formed by many types of professionals in the most varied segments of society such as universities, governments, schools and private enterprises. They are always adding new functions, suggesting changes and improving the platform. Among all the VLE open source options, Moodle is the most accepted in Brazil and in the world, for it has no costs, open and flexible architecture, and easiness to install and to customize. These are the reasons we chose Moodle to develop this research.

3. Learning Style Identification on Moodle

This research proposes, among its objectives, to recognize the learning style of each individual on Moodle, allowing the environment to be adapted to its own way of learning. To achieve this, the user profile on Moodle presents three questionnaires based on the theories of Felder and Silverman [8], Alonso and Gallego [9], and Kolb [10]. Figure 1 shows the form to edit user's profile on Moodle with the specific categories of each questionnaire.



Cidade/Município*

Selecione um país*

Zona de fuso horário

Idioma preferido

Descrição ?

Família da font - Tamanho da fc - Parágrafo

B *I* U ABC x₂ x₁ [List Icons] [Undo] [Redo] [Image] [Table] [Link] [Text] [Color] [Background Color] [Align] [Indent] [Outdent]

[List Icons] [Image] [Table] [Link] [Text] [Color] [Background Color] [Align] [Indent] [Outdent] HTML

Caminho: p

- ▶ [Imagem do usuário](#)
- ▶ [Interesses](#)
- ▶ [Opcional](#)
- ▶ [QEA - Felder e Silverman](#)
- ▶ [QEA - Honey-Alonso](#)
- ▶ [QEA - Kolb](#)

Figure 1: The categories on the questionnaires of user's profile on Moodle.

When the category is expanded, each author's questionnaire is disposed to the user allowing him/her to edit in his/her own learning style. The questionnaires are in Portuguese, but are identical to the ones developed by the original authors, with the same guidelines. Figure 2 presents part of a template with Felder and Silverman's questionnaire.



▼ QEA - Felder e Silverman

1. Eu compreendo melhor alguma coisa depois de ↕
2. Eu me considero ↕
3. Quando eu penso sobre o que fiz ontem, é mais provável que afluam ↕
4. Eu tendo a ↕
5. Quando estou aprendendo algum assunto novo, me ajuda ↕
6. Se eu fosse um professor, eu preferia ensinar uma disciplina ↕
7. Eu prefiro obter novas informações através de ↕
8. Quando eu compreendo ↕
9. Em um grupo de estudo, trabalhando em uma matéria difícil, eu provavelmente ↕
10. Acho mais fácil ↕

Figure 2: Felder and Silverman's questionnaire on Moodle.

When the data profile are updated they are basically stored on Moodle's table mdl_user, mdl_user_info_category, mdl_user_info_field and mdl_user_info_data. The table mdl_user presents the general data from each user such as login, id, password, e-mail, and other. The table mdl_user_info_category stores information from the categories created to the updating profile form and received the names: QEA – Honey-Alonso, QEA – Felder and Silverman, and QEA – Kolb. The mdl_user_info_field table contains information from the fields of the form that appear when editing the profile, saved as name of the field, type of field (as checkbox, short text, description and multiple choice) and answers options. Finally, the table mdl_user_info_data stores information changed on the questionnaires form, based on user's id.

To do the calculation of learning style, it was used a PHP programming language. Each questionnaire has a different calculation, based on the guidelines established by the authors. Figure 3 presents a code fragment of the calculation of learning style based on Honey and Alonso's theory, they categorize active, reflexive, theoretical and pragmatic styles.



```

436. // Cálculo para Honey e Alonso
437. $ativo = 0;
438. $reflexivo = 0;
439. $teorico = 0;
440. $pragmatico = 0;
441.
442. $sqlhon = "SELECT mdi_user_info_data.id as dataid, mdi_user_info_data.fieldid, shortname, mdi_user_info_data.data
FROM mdi_user_info_data
443. INNER JOIN mdi_user_info_field ON mdi_user_info_data.fieldid = mdi_user_info_field.id WHERE userid = $idusuario
AND shortname LIKE 'hon%'";
444. $resultshon = $CS->get_records_sql($sqlhon, array($idusuario));
445.
446. foreach ($resultshon as $result) {
447.     switch (str_replace('hon', '', $result->shortname)) {
448.         //Para o estilo pragmático 1, 8, 12, 14, 22, 24, 30, 38, 40, 47, 52, 53, 56, 57, 59, 62, 68, 72, 73, 76
449.         case 1:case 8:case 12:case 14:case 22:case 24:case 30:case 38:case 40:case 47:case 52:case 53:case 56:case 57:case 59:case 62:case 68:case 72:case 73:case 76:
450.             if($result->data == 1){$pragmatico += 1;}
451.             break;
452.
453.         //Para o estilo ativo 3, 9, 7, 8, 23, 20, 26, 27, 35, 37, 41, 43, 46, 48, 49, 51, 61, 67, 74, 75, 77
454.         case 3:case 9:case 7:case 8:case 23:case 20:case 26:case 27:case 35:case 37:case 41:case 43:case 46:case 48:case 49:case 51:case 61:case 67:case 74:case 75:case 77:
455.             if($result->data == 1){$ativo += 1;}
456.             break;
457.
458.         //Para o estilo Teorico 2, 4, 6, 11, 15, 17, 21, 23, 25, 29, 33, 45, 50, 54, 60, 64, 66, 71, 78, 80
459.         case 2:case 4:case 6:case 11:case 15:case 17:case 21:case 23:case 25:case 29:case 33:case 45:case 50:case 54:case 60:case 64:case 66:case 71:case 78:case 80:
460.             if($result->data == 1){$teorico += 1;}
461.             break;
462.
463.         //Para o estilo Reflexivo 10, 16, 18, 19, 28, 31, 32, 34, 36, 39, 42, 44, 49, 55, 58, 63, 65, 69, 70, 79
464.         case 10:case 16:case 18:case 19:case 28:case 31:case 32:case 34:case 36:case 39:case 42:case 44:case 49:case 55:case 58:case 63:case 65:case 69:case 70:case 79:
465.             if($result->data == 1){$reflexivo += 1;}
466.             break;
467.     }
468. }
469.
470. echo "<br /><b>Resultados para a teoria de Honey e Alonso:</b>";
471. echo "<br />Pragmatico = $pragmatico";
472. echo "<br />Teorico = $teorico";
473. echo "<br />Ativo = $ativo";
474. echo "<br />Reflexivo = $reflexivo <br />";

```

Figure 3: calculation code of learning style to Honey and Alonso's theory

According to Kolb, learning styles consist of the quadrants accommodating, diverging, converging and assimilating. To the questionnaire of learning style analyses based on the theory of Felder and Silverman, the analyses is made using the criteria of active/reflexive, sensorial/intuitive, visual/verbal, sequential/global.

3. Conclusion

This research is now on the finishing digital material step that is based on the theory of Felder and Silverman that shall be disposed on the platform. Though the user profile has three questionnaires to analyze style, on the next offers of the program only one theory will be the basis of the resources and activities in the environment. The data of the user's answers will be analyzed in a future phase of the research with the main objective of reflecting about similarities and differences among theories, styles and pattern of user's answers. These data will compose the study of case.

The theory of Felder and Silverman was used to the development of didactic material, and a group of rules was established to the developers who are now implementing the material. Table 1 explains the rules to material development.

Table 1: Rules to the development of didactic material.

Quadrant	Style	Contents organization
Sequential/Global	Sequential	Contents disposed on the pattern order.
	Global	Links to quick access to material.
Sensing/Intuitive	Sensing	Complementary Reading available.
	Intuitive	Complementary Reading unavailable.
Active/Reflective	Active	Group activities.
	Reflective	Individual activities.
Visual/Verbal	Visual	Less textual explanation, more graphics, images and tables.
	Verbal	Less graphics, images and tables.

The study of case consists on an extension course to form teachers that will think about the use of Information and Communication Technologies on the development of digital teaching materials. It is a

40 hours course discussing the following contents: historical contextualization of digital and audiovisual resources; concept and characteristics of advanced digital and audiovisual resources; characterization of a multidisciplinary team to produce didactic material; elaboration, applicability and evaluation of the advanced resources to produce didactic material.

The research means to emphasize the value of learning styles on teaching the different modalities. It hopes to give a significant contribution to educational areas and the development of systems, suggesting that educational institution may use learning styles in distance education environments, providing software solution and developed materials.

After all, we understand that the learning styles theories are more harmonic to distance education and may have a better use on courses with a constructionist approach, since its pedagogical practices focus on the students learning, pointing out pedagogical and didactical use of technological tools, learning objects and virtual learning environments.

We hope that the learning turns more collaborative, participatory and open, since the apprentices will feel more introduced to the process, cause the way they learn have been taken in consideration during the whole course. Thinking about this, this investigation may contribute to the area, helping to join the theories and the pedagogical practices evolved, helping to change the way distance courses have been offered, and how knowledge is built in them.

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