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On Modelling e-Education Ecosystems in Multicultural Contexts

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Abstract. A sociotechnical system is a complex inter-relationship of people and technology, including hardware, software, data, physical and virtual surroundings, people, procedures, laws and regulations. An e-Education environment is a particularly complex example of a sociotechnical system that requires equal support for user needs and technological innovations. The challenge for e-Education environment development is that in addition to the producers, users, domain experts and software developers, pedagogical experts are also key stakeholders. In our paper, we discuss different meta-aspects and components of modelling e-Education ecosystems in multicultural contexts.

Keywords. e-Education, ecosystem, multicultural, context, LTSA

Introduction

The growing multicultural nature of education and training makes it critical that instructors and instructional designers, especially those working in e-Education environments, develop the skills to deliver culturally sensitive and culturally adaptive instruction. In addition to the multicultural context in e-Education, we also face global domain contexts for teaching, such as in environmental science, crisis management and medicine.

Cultural sensitivity is not only one-way from a teacher to a learner. Instructional providers should be acutely aware of their own cultures because their world views cannot be separated from the e-Education they develop [1]. They should become cognisant of how their own cultural perspectives are represented in the design decisions they make. Furthermore, instructional providers should examine the assumptions they hold about how learners will and should respond. Moreover, they must balance the need to help students adapt to specific professional, academic and mainstream cultures and the need to embrace the culture in which the student is embedded [2]. Hence, developing e-Education systems in multicultural contexts is no small challenge.

The role and importance of technology in the development of e-Education systems is often exaggerated by technology providers. It is often stated that the implementation of a learning management system (LMS) alone is all it takes to realize e-Education [3]. The problem is that in many cases, the development of e-Education projects devolve into purely technical processes, resulting in expensive software implementations that are essentially unused by uninformed, fearful or resentful teaching staff. Instead, designers, in collaboration with teachers and learners, should seek to understand the basic components of the e-Education ecosystem puzzle (Figure 1). Teachers and learners play key roles in this process. At the University of Jyväskylä (Finland), the rector's office initiated the university level e-Education development project for every faculty. In the Faculty of Information Technology, the focus of the e-Education project is on developing flexible and high level ICT- and pedagogical research-based learning environments [4].

We divide our e-Education system research and development journey into three main parts. First, we model the meta-level of e-Education ecosystems in multicultural contexts, where the aim is to identify and discuss its main components without going into technical details (this paper). In the second phase, we apply a pedagogical model called the progressive inquiry (PI) model to remote teaching requirements engineering in a multicultural e-Education environment, and we also develop feedback mechanisms for this e-Education environment (forthcoming paper). In our third phase, we report the practical results of the teaching requirements engineering in an e-Education ecosystem in a multicultural context (forthcoming paper).

In this first paper, we discuss the different meta-aspects and components of modelling e-Education ecosystems in multicultural contexts. The paper is organized as follows. In Section 1, we define an e-Education ecosystem. In Section 2, we briefly describe the learning technologies systems architecture (LTSA) defined by IEEE as our abstraction framework. The requirements engineering approach of e-Education in multicultural contexts is discussed in Section 3 (this must not be confused with teaching requirements engineering). In Section 4, we introduce the cultural dimensions of multicultural e-Education environments. Finally, in Section 5, we conclude and describe some issues for further research.

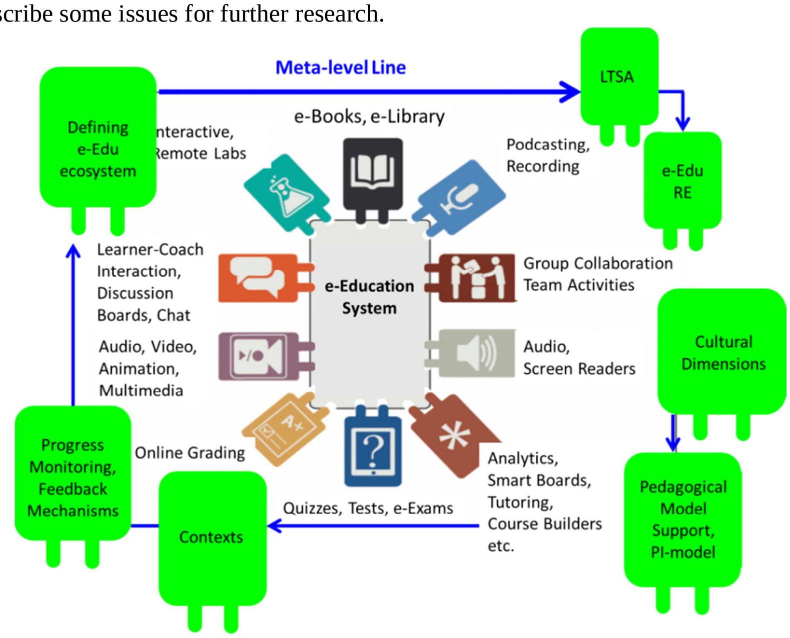

Figure 1. The basic components of an e-Education system. The green components are meta-level topics (meta-level line) which are the focus of our research on the first phase. The inner components are the technical issues that cannot be efficiently realized before the meta-level topics are processed.

1. What is an e-Education Ecosystem?

The term “ecosystem” is usually associated with the biological sciences. However, in recent years, the e-Education community has begun to study the e-Education environment metaphorically as a self-sustaining ecosystem which provides learners the tools and surroundings they need to achieve their learning objectives [5]. What are the characteristics of an e-Education ecosystem and how can e-Education professionals create ecosystems that encourage change and motivate both learners and teachers?

The development of e-Education systems is often technology-driven. It is often stated that an LMS alone is all it takes to implement e-Education, so in many cases, the focus of e-Education projects seems to be mainly on technical issues and processes [3]. Instead, designers and developers should try to understand the basic components of what constitutes an e-Education ecosystem. The e-Education ecosystem approach specifies the requirements for e-Education system architecture from the viewpoints of both pedagogical development and systems integration. The pedagogical models and requirements, both pedagogical and technical, for supporting learning change over time, and so should e-Education systems.

Digital ecosystems are metaphorically based on a systemic evolutionary process and may be composed of three different layers [6, 7]. The first layer is the ecosystem infrastructure which includes the mechanisms for the composition, its evolution and the migration of the digital components among the different users. The second layer is the domain-specific ecosystem including the services, solutions and components tailored for a specific domain. Finally, the third layer is the local ecosystem, referring to local implementations of the domain specific ecosystem in nodes and networks of innovation.

In many respects, an e-Education ecosystem is very similar to a scientifically-based ecosystem. Science defines an ecosystem as being a community where organisms interact with one another and with their physical environment [8]. Every organism has a role to fulfil and there must be a harmonious balance between all aspects of the ecosystem for the organisms to flourish and evolve. In the world of e-Education, an e-Education ecosystem is an environment involving educational models and technologies and authoring tools and resources. Its main objective is to promote knowledge and skills development for all learners within the e-Education framework. Every member of the e-Education environment should be active and contribute for all learners to get the most benefit, such as through group work. Every learner should also take advantage of the resources available to achieve their goals and objectives. For an e-Education ecosystem to be successful, all participants must be empowered to learn and feel as though they are part of the overall ecosystem.

What are the basic components of an e-Education ecosystem? According to the scientific definition, every ecosystem has three main components: organisms, a physical environment and the relationships between the organisms and their environment [9]. In an e-Education ecosystem, the corresponding components are teachers/supervisors/learners/facilitators, which are the actual “organisms” of the e-Education ecosystem, and the e-Education space and resources. In other words, we need e-Education platforms where learning will take place and e-Education cultures which create positive attitudes towards the overall learning processes and participants’ interaction with e-Education courses.

There are also a number of core ideologies that are part of a successful e-Education ecosystem, such as [2]:

- Engaging e-Education content. One of the most important aspects of a successful e-Learning ecosystem is high quality content that engages and emotionally connects the learner with the e-Education course. Regardless of the format, the content should always achieve learning goals and change learning behaviours. As a result, learners should be able to improve their lives outside of the e-Education ecosystem.
- Continuous assessment and feedback mechanisms. Assessment is the key to any learning process. Assessment should be given on a regular basis, such as after completing a module or phase. Step-by-step assessment and progress gives teachers and supervising teachers the means to monitor learner progress, which may include reports, course diaries, quizzes or e-exams.
- Modern technologies and learning tools, which give learners access to the knowledge and skill set development they need to achieve their goals and offer them the possibilities to interact with other students in the same e-Education course or in the same e-Education environment (such as at the campus level).
- A support structure for learners. A solid support structure (such as easy access to supplemental online resources, their teachers and other students) is the core of every successful e-Education ecosystem. If learners do not get the help and feedback they need during the e-Education process, they are less likely to achieve the desired outcome. This is why a support structure is of the upmost importance, in addition to a supportive e-Education culture. In practice, this means that the teacher/supervising teacher should fully commit herself/himself to his/her e-Education courses and related processes.
- A support structure for teachers and supervising teachers. Reliable and solid e-Education support services are also necessary for teachers and supervising teachers. Usually these services are provided by the university's IT department.

Above all, an e-Education ecosystem should provide learners with encouragement and motivation for them to become active members of the e-Education group or community. So, how should we proceed to develop the architecture for an e-Education system? We would like to keep it neutral at the meta-level to avoid discussions on technical details in this phase of the development process. We use the learning technologies systems architecture (LTSA) developed by the IEEE [10] to continue on our e-Education journey.

2. The Learning Technologies Systems Architecture (LTSA)

A sociotechnical system is a complex inter-relationship of people and technology, including hardware, software, data, physical and virtual surroundings, people, procedures, laws and regulations [11]. An e-Education environment is a particularly complex example of a sociotechnical system that requires equal support for user needs and technological innovations. The challenge for e-Education environment development is that in addition to the producers, users, domain experts and software developers, pedagogical experts are also key stakeholders. Thus, two main levels of tasks must be taken into account: (1) learning tasks that are of interest to pedagogical experts and (2) working tasks (the performance of which should be supported during the course) that are of interest of the environment's producers, users and domain experts. Both influence the functionality, quality, content and presentation of the e-Education environment. In practice, it is the pedagogical strategy that drives the courseware.

We apply the learning technologies systems architecture (LTSA) developed by the IEEE [10]. Abstraction of the LTSA is presented in Figure 2, and definitions of the LTSA components are summarized in Table 1.

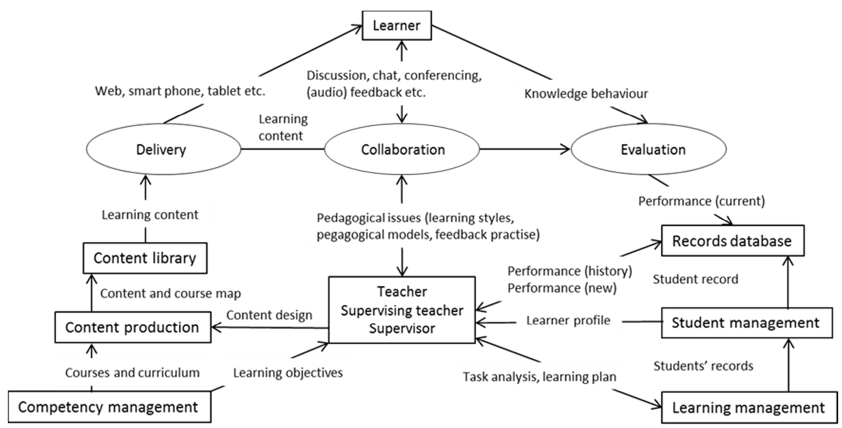

Figure 2. Abstraction of the learning technologies systems architecture (LTSA) [10].

Table1. Definitions of the LTSA system components [10].

System component	Definition
Process	
Learner entity	The learner entity may represent a single learner, a group of learners learning individually, a group of learners learning collaboratively, a group of learners learning in different roles, etc.
Evaluation	The processing of behaviour information to produce assessment and learner information.
Coach (teacher, supervising teacher or supervisor)	Negotiates/exchanges learning parameters for optimum learning experience, receives current assessment information from evaluation, searches and retrieves learner information relevant to the current learning experience and searches learning resources via queries for appropriate learning content.
Delivery	An abstract process that may transform information obtained via learning content into a presentation, which may be transferred to the learner entity via a multimedia data flow.
Data flow	
Learning parameters	A two-way data flow representing exchange between the learner entity process and the coach process.
Behaviour	A data flow from the learner entity process to the evaluation process that represents information about learner activities and

	actions, which may be used by the evaluation process.
Learner information stored/retrieved by evaluation	A two-way data flow between the evaluation process and the learner records data store that represents the storage and retrieval of learner information.
Learner information received by system coach	A one-way data flow from the learner records data store to the coach process that represents the coach process requests for learner information.
Learner information stored by system coach	A one-way data flow from the coach process to the learner records data store that represents the coach process requests to store learner information.
Catalogue information	A one-way data flow from learning resources to the coach process that represents the result of searches of the learning resources data store, as directed by the query control flow.
Locators sent by coach	A one-way data flow from the coach process to the delivery process that identifies or points to learning content.
Learning content	A one-way data flow that represents the materials that create, coach, suggest and deliver on the learning experience.
Interaction context	A one-way data flow from the delivery process to the evaluation process that may provide information necessary for the evaluation process to interpret the information supplied by the behaviour data flow.
Multimedia	A one-way data flow that represents the simultaneous presentation of several types of media from the delivery process to the learner entity.
Data store	
Learner records	The storage and retrieval of past, present and future learner information.
Assessment information	A data flow from the evaluation process to the coach process that represents information about learners' current states, which may be used in the coach process to determine optimal learning experiences.
Learning resources	A data store that may include representations of knowledge, presentations, tutorials, tutors, tools, experiments, laboratories and other learning materials.
Control flow	
Query	A one-way control flow from the coach process to the learning resources that represents search requests for learning content.
Locators sent by delivery	A one-way control flow from the delivery process to the learning resource store is a control flow containing locators (such as URLs) identifying or pointing to learning content.

The LTSA provides a neutral abstraction schema for an e-Education system. LTSA is a conceptual model representing the information flow and links between various modules and the interaction between the main processes and the learning value chain. Next, we need a requirements engineering approach to make LTSA more concrete.

3. A Requirements Engineering Approach to e-Education Systems Development

A requirement is a condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification or other formally imposed document [12]. A well-formed requirement is a statement of system functionality (a capability) that must be met or possessed by a system to satisfy user needs or objectives and that is qualified by measurable conditions and bounded by constraints [13].

Requirements engineering contains a set of activities for discovering, analysing, documenting, validating and maintaining a set of system requirements [14, 15]. It is divided into two main groups of activities: requirements development and requirements management. Requirements development includes activities related to discovering, analysing, documenting and validating requirements, whereas requirements management includes activities related to maintenance, namely identification, status tracking, traceability and change management of requirements. Requirements are commonly classified as [14, 15]:

- Business requirements, which describe why the project is being undertaken;
- Business rules, which include corporate policies, government regulations, industry standards, accounting practices and computational algorithms. There are not software requirements per se but the origin of several types of software requirements;
- Design constraints, which are requirements that affect or constrain the design of a system or system component, such as language requirements, physical hardware requirements, software development standards and software quality assurance standards;
- External interface requirements, which are requirements that specify the hardware, software or database elements with which a system or system component must interface or that sets forth constraints on formats, timing or other factors caused by such an interface;
- Features, which are one or more logically related system capabilities that provide value to a user and are described by a set of functional requirements.
- User requirements, which describe the tasks users must be able to perform with the system;
- Project requirements, which are the constraints placed on the development process of the system, e.g. budget, schedule and staff;
- Functional requirements, which specify an action that a system must be able to perform, without considering physical constraints, and specifies a system's input/output behaviour;
- Non-functional requirements, which specify system properties, such as environmental and implementation constraints, performance, platform dependencies, maintainability, extensibility and reliability. Non-functional requirements are often classified into the following categories:
    - Performance requirements, which specify the performance characteristics that a system or system component must possess, such as maximum CPU usage or maximum memory footprint;
    - External interface requirements, which specify the hardware, software or database elements with which a system or system component must interface or that sets forth constraints on formats, timing or other factors caused by such an interface;
    - Design constraints, which are requirements that affect or constrain the design of a system or system component, such as language requirements, physical hardware requirements, software development standards and software quality assurance standards;

- o Quality attributes, which are requirements that specify the degree to which a system possesses attributes that affect quality, such as correctness, reliability, maintainability and portability.

Figure 3 shows the main specification levels of the e-Education system requirements engineering process.

Level 1: Learners Specification
- Learner characterization
- Acquired educational profile
- Requested educational profile

Level 2: Cultural Specification
- Cultural models (Hall, Hofstede, Lewis)
- Learning styles

Level 3: Pedagogical Specification
- Pedagogical model selection (PI-model)
- Main learning objective:
  - Subjects to be taught
  - Task definition
  - Required educational profile
  - Target educational profile
  - Description of socio-technical environment
  - Definition and description of learning places
- Instructional strategy:
  - Definition and specification of phases
- Feedback mechanisms

Level 4: Learning System Context Specification
- System environment
- Support for pedagogical models
- Organizational e-Education strategy
- Organizational IT-services/support strategy

Level 5: Interaction Specification
- Accessability
- Navigation functions
- Orientation functions in courseware space
- Functions for collaboration
- Content modules and organization

Level 6: Data Specification

Level 7: Implementation Specification

Level 8: Courseware Architecture Specification

Figure 3. The main specification levels of the e-Education system requirements engineering process.

Level 1 (learner specification) serves to identify the learner roles and their tasks. Level 2 (cultural specification) relates to the identification of cultural models and learning styles. Pedagogical specification defines the pedagogical models and learning styles to be used in Level 3, including instructional specification (such as writing, language and presentation styles, the usage of examples, and exercises and their feedback mechanisms). Level 4 specifies the e-Education system context. Level 5 (courseware interaction specification) mainly deals with functional requirements, specifying requirements such as navigational functionalities, functionalities for orientation in the courseware space and functionalities for supporting cooperation and collaboration, including a rough dialog and user interface design. In Level 6, data requirements, which are mainly requirements regarding the content of the courseware (such as the topics that have to be covered and the characteristics of these topics), which must be complete, up-to-date and consistent. Data requirements, which specify how the content has to be modularised and organised (such as the number of modules to be developed, the maximum online learning time a module is allowed to comprise, or sequences of content that have to be realised in the courseware). Implementation requirements in Level 7 deal with restrictions on media usage in the courseware and the parameters of the media types. Finally, the courseware architecture specification in Level 8 defines how the courseware interacts with components required to run the courseware. Examples of such components are an LMS, feedback mechanisms, a user management component, a chat system and a content management system. It also supports the selection of the hardware suitable to run the courseware.

Communication between the learner and the coach is the heart of the e-Education environment. To determine what we must take into account in multicultural e-Education environments, we must investigate Level 2 in more detail.

4. The Cultural Dimensions of an e-Education Framework

The multicultural nature of higher education environments is an emerging trend. It is important that university teachers and supervisors, especially those working in e-Education environments, develop their pedagogical and technical skills to deliver culturally sensitive and culturally adaptive education.

Inherent in multicultural environments is the need to recognize cultural differences. People from different cultures tend to perceive the world differently but are sometimes unaware of these alternative ways of perceiving, believing, behaving and judging. According to Hall [16], most people hold unconscious assumptions about what is appropriate in terms of space, time, interpersonal relations and ways of seeking truth. These assumptions may cause intractable difficulties in intercultural encounters. A conscious effort must therefore be made to overcome ethnocentric attitudes and to recognize the cultural differences between nations and ethnic groups.

Intercultural awareness is a prerequisite for achieving intercultural understanding and developing intercultural communication skills. It starts when a person realizes that he or she has a certain cultural identity that is one among many and becomes aware of the similarities and differences between cultural identities. The ability to differentiate enables people to compare and therefore evaluate their culture in relation to others. Developing intercultural competence includes self-reflection, gathering information about one’s own and other cultures, appreciating cultural similarities and differences, using cultural resources and acknowledging the essential equality and value of all cultures. Culture is demonstrated, amongst other things, by the ability or sensitivity to interpret intercultural styles of communication (language, signs, gestures, body language and customs). In intercultural communication, people communicate within and between cultures by means of language, which is therefore central to their social relationships and reveals status, power, authority and levels of education. Cultural differences therefore tend to be revealed in language and misunderstandings between people from different cultures tend to arise from their use of language to communicate with each other. Successful communication is only possible on the basis of a shared code. To share a code you must know the meaning of the foreign word(s) and the meaning must be the same in both languages for if it is different, the code is not shared [17].

In conclusion, what is required to achieve proper intercultural understanding is informed intellectual appreciation of and engagement with cultural and individual differences, which presupposes the recognition and acceptance of the existence and inevitability of cultural diversity. These requirements should be fulfilled in a spirit of tolerance, empathy and respect.

Parrish and Linder-Van Berschot study cultural differences to recognize those dimensions of culture that are most likely to impact educational situations [1], identifying eight cultural parameters of social relationships (equality and authority, individualism and collectivism, and nurture and challenge), epistemological beliefs (stability-seeking and uncertainty acceptance, logic argumentation and rationality, causality and complex systems) and temporal perceptions (clock and event time and linear and cyclical time).

In our study, we apply their findings and the three main cultural models, Hall's model, Hostede's model and Lewis'model, to development process of our e-Education ecosystem [16, 18, 19]. (The cultural models are only referred here because they have been discussed in more detail in several EJC-forum papers, such as [20, 21, 22, 23]). The cultural dimensions of an e-Education framework are presented in Table 2.

Table 2. The cultural dimensions of an e-Education framework.

Social relationships	**How is this dimension manifested in e-Education situations?**	
1. Equality and authority How is inequality handled? How is status demonstrated and respect given? What interactions are appropriate for those of unequal status?	**More equality** Teachers are treated more as supervisors. Students take responsibility for learning activities. Dialogue and discussion are critical learning activities.	**More authority** Teachers are treated as authorities. Teachers are responsible for what happens in the course. The teacher is the primary communicator.
2. Individualism and collectivism Which prevails, the interest of the individual or the interest of the group? To what degree are interpersonal relationships valued?	**More individualistic** There is an expectation that students speak up. Learning how to learn (cognitive skill) is primary (individual growth). Expression of the student's point of view is a valuable component of learning. Hard work is motivated by individual benefit.	**More collectivist** Students speak up in limited situations. Learning how to do (content knowledge) is primary (social growth). Students expect to accommodate the teacher's point of view. Hard work is motivated by the greater good.
3. Nurture and challenge Which is the more important set of goals, cooperation and security or recognition and advancement? Which achieves better learning outcomes, supportive acts or challenging	**More nurturing** The average is used as the norm. All students are praised. Collaboration is cultivated. Failure is a growth opportunity. There is more modesty. Good relationships and security are sought.	**More challenging** The best student is used as the norm. Only excellence is praised. Competition is cultivated. Failure is a highly discouraged. There is more assertiveness. challenges and

acts?		recognition are sought.
Epistemological beliefs	**How is this dimension manifested in e-Education situations?**	
4. Stability-seeking and uncertainty acceptance How is uncertainty dealt with? Is it avoided or accepted? Is structure assumed to be more important than flexibility? What is the status of knowledge, established or in a process of development?	**More stability-seeking** There are more structured learning activities and a focus on getting the right answers. Ambiguity is to be avoided. Teachers are expected to have the answers. There is single textbook or teacher authority. Luck is a factor in student success (e.g. guessing the right things to study for the test). It is more stressful.	**More uncertainty acceptance** The focus is on process and justified opinions. Learning activities are more open-ended (discussions and projects). Ambiguity is a natural condition. Teachers can say 'I don't know'. Many resources are used. A demonstrated ability to think is the key to academic success, not having right answers. It is less stressful.
5. Logic argumentation and rationality How are arguments developed? Which is more important, logical consistency or practical outcomes? How is disagreement managed?	**More logical** There is a focus on logical argumentation to find truth and an insistence on single truths based on logical reasoning. Debate/argumentation are learning activities. Being right is the most important. There is a willingness to challenge others when the teacher/students are presumed wrong or are being inconsistent.	**More reasonable** There is a focus on achieving practical and socially acceptable outcomes and an acceptance of multiple truths based on experience. Consensus building is a learning activity. Being virtuous is the most important. There is an acceptance of contradictions for the sake of continuity and harmonious dialogue.
6. Causality and complex systems (analysis and holism) How is causality typically assigned? Is it assigned to a single, most likely source, or is it assigned to the broader context? (	**More focus on causality** Learners are expected to be goal-oriented. Knowledge is tied to cause and effect explanations. There is a focus on stable knowledge and rules, and learning success or failure is attributed to student characteristics.	**More focus on systems and situations** There is more willingness to work within situational constraints. Knowledge is tied to explanations of systems and situations. There is a focus on evolving and situational knowledge. Learning success or failure is attributed to the situation.
Temporal perceptions	**How is this dimension manifested in e-Education situations?**	
7. Clock time and event time Do people conform to an external measure of time or do they allow the event at hand to unfold in its own time? Which are more important, deadlines or relationships? (	**More clock focus** Instructional activities start and stop promptly. Meetings outside of class time are limited to strict schedules. There are strict deadlines and consequences for missing them. Learners like procedures. Learners work quietly towards planned ends	**More event focus** Instructional activities are allowed to continue as long as they are useful. Boundaries between class and outside class time are more fluid. Work continues towards improvements with less regard for deadlines. Learners are willing to bypass procedures. Learners are talkative, expressive and may ignore plans.
8. Linear time and cyclical time Do people see time as a path and see goals as necessary destinations or as a pattern of interlocking cycles into which they step in and out over the	**More linear time** Time is to be managed. Learning proceeds along a linear path with clear prerequisites and milestones. Goal-setting is essential to learning. Time is not to be wasted,	**More cyclical time** One adapts to time. Learning is seen as practice towards slowly increasing perfection. Goals are secondary, one adapts to the situation to draw from it as

course of a life?	and actions should be quick and decisive if one cares about achievement. Opportunities are not to be wasted. Chances do not present themselves twice. The past is irrelevant. Future goals are what are important. Repetition can be seen as a being in a "rut" (not progressing). Students want to see immediate relevance.	much as possible. Time exists for observation and reflection, and rushing is counter-productive to achievement. Because time is a series of cycles, opportunities recur. When they do, one may make wiser decisions. The past is influential because cycles repeat. One carries the past forward. Repetition is valuable for learning. Students may be more patient to discover relevance.

We can summarize the challenges in practicing e-Education in multicultural contexts as follows [1]: (1) understanding and appreciating learner cultural differences to make the appropriate instructional decisions to enhance their learning; (2) becoming aware of one's own cultural preferences and not assuming a "right" way to think; (3) to improve instruction, determining which learner behaviours represent cultural values and are therefore less prone to modification; (4) accepting the dual responsibility of educators to acculturate and respect individual learner cultural backgrounds and (5) accepting that research-based instructional strategies are also culture-based and therefore may, at times, be inappropriate or require adaptation.

5. Conclusions

In this paper, we discussed the basic, meta-level components of e-Education ecosystems in multicultural contexts. Our main message is that the more technical issues cannot be efficiently realized before the meta-level topics have been addressed. We presented the learning technologies systems architecture (LTSA) as the abstraction schema for our e-Education systems framework. We described the main requirements engineering levels for e-Education systems specification, and we introduced the cultural dimensions of e-Education environments.

Our next research paper and development phase will use the progressive inquiry (PI) pedagogical model for developing a context-aware e-Education environment and feedback mechanisms. Context-aware e-Education is an educational model that guides the selection of learning resources to make the e-Education content more relevant and suitable for learners in a specific context. Our case study will be related to the e-requirements engineering (e-RE) course in the Faculty of Information Technology at the University of Jyväskylä.

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