FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

Concursos de Projectos de I&D
Proposals for R&D Projects

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Referência do projecto
Project reference
PTDC/EIA/71816/2006

1. Identificação do projecto
1. Project description [-]

Financiamento solicitado
Requested funding
55.962,00 Euros

Área científica principal
Main Area
Engenharia Informática

Área científica Secundária
Secondary area
Ciências da Educação

Título do projecto (em português)
Project title (in portuguese)
STM - Sistema Tutorial Minimalista

Título do projecto (em inglês)
Project title (in english)
LiTS - Light Tutoring System

Palavra-chave 1
sistemas tutoriais

Keyword 1
tutoring systems

Palavra-chave 2
desempenho na aprendizagem

Keyword 2
learning performance

Palavra-chave 3
método socrático

Keyword 3
Socratic method

Palavra-chave 4
e-aprendizagem

Keyword 4
e-learning

Objectivos sócio-económicos
Socio-economic objectives
Desenvolvimento social e Serviços Sociais (incluíndo ensino e formação, cultura e lazer, estrutura política, mudanças sociais e conflitos)

Data de início do projecto
Starting date
01-03-2007

Duração do projecto em meses
Duration in months
30

2. Instituições participantes

2. Participating institutions

Instituição Proponente
Principal Contractor
Universidade do Minho (UM)
Largo do Paço
4700-320Braga

Instituições Participantes
Participating Institutions
Universidade do Minho (UM)
Largo do Paço
4700-320Braga

Unidade de Investigação
Principal Research Unit
Centro Algoritmi (Algoritmi/UM)
Campus de Azurém
4800Agra - Além

Instituição de Acolhimento
Host Institution
Universidade do Minho (UM)
Largo do Paço
4700-320Braga

3. Orçamento
3. Budget

Instituição Proponente
Principal Contractor

Universidade do Minho

DESCRIÇÃO DESCRIPTION	2007	2008	2009	2010	2011	**TOTAL**
Recursos Humanos Human resources	10712	22127	3997	0	0	36836
Missões Missions	0	2500	2500	0	0	5000
Consultores Consultants	0	0	0	0	0	0
Aquisição de serviços e manutenção Acquisition of services and maintenance	0	0	0	0	0	0
Outras despesas correntes Other current expenses	1050	1250	500	0	0	2800
Despesas gerais Overheads	2592	5335	1399	0	0	9326
Equipamento Equipment	1200	800	0	0	0	2000
TOTAL	15554	32012	8396	0	0	**55962**

Instituições Participantes
Participating Institutions

Universidade do Minho

DESCRIÇÃO DESCRIPTION	2007	2008	2009	2010	2011	TOTAL
Recursos Humanos Human resources	0	0	0	0	0	0
Missões	0	0	0	0	0	0

Missions						
Consultores Consultants	0	0	0	0	0	0
Aquisição de serviços e manutenção Acquisition of services and maintenance	0	0	0	0	0	0
Outras despesas correntes Other current expenses	0	0	0	0	0	0
Despesas gerais Overheads	0	0	0	0	0	0
Equipamento Equipment	0	0	0	0	0	0
TOTAL	0	0	0	0	0	**0**

Orçamento Global
Global budget

DESCRIÇÃO DESCRIPTION	2007	2008	2009	2010	2011	**TOTAL**
Recursos Humanos Human resources	10712	22127	3997	0	0	36836
Missões Missions	0	2500	2500	0	0	5000
Consultores Consultants	0	0	0	0	0	0
Aquisição de serviços e manutenção Acquisition of services and maintenance	0	0	0	0	0	0
Outras despesas correntes Other current expenses	1050	1250	500	0	0	2800
Despesas gerais Overheads	2592	5335	1399	0	0	9326
Equipamento Equipment	1200	800	0	0	0	2000
TOTAL	15554	32012	8396	0	0	**55962**

Plano de financiamento
Finance plan

DESCRIÇÃO DESCRIPTION	2007	2008	2009	2010	2011	**TOTAL**
Financiamento solicitado à FCT Requested funding	15554	32012	8396	0	0	55962
Financiamento próprio Own funding	0	0	0	0	0	0
Outro financiamento público Other public-sector funding	0	0	0	0	0	0
Outro financiamento privado Other private funding	0	0	0	0	0	0
Total do Projecto **Total of the project**	15554	32012	8396	0	0	**55962**

4. Justificação do orçamento
4. Budget justification

–

4.1. Justificação dos recursos humanos
4.1. Human resources justification

Tipo	Nº de pessoas	Duração	Custo envolvido (€)
(BI) Bolsa de Investigação (Lic. ou Bacharel)	1	12	11128

Justificação

The mission of this team member will be to help researchers in the field evaluation of the prototype, interacting with course designers and students, collecting and analyzing results. (Tasks E2 to E3)

Tipo	Nº de pessoas	Duração	Custo envolvido (€)
(BI) Bolsa de Investigação (Mestre)	1	24	25708

Justificação

The mission of this team member will be to make the functional analysis of the software prototype, its implementation, debug, revision and upgrade. (Tasks P1 to P3)

Custo total: 36836

4.2. Justificação de missões
4.2. Mission justification

Tipo	Local	Nº de deslocações	Custo envolvido (€)
Participação em congressos	Europe / USA	2	4000

Justificação

The purpose of these missions is to present the intermediate results obtained at international conferences in Europe or the USA and to get live feedback.

Tipo	Local	Nº de deslocações	Custo envolvido (€)
Participação em congressos	Portugal	2	1000

Justificação

The purpose of these missions is to present the intermediate results obtained at conferences in Portugal and to get live feedback.

Custo total: 5000

4.3. Justificação de consultores
4.3. Consultants justification
(vazio)
(void)

4.4. Justificação de aquisição de serviços e manutenção
4.4. Acquisition of services and maintenance justification
(vazio)
(void)

4.5. Justificação de outras despesas correntes
4.5. Current expenses justification

Tipo de despesa	Custo envolvido (€)
Bibliography's acquisition	2000

Justificação

This amount refers to necessary expenses for acquiring relevant bibliography.

Tipo de despesa	Custo envolvido (€)
Consumables	800

Justificação

This amount refers to expenses on consumables including the production of materials for evaluation of the prototype.

Custo total: 2800

4.6. Justificação do Equipamento
4.6. Equipment justification

4.6.1. Equipamento já disponível para a execução do projecto
4.6.1 Available equipment
(vazio)
(void)

4.6.2. Discriminação do equipamento a adquirir
4.6.2. List of new equipment requested

Tipo de equipamento	Fabricante	Modelo	Custo envolvido (€)
Computers (2)	To specify	To specify	2000

Justificação

This amount is intended for purchasing 2 desktop computers, peripherals and included maintenance to serve as workstations for the hired team members. One of them must have enough power to support software development and Web site serving.

Custo total: 2000

5. Equipa de investigação
5. Research team

5.1 Lista de membros (2)
5.1. Members list (2)

Nome Name	Função Role	Grau académico Academic degree	%tempo %time
Paulo José Guimarães Garrido	Inv. Responsável	DOUTORAMENTO	25
Ana Amélia Costa da Conceição Amorim ...	Investigador	DOUTORAMENTO	10

(O curriculum vitae de cada membro da equipa está disponível clicando no nome correspondente)
(Curriculum vitae for each research team member is available by clicking on the corresponding name)

5.2. Lista de membros a contratar durante a execução do projecto (2)
5.2. Members list to hire during project's execution (2)

Membro da equipa Team member	Função Role	Duração Duration	%tempo %time
(BI) Bolseiro de Investigação (Lic. ou Bacharel) 2	Bolseiro	12	100
(BI) Bolseiro de Investigação (Mestre) 1	Bolseiro	24	100

6. Projectos financiados
6. Funded projects

-

(Sem projectos financiados)
(No funded projects)

7. Indicadores previstos
7. Expected indicators

-

Indicadores de realização previstos para o projecto
Expected output indicators

Dados temporariamente indisponíveis

8. Anexo técnico
8. Technical addendum

-

8.1. Resumo
8.1. Abstract
Resumo (em português)
Abstract (in portuguese)

Em termos de Cibernética, os Sistemas Tutoriais Inteligentes (STI) podem ser descritos como fornecendo orientação individualizada ao aprendente com base na identificação de um modelo do mesmo e de um modelo das estratégias de ensino utilizadas. Os modelos referidos permitem modular ou parametrizar as regras pelas quais o "feedback" é dado ao aprendente de forma individualizada. Considera-se que os STI permitem obter ganhos elevados de eficiência de aprendizagem, como resultado da orientação individualizada, pelo que a sua disseminação seria extremamente desejável – a Sociedade do Conhecimento coloca a todos os cidadãos necessidades de aprender rapidamente em diversos domínios do conhecimento. No entanto, tal disseminação pode ser dificultada porque os STI se mostram economicamente viáveis apenas em áreas especializadas.

A proposta subjacente à submissão deste projecto tem a seguinte hipótese de trabalho. Para tarefas de aprendizagem, cuja realização se acredita como sendo razoavelmente avaliada por testes de escolha múltipla, é possível construir sistemas tutoriais que, não sendo inteligentes no sentido estrito do termo, apresentem rácios de desempenho / custo permitindo uma significativa disseminação do seu uso e consequentes ganhos sociais em eficiência de aprendizagem. Como primeiro passo para explorar a proposta, o projecto submetido tem por finalidades construir um protótipo de "software" de um Sistema Tutorial Minimalista (STM) e avaliá-lo.

O protótipo será constituído por uma máquina tutorial capaz de interpretar descrições de cursos. Uma única máquina tutorial poderá correr tantos cursos quantas as descrições disponíveis, na medida em que dispuser de potência computacional e de comunicação.

A máquina tutorial oferecerá duas interfaces: a do projectista e a do aprendente. A interface do projectista de cursos permitirá preparar um curso, declarando a sua descrição através de um conjunto unificado de ferramentas de "software". Ao declarar a descrição do curso, o projectista assume um quadro conceptual subjacente ao processo de aprendizagem caracterizado por:
- O domínio de conhecimento do curso será particionado num conjunto de nodos para o qual uma relação de precedência na aprendizagem é declarada; o resultado é um grafo direccionado acíclico (GDA) (Fig.1). Cada nodo representa uma "quantidade" de conhecimento que se supõe a aprendente conseguir construir num "acto de aprendizagem atómico".
- Para cada nodo o projectista fornecerá:
o Uma apresentação do nodo;

o Um conjunto de procedimentos de aprendizagem iniciais a activar condicionalmente; note-se que um procedimento de aprendizagem tem conteúdo aberto no sentido de que deve ser entendido como um conjunto ou sequência de coisas que o aprendente deve fazer, não necessariamente aceder apenas a conteúdos "on-line".
o Um conjunto de sequências de questões, cada questão podendo ser respondida através de selecção entre escolhas múltiplas, e o padrão de respostas correctas para cada sequência;
o Para cada resposta "errada" (ou para padrões de resposta com respostas erradas), um procedimento de aprendizagem ditado pelo erro e / ou uma (diferente) selecção de procedimento inicial de aprendizagem; note-se que por defeito um procedimento ditado por erro será explicitar uma frase contraditória implicada pela resposta.

Uma descrição de um curso é constituída pelos itens referidos acima dados numa lista de nodos (Fig. 2). Baseada na descrição do curso, a máquina tutorial guiará a aprendente através do mesmo, apresentando os nodos de acordo com a relação de precedência de aprendizagem e com o progresso da aprendente. O progresso é objectivamente definido pela resposta correcta a todas as questões de uma sequência atribuída a um nodo. Se o aprendente falha uma ou mais questões, então os procedimentos de aprendizagem ditados por erro são invocados, após o que outra sequência de questões do conjunto atribuído ao nodo será apresentada (Fig.3). A partir da descrição, o funcionamento básico de um STM pode ser divisado, embora um conjunto de outras funcionalidades seja possível, como implementar uma aproximação socrática num curso.

Quanto vale o conceito de STM na prática? O projecto submetido tem por finalidade obter uma primeira resposta a esta pergunta, avaliando através de um conjunto de casos de utilização do protótipo:
- Reacções, quer de projectistas, quer de estudantes, à sua usabilidade;
- Desempenho na aprendizagem de estudantes que sigam disciplinas através do protótipo de STM versus uma referência conveniente;
- Custos de preparação de cursos.

A interface do projectista será avaliada em termos de usabilidade e da curva de aprendizagem, quer dos detalhes de utilização da interface, quer, sendo esse o caso, do quadro de conceitos subjacente ao sistema. Estas características aparecem como determinantes do custo de preparação de um curso.
A avaliação da reacção dos estudantes é também crucial, quer em termos da "adesão emocional", quer em termos de eficiência de aprendizagem aumentada.

Resumo (em inglês)
Abstract (in english)

Describing Intelligent Tutoring Systems (ITS) in terms of Cybernetics, one may say that they are aimed to provide individualised guidance to learners on the basis of the identification of a learner's model and of an existent teacher' strategies model (adaptation level). Given records of the deviance between assumed admissible behaviours of the learner and the actual observed behaviours, the referred two models enable to modulate or to parameterise the rules of giving feedback to the learner in an individualised fashion (feedback level). ITS are reported to give elevated gains in learning efficiency, as a result of the individualised guidance, and so its dissemination would be a most desirable event – the Knowledge Society presses every citizen to learn fast in diverse domains of knowledge. Yet, this dissemination may be hampered because ITS are expensive to build and targeted to specific domains, so they become economically viable only in specialised areas.

The proposal underlying the submission of this project has the following working hypothesis. For learning tasks, which completion is currently believed to be reasonably assessed by multiple-choice tests, it is possible to build tutoring systems that, while not being intelligent ones in a strictly proper usage of the term, are capable of delivering learning performance / cost ratios that will enable a significant spread of their usage and consequent social gains in learning efficiency. As a first step to put the proposal at work, the submitted project aims to build a software prototype of what may be termed a Light Tutoring System (LiTS) and evaluate it.

Such a prototype will be constituted by a tutoring engine able to interpret course descriptions. A single tutoring engine will be able to run as many courses as course descriptions and computational / communication power will be available.

The tutoring engine will offer two interfaces. One interface will be for course designers (designer interface) the other for course takers (learner interface). The designer interface will put at the course designer's hands a unified set of software tools to set up a course by stating its course description. In stating the course description, the designer assumes a conceptual framework underlying the learning process characterised as:
- The knowledge domain of the course will be partitioned in a set of nodes endowed with a relation of learning precedence among nodes; the result is a acyclic graph, or DAG (Fig. 1); each node represents a "chunk" of knowledge that the learner is supposed to be able to learn in an "atomic learning act".
- For each node the designer will provide:
o A presentation of the node.
o A set of conditionally enabled initial learning procedures for the node; let one note that a learning procedure is open in content in the sense that it must be understood as a set or sequence of things for the learner to do, not

necessarily just to access on-line content.
o A set of sequences of questions each being answerable through multiple choice together with the correct pattern of answer for each sequence.
o For each 'wrong' answer (or for answer patterns containing "wrong" answers), an error driven learning procedure and / or a (different) selection of initial learning procedure; let one note that the default for an error driven learning procedure will be to elicit a contradiction from the false sentence implied by the answer.

A course description is constituted by the above referred items given through a list of nodes (Fig.2). On the basis of the course description the tutoring engine will guide a learner though it, presenting the nodes according to the precedence relation (technically according to a sorting of the DAG) and the progress of the student. Progress is objectively defined by a student answering correctly to all the questions in a sequence assigned to a node. If a student fails one or several questions then the corresponding error driven learning procedures are invoked and another sequence of questions of the set assigned to the node will be presented (Fig.3). From the description, the basic functioning of a LiTS may be sketched, but a host of possibilities exist, as implementing a Socratic approach in a course.

How much is worth the LiTS concept in practice? The submitted project aims to get a first answer to this question by assessing through a set of cases of prototype's use:
- Reactions of both designers and learners in terms of usability;
- Learning performance of students following trial courses on the LiTS prototype versus a convenient reference;
- Course set-up costs.

The designer interface will be evaluated for usability and for a fast learning curve both of the interface ins and outs as for the framework concepts underlying the system, that being the case. These characteristics appear as decisive for the cost factor of setting-up a course.
Evaluation of learners' reaction is also crucial both at "emotional adherence" to the system as at improved learning efficiency.

8.2. Objectivos
8.2. Objectives
Descrição dos Objectivos do Projecto
Project Objectives (description)

The general objective of the project is to evaluate a software prototype of a light tutoring system, as characterised in the abstract.
Specific objectives for the prototype to be evaluated are:
- Web based: designers and learners interacting with it through a Web browser and connection.
- To implement (designer interface) the facilities needed to create a course description, according to the characteristics outlined, and to test its result as a running course.
- To implement (learner interface) a learning mode of the tutoring engine which actually allows for a student to take the course and to receive visual feedback of his or her advancement.
Specific objectives for the evaluation on a minimal target number of 5 trial courses are:
- To assess the overall usability of the designer and learner interfaces.
- To assess the cost of setting-up courses.
- To assess the learning performance of students using the trial courses against a convenient reference.

Descrição dos Objectivos do Investigador Responsável
Principal Investigator Objectives (description)

The general objective of the PI is to contribute for the satisfaction and realisation of what he perceives as both a pressing collective necessity and a promising collective possibility: learning – faster, better and more – through the use of computers and communications equipment.
The specific objective of the PI is to test experimentally the working hypothesis underlying the submitted project, i.e., to get measures from course designers and students of the potential impact of the LiTS concept for generating useful software.

8.3. Estado da Arte
8.3. State of the Art
Descrição do Estado da Arte
State of the Art (description)

To the best knowledge of the PI there is no scientific established confirmation or rejection of the working hypothesis underlying the project's submission. T. Murray (1999) in a survey paper of ITS authoring systems states that "A very rough estimate of 300 hours of development time per hour of online instruction is commonly used for the development time of traditional CAI". And further that "Many hope to see ITS development times that are an order of magnitude less than the 300:1 CAI productivity ratio".

While these figures are clearly relevant to the research to be made in LiTS, they stay somehow unlinked to the question addressed by this project. First, because it is necessary to know how one hour of online instruction relates

with learning performance. Second, because the learning procedures are open in content which means that a designer may author content for a course but she is free not do so – she may just point content that should be studied or even point no content at all and request the student to make some experience. And third, because a LiTS does not aim to be an ITS although it is hypothesized that it will put at the designer's hands a minimal set of tools to produce quite intelligent courses.

This having been said, it becomes necessary to give arguments on why, in spite of an eventually perceived "strangeness", the LiTS proposal makes sense and the working hypothesis deserves to be tested.

Artificial Intelligence – from the days of A. Turing – has followed a developing path that one may term as expert centred. At the core of the endeavour stands an expert, be him a logician, a mathematician, a computer scientist, a physician, an engineer – whose knowledgeable behaviour is to be reproduced by the intelligent artefact to be built, most often this being a computer running a piece of software. The knowledgeable behaviour may be exceedingly complex, but assuming that any system is amenable to a logico-mathematical model, and building on a result of E. Post (in P. Odifreddi, 1989) – that all logical deduction is computable – the endeavour seems reasonable and even exciting. By writing software or by writing software that rewrites itself, one expects to create artefacts more and more intelligent, that progressively will make the knowledge of few available to satisfy the needs and desires of many. The whole process looks as if some spots – the experts – radiate their knowledge through the reproductive capabilities of the written software to the collective of all other people, who, in this manner, do not need to know.

Yet, there are arguments both theoretical and empirical indicating that an expert centred intelligent artefact is not the best technological solution to every problem one thinks it may be and that, in fact, many problems may be better solved by "lighter" approaches. These approaches, while not freeing the "all other people" from knowing, also do not pose for anyone the stringent conditions of own knowledge, which the designer of intelligent artefacts embraces.

Let one consider the Law of Requisite Variety (LRV) stated by W. Ashby (1956). It applies to any 2 systems connected in a feedback configuration from which one is distinguished as the controller and the other as the controlled system. It is the goal of the controller to induce a desired behaviour of the controlled system. Keeping aside aversive connotations that the word "control" may have when applied to humans rather than machines, one may recognise that this is the case for tutoring (or teaching). Tutors (or teachers) and learners are connected in a feedback configuration (hopefully!) and it is the goal of the tutor (or teacher) to induce an optimal learning behaviour of the learner.

The concept in LRV is that the variety of the controlled system will make it deviate from the desired behaviour. And that to cope with the provoked deviations the controller must possess an equal or greater amount of variety. Let one suppose that one models the variety of the possible systems to be controlled by a non-stationary model with n parameters. Then the controller must have n parameters and the values of some of them must be adjusted. Adjusting requires algorithms to change the values – software that rewrites itself – that comes along with more, say, r parameters to be at least initialised. As long as one tries to model more precisely the controlled system or address larger populations, n+r will increase and in general the controller's complexity. It will also increase if one takes the dual approach of modelling not the controlled system but the controller, i.e., the expert (in this case tutor or teacher). Then the same problem arises as an increasing intelligent or knowledgeable behaviour also exhibits increasing variety.

So it seems worthwhile to consider an enlarged spectrum of problem solving strategies – including the expert centred approach. An implicit assumption in this one is that the "all other people" are factored out from the searched technical solution to the problem. What if "all other people" are factored in the search?

Then an intriguing possibility arises: collective intelligence (D. Wolpert, 2004; F. Heylighen, 1999, P. Garrido 2006) may emerge.

In the PI's view collective intelligence happens when a group of people exhibits a level of intelligence that is greater than the mean level of its members. It is currently recognised that in today's conditions, an intelligent collective must be supported by a communications network. To this one should add computers and software that enable people to exercise their knowledge and exploration capabilities, without requiring levels of aversive effort.

If one considers the problem of getting people to learn faster, better and more, then the "all other people" that must be factored in the search of a solution are clearly teachers. It is hypothesised that the LiTS concept may give birth to software that enables a great number of them to exercise their knowledge and exploration capabilities in creating tutoring systems that address their most pressing concerns of providing individualised guidance to their students.

The LiTS concept binds a number of ideas that in isolation may seem nearly trivial, but that together make sense for

building tutoring systems: making the tutoring engine independent of domain knowledge, structuring the knowledge domain as a DAG according to a constructive relation among nodes, exploring the DAG to guide students through the knowledge domain and to assess their progress, adopt the widely used method of multiple choice answers to measure objectively progress, leaving learning procedures open in content both for initial learning as for feedback on errors, and proposing the deduction of contradiction as the default for the last.

In relation to previous work on teaching interfaces (P. Garrido, 2004), the PI sees LiTS as a very satisfactory advance prompted by the submission of this project.

Other relationships of the proposed work with the state of the art are dealt with in the Web page:

http://www.lits.dei.uminho.pt

References

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F. Heylighen, (1999). Collective intelligence and its implementation on the Web: algorithms to develop a collective mental map. Computational and Mathematical Theory of Organizations, 5(3), 253-280.

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P. Garrido, (2004) A learning-oriented knowledge representation for teaching interfaces. In Proceedings of the International Conference on Systems, Man and Cybernetics, The Hague, Netherlands, October 2004.

P. Garrido, (2006). Collective Intelligence. Submitted to Encyclopaedia of Networked and Virtual Organisations (G. Putnik and M. Cunha, Eds).

T. Murray, (1999). Authoring Intelligent Tutoring Systems: An Analysis of the State of the Art, International Journal of Artificial Intelligence in Education, 10, 98-129.

W. R. Ashby, (1956). An Introduction to Cybernetics (Spanish version) (1960 ed.). Buenos Aires: Nueva Visión.

8.4. Resultados e Repercussões
8.4. Results and Repercussions
Divulgação de Resultados (descrição)
Diffusion of Results (description)

Diffusion of results will be made through:

- 1 communication to an international conference at the end of the first year of the project, describing the project aims and the software prototype developed.

- 1 communication to a Portuguese conference at the end of the first year of the project, describing the project aims and the software prototype developed.

- 1 communication to an international conference at the end of the second year of the project, describing preliminary results of the prototype´s evaluation.

- 1 communication to a Portuguese conference at the end of the second year of the project, describing preliminary results of the prototype´s evaluation.

- 1 communication to an international journal at the end of the project describing the project and its results in full.

- 1 communication to a Portuguese journal at the end of the project describing the project and its results in full.

To these, one must add the fact that the web site hosting the prototype will act as a locus of diffusion in the Web of the project and its results .

Repercussões (descrição)
Repercussions (description)

As any scientific endeavour which aim is to test a hypothesis, the repercussions of this project depend on the outcomes of the test. So, to speak about repercussions one must consider the possible outcomes.
One recalls that the working hypothesis underlying this project submission is that the LiTS concept will allow building tutoring systems with a performance / price ratio that will enable a significant spread of their usage and

consequent social learning performance gains.
Now, let one examine first an extreme negative outcome. That would result from the evaluation of the prototype clearly indicating that the working hypothesis under the LiTS concept is plainly false. No repercussions are to be expected other than making explicit reasons of failure of the approach.
An extreme positive outcome would be to confirm the working hypothesis in full (or at least in a very high degree). In this case the repercussions of this project could be many and interesting. It could give rise to a generation of tutoring systems, either standing alone or to be integrated inside Learning Management Systems. Although these tutoring systems would be limited to "learning tasks which completion is currently believed to be reasonably assessed by multiple-choice tests", the domain of tasks that are amenable to such assessment is indeed so large, from primary schools to universities, from scholar education to professional education, that such result would have a significant impact. It could even give birth to a kind of learning oriented knowledge representation.
Of course, a spectrum of intermediate results lay in-between these two extreme outcomes with corresponding repercussions, from delimiting learning tasks types where LiTS may be useful to a deeper understanding of factors of success of tutoring systems, both from the learner's point of view (amount and quality of feedback received) as from the designer's point of view (adequateness of basic concepts of the system, easiness of creating effective and or sophisticated teaching strategies).

8.5. Regionalização
8.5. Regionalization

Região Region	Percentagem Percent
Norte	100
Centro	0
Lisboa e Vale do Tejo	0
Alentejo	0
Algarve	0
Região Autónoma dos Açores	0
Região Autónoma da Madeira	0

Descrição
Description
The regionalisation results of this project are only worth to be discussed if the outcomes of the evaluation are (strongly) positive.
In this case, the concept of LiTS will be shown viable and it comes in order that the results of the project enter a knowledge transfer process (KTP). It is conceivable that this KTP may have a host of ways for being realised. A very plain one would be to create a company or organisation which would lead the development and spread of EiTS, both in the revision and upgrading of the tutoring engine as in the collection of developed courses, actually establishing a learning centre.
The creation of such a company or organisation will naturally proceed through University of Minho Knowledge Transfer Office and also naturally it would have its headquarters nearby – although theoretically it could be located anywhere. If that is the case then the regionalisation impact would be, from this point of view, largely dominant at the North region of Portugal.

8.6. Tarefas
8.6. Tasks

Lista de tarefas (7)
Task list (7)

Designação da tarefa Task denomination	Data de início Start date	Data de fim End date	Pessoas * mês Person * months
E1 Specifications for evaluation of the ...	01-03-2007	29-02-2008	12
P1 Analysis and design of prototype soft...	01-03-2007	31-08-2007	7,5
P2 Prototype's implementation	01-09-2007	29-02-2008	7,5
P3 Prototype's debug and documenting	01-03-2008	28-02-2009	15
E2 Field evaluation of designers	01-03-2008	31-08-2008	6,6
E3 Field evaluation of students	01-09-2008	28-02-2009	6,6
E4 Consolidation of the results and conc...	01-03-2009	31-08-2009	2,1

(Os detalhes de cada tarefa estão disponíveis clicando na designação correspondente)
(Details for each task are available by clicking on the corresponding denomination)

8.7. Referências Bibliográficas
8.7. Bibliographic references

Ano Publicação
Year Publication

2004 Garrido, P. "A learning-oriented knowledge representation for teaching interfaces". In Proceedings of the International Conference on Systems, Man and Cybernetics, The Hague, Netherlands, October 2004.

2004 Carvalho, Ana Amélia Amorim e Pereira, Virgínia (2004). A Web-based learning platform to promote cognitive flexibility through deconstruction and reflection. In Janice Nall & Robby Robson (eds), E-Learn 2004 –World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Norfolk, VA: Association for the Advancement of Computing in Education, 1120-1126.

2002 Carvalho, Ana Amélia Amorim; Pinto, Carlos Sousa e Monteiro, Pedro (2002). FleXml: an integrated distance learning tool to improve cognitive flexibility. In J. A. Carvalho, A. Hubler e A. A. Baptista (eds), Proceedings of the 6th International ICCC/IFIP Conference on Electronic Publishing, Berlin: VWF, 115-124.

2004 Carvalho, Ana Amélia Amorim (2004). Avaliar a Usabilidade da Plataforma FleXml: descrição dos testes realizados com utilizadores. In Ximena Barrientos (ed), Actas do VII Congreso Iberoamericano de Informática Educativa. Monterrey: Universidad de Monterrey, 197-206.

2005 Pedrosa, Raquel; Valente, Joana; Rocha, Filipe; Carvalho, Ana Amélia (2005). Modelo de Aprendizagem Contextual Online: uma proposta. In António Mendes, Isabel Pereira e Rogéro Costa (eds), Simpósio Internacional de Informática Educativa. Leiria: Escola Superior de Educação de Leiria, 257-262.

8.8. Artigos Anteriores
8.8. Previous Articles

Ano **Year**	**Artigo (endereço na *Internet* - URL)** **Paper (Link in the Internet - URL)**
2002	http://www.lits.dei.uminho.pt/qblc.pdf
2001	http://www.lits.dei.uminho.pt/utes.pdf
2002	http://www.lits.dei.uminho.pt/tu.pdf
0	*(vazio)* *(void)*
0	*(vazio)* *(void)*

9. Ficheiros Anexos
9. Attachments

-

Nome **Name**	**Tamanho** **Size**
LiTS_Figures.pdf 31-08-2006 5:31:53	98Kb

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