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In its first five years, the Journal logged over five million page views and almost one million downloads of Acrobat files of monthly journals and eBooks.

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Editorial

The Future of Curriculum

Donald G. Perrin

The June Editorial introduced the idea of a Divergent Curriculum. Many question its practicality. It is difficult to administer and there is no preexisting standards to compare results.

I previously challenged the relevance of standardized tests. Their thread of comparison belongs to a world that is rapidly disappearing. The so-called "objective testing" bubble has burst like the dot-com and stock-market bubbles, resulting in entirely new trends yet to be defined.

Standardized tests do not reflect the changing world in which we live. Whatever replaces traditional curriculum and standardized tests must be performance based. Outcomes must be defined in measurable and observable terms; knowledge and skills must be proactive to prepare learners for the world they enter on graduation. Curriculum must be redefined to anticipate change. Hence, it will forever be "under construction". Much of what is relevant to the past and the present may not be relevant in the future.

The traditional convergent curriculum tends to limit student learning to what teachers, professors, curriculum experts, and test-makers know and understand. Our students live in a world of computers, cell phones and social networks and their future is not our future. They are eminently capable of solving their own technical problems and learning needs. They can generate programs for their personal growth just as students did in German universities many years ago. Under the German system, students travelled to learn under professors of their choice and returned to their home university for final exams and graduation. Technology now allows us to do this with global reach from our campus, workplace, or home. Learners can customize programs of study relevant to their worlds and their future. And eligible students on any campus can study with top professors in their field without the need to travel.

Today, distance learning technologies have been integrated into regular classroom instruction and distance learning courses qualify for regular credit. Many institutions accept distance learning courses from other universities as part of their regular program. The next breakthrough will be acceptance of entire programs from other institutions so that small and remote campuses can offer a full complement of courses and programs.

Tony Bates futuristic model "to improve cost effectiveness of the academy", (1) also reported by Stephen Downes in OLDaily (2), presents additional options arranged here as ABCs:

- **A**bolish the semester system
- **B**uild courses around learning outcomes, and
  assess outcomes through 'proof of learning'
- **C**reate university consortia to allow for automatic credit transfer
- **D**esign and deliver large undergraduate courses using teams,
  break large classes into groups of 20-30 students, and
  train Ph.D. students in teaching and learning
- **E**mphasize collaborative learning
- **F**ocus on getting students to do the work: find and organize materials and resources

The last point suggests that students could develop their own program of studies. Also, consortia may be an important first step to introduce programs from other institutions and enable small institutions to offer courses in disciplines they were not otherwise equipped to teach.

Vernon Anderson advocated a core curriculum of common learnings from which students could take divergent paths. Over the past century, programs have grown that the core curriculum has become almost the entire graduate program. The core should be small, powerful, and flexible to enable students to build effective programs responsive to their professional needs.

We need to involve our students. Many students know what they need for their professional development even better than we do. They have time for research, and intimate contact with the realities of their profession and their daily lives. Professors and advisors should encourage students to propose a program that is right for them and accept proposals that meet or exceed the academic standards of their discipline and their institution of higher learning.

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1. Tony Bates, http://www.tonybates.ca/2009/10/10/using-technology-to-improve-the-cost-effectiveness-of-the-academy-part-1/ October 10, 2009.

2. Stephen Downes, OLDaily. October 14, 2009

3. Vernon E. Anderson. Principles and procedures of curriculum improvement 2nd Edition, Ronald Press, 1965

Editor's Note: This is a detailed study relating instructional design and preferred learning to effectiveness of online learning. It specifically addresses the use of text, voice and animations on networks with limited bandwidth, and benefits from student feedback through questionnaires and written statements on design elements that contributed to effective learning.

Designing Online Learning Environments for Distance Learning

T. A. Weerasinghe, R. Ramberg, K. P. Hewagamage
Sweden and Sri Lanka

Abstract:

The design of an online learning environment (OLE) and its content of a distance educational programme can be considered as a major factor in success or failure of the learning environment and the respective learning programme. Therefore, the role of the instructional designers who design online learning environments for distance learning programmes has become demanding. To support instructional designers to be effective, they are provided with instructional design guidelines. However, most of these guidelines are not specific and not easily applicable. Therefore, we were motivated to create sets of icable instructional design guidelines that were easy to follow. We selected an OLE which was already reported as successful in achieving learning effectiveness and student satisfaction. We gathered students' experiences using the OLE for their studies and analysed the data to find what design components of the OLE led to learner satisfaction, what design strategies and features for learning content led to the learning effectiveness, and whether there was a relationship between students' learning style preferences and learning design preferences. The findings of the data analysis were presented in a form of instructional design guidelines for instructional designers designing online learning materials for novice online learners following distance learning programmes on computer applications and information technology.

Keywords: instructional design guidelines, online learning, distance learning programmes

Introduction

Instructional designers can design learning content with media elements like text, images, videos, audio clips. Animations and learning environments can be designed with components such as interactive learning content, activities, discussion forums and quizzes. It is the instructional designers' responsibility to design learning components and learning contexts with appropriate media elements to facilitate learning (Tessmer & Richey 1997). However, it is difficult to design online learning materials for distance learners who do not have regular contacts with teachers. Instructional designers need to design the learning material not only with target subject content to be studied alone but also with appropriate guidance and support that learners require to do their studies successfully. Also, some researchers claim that most of the e-learning programmes fail as a result of their poorly designed learning materials (Bork & Britton Jr., 1998; Ismail, 2002). This implies that the design of an OLE and its content can result in success or failure of the learning programme and the OLE through which the learning programme is delivered. Successfulness of an OLE can be measured with the students' satisfaction with the OLE (Levy 2007) and the effectiveness of the OLE for students to achieve their learning objectives by scoring high marks at examinations. Therefore, it is important to study the design components and features of well designed learning materials in distance learning programmes which lead to student satisfaction and learning effectiveness.

There are different findings reported in the e-learning literature regarding components and features of online learning environments which lead to learner satisfaction and learning effectiveness. For example, Rovai and Barnum (2003) report that student satisfaction and students' perceived learning can be significantly influenced by using strategies that promote active online interactions whereas Ecom, Wen and Ashill (2006) report that they could not find any positive relationship between interactions and students' perceived learning.

Other than the course components and design features, student' learning style preferences can also have an impact on the student satisfaction (Piccoli, Ahmed & Ives, 2001) and learning effectiveness (Kim & Sonnenwald, 2002) in an online learning environment. Therefore, it is important to consider students' learning style preferences in designing and delivering online courses (Bostrom et al., 1990). Smith and Woody (2000) suggest that inconsistencies between different reports in the e-learning literature on effectiveness of multimedia instructions may reflect the interaction between the teaching styles and learning styles. When students are not taught but are supposed to learn by themselves, they have to learn with the media and instructions on the distance learning material. Therefore, instructional designers need to know which design components and media elements should be designed for learner satisfaction and learning effectiveness of students having different learning style preferences. Also, instructional designers will find it useful if findings of design experiments in online learning environments can contribute to instructional guidelines to help the instructional designers.

Existing literature provides guidelines to design e-learning materials (e.g. Brown et al., 2002; Goodyear, 2001; Young, 2003). However, Grabinger (1993) reveals that there is a need for empirically based set of instructional design guidelines to facilitate learning. Further, Grabinger recommends three general guidelines; 'provide macro level organisation' (organizing the elements on the template), 'use structure to create micro level of organization' (use a structure to arrange the learning content on the interface) and 'provide visual interest'. However, these guidelines lack specific information that an instructional designer can easily follow. Also, they do not specifically target designing OLEs for learner satisfaction and learning effectiveness. Therefore, a contribution to the field of instructional design would be to provide sets of easily applicable instructional design guidelines with specific information for instructional designers to design OLEs for learner satisfaction and learning effectiveness.

In a previous paper we reported an OLE which was successful in achieving learner satisfaction and learning effectiveness (Weerasinghe et al., 2008). In this paper we discuss the design features, components of the OLE and design strategies used to design the OLE which led to its successfulness as perceived by the students. This paper attempts to provide comprehensive and easy applicable sets of instructional design guidelines for instructional designers designing online learning materials for novice online learners following distance learning programmes on computer applications and information technology.

Design of an Online Learning Environment

University of Colombo School of Computing (UCSC), Sri Lanka, conducts an external degree programme called Bachelor of Information Technology (BIT). UCSC does not provide any face-to-face teaching to the BIT students and, in order to provide necessary guidance and support, UCSC introduced an OLE through a Learning Management System (LMS) at http://lms.bit.lk/lms/. UCSC needs to improve this OLE to provide the necessary support that the BIT students require to complete their degrees successfully. Therefore, the goal of designing our OLE was to achieve learner satisfaction and learning effectiveness where learner satisfaction was measured with learners' attitudes towards the OLE and the learning effectiveness was measured with how well students could score, at the examinations by using only the OLE for their studies.

The students' learning experiences presented in this paper were obtained with respect to the learning contents designed and developed for a practical subject of a course in the first Semester of the BIT programme. The learning objectives targeted at the skills and the knowledge enhancement by using the Dreamweaver application to design and develop Web sites. For example learning content on how to create a hyperlink using the Dreamweaver application software targeted the students' achieving necessary skills to create hyperlinks using the tools available in the application. On the other hand to discuss the importance of creating light weight content for web sites, students needed to acquire some knowledge using the OLE.

Theoretical Perspectives for Designing the OnlineLearning Environment

The online learning materials were systematically designed and developed according to an e-learning content development process which was defined based on a well known instructional system development (ISD) model, ADDIE (Analysis, Design, Development, Implementation and Evaluation) (Weerasinghe et al., 2007). The content development process affirms that online learning content should be designed according to sets of design principles. This paper presents those design principles as design guidelines.

Design guidelines of the OLE were inspired by the principles of the three main directions of learning theories; behaviourism, cognitivism and constructivism. Behaviourism and cognitivism both support structuring of the learning content in small sections, preparing learning objectives and measuring students' learning achievements based on those predefined objectives (Mergel, 1998). If principles of only these two objectivist theories are considered in designing of online learning content, then the online learning content is assumed to perform as a teacher whose job is to transfer the knowledge to the learners (Phillips, 1998). According to Phillips, the learners in an objectivist learning environment are considered as 'empty vessels'. Therefore students in an OLE are not supposed to bring new ideas and construct knowledge by active involvement in the OLE.

Learning environments which actively involve learners in constructing their knowledge through their own experiences are designed according to the principles of constructivist learning theories. According to constructivism pre-defined learning objectives are not always predictable and learning is more open to the students (Mergel, 1998). Therefore, learning activities in a constructivist OLE do not aim to achieve a predefined set of learning objectives and it is difficult to design assessments and grade students' learning achievements in a constructivist OLE.

The design of our OLE was further supported by Gagne's nine events of instruction: gaining attention; informing the learner of the learning objectives; stimulating recall of prior knowledge; presenting the stimulus material; providing learning guidance; eliciting the performance; providing informative feedback; assessing the performance; and enhancing retention and transfer (Gagne et al., 2005). These were derived from principles of the objectivist theories of learning (Mergel, 1998). By referring to many learning and instructional design theories, Merrill (2002) has reported five fundamental prescriptions for effective instruction (Learning is promoted when learners engage in a task-centred instructional strategy, observe a demonstration, apply new knowledge, activate prior knowledge or experience and when learners integrate their new knowledge into their everyday world.). We found that those prescriptions closely relate with our reasoning of promoting learning in the OLE. Also, our design ideas were nourished by the perspectives of problem based learning and inquiry based learning activities implemented on social constructivist learning settings. However, we did not limit our research to any particular learning or instructional design theory and we did not use any particular instructional design model in designing the OLE and its content.

Learning Styles

There can be learners with different styles of learning in an OLE. A student's learning style preference can be a significant factor contributing to his/her academic achievements (Cassidy & Eachus, 2000). Therefore, understanding of thelearning style preferences of students helps to design courses to facilitate learning of individual students (Peng, 2002). There are different models to characterise learning styles. Peter Honey and Alan Mumford developed a learning style model with four categories based on Kolb's learning style theory (Chapman, 2003). The four categories of learning styles are activist, theorist, reflector and pragmatist. According to the explanation done by Honey (2007);

- Activists like to learn by doing. They like to take challenges and experience new things. They want to try out exercises or participate in activities without thinking of the consequences.
- Reflectors learn by observing and thinking about what happened. They listen carefully to everyone, think over all ideas and repeat the learning when they get a chance to do it.
- Theorists like to see concepts, models and the overall image of the lesson. The content needs to be presented in an order and explained from the simple things to details.
- Pragmatists learn best when they are given a chance to practice what is immediately demonstrated or explained. They enjoy experimenting with new ideas.

Learning Style Questionnaire (LSQ) is an instrument developed by Peter Honey and Alan Mumford to find the learning style preferences of the learners. It has been used and commented as a valid and reliable learning style questionnaire by many researchers (e.g. Allinson & Hayes, 1988; Fung et al., 1993; Owens & Barnes, 1992). LSQ has two versions; one with 80 questions and the other one with 40 questions (40-item LSQ). According to Honey (2007) 40-item LSQ is designed for young learners who are not in managerial roles. The majority of the BIT students who participated in this study belong to the age group of 20-25 years. Therefore, we decided to use Honey's and Mumford's 40-item LSQ to identify the students' learning style preferences.

The online learning content was designed to support learners having any of the four different types of learning styles; activist, reflector, theorist and pragmatist. For example, note pages with full textual descriptions were linked to the main interfaces to support the theorists and activity pages having activities based on the learning content were linked to the main interfaces to support activists.

Instructional Design Guidelines used for Designing the OLE and its Content

The design of the OLE and its content was done focusing on three main aspects; structure of the learning content, presentation of the learning content with multimedia, and design of learning activities and evaluations. In order to help instructional designers in designing the online learning content, UCSC introduced a set of instructional design guidelines for each of those focal aspects. The guidelines were formed based on the previous experience of the UCSC in designing online courses and teaching for several years using OLEs.

Structuring Learning Content:

The learning content was analysed and the learning objectives were defined at the beginning of the instructional design process. The learning content was structured and constructively aligned with the learning objectives according to the following set of guidelines.

- Display the learning outcomes of the course at the beginning of the course and display the learning objectives of each section at the beginning of its section content. Learning outcomes of the course were shown to the learner on top of the menu page which was named as 'Topic Outline' (Figure 1) which listed links to access the

course sections. A course section contained lot of sub-sections and the learning objectives of a section were displayed on top of the list of its sub-sections.

- Order the learning content according to the syllabus - The students received the syllabus once they were registered for the semester. Therefore in order to help them easily find the learning content that they wanted to study, the learning content in the OLE was organized according to the order of lesson titles in the syllabus.
- Further divide the learning content into small units and place them on an appropriate navigational system - Usually learners start learning with a wide-angle view of the learning content that lacks detail information (Reigeluth et al., 1980). Therefore we organized the learning content from general to detail using hyperlinks. When a student clicked on a sub-section title on the Topic Outline page, it opened a window with three frames showing a list of unit titles on the left frame, the learning content of a unit on the right frame (Figure 2) and site name and main navigation on the top frame. Each unit contains the main page of interactive learning content (MIL page), one or more activity pages, note pages and several other interactive learning content pages (OIL) which contain detailed descriptions of the content on the MIL page.

Figure 1: Topic Outline page

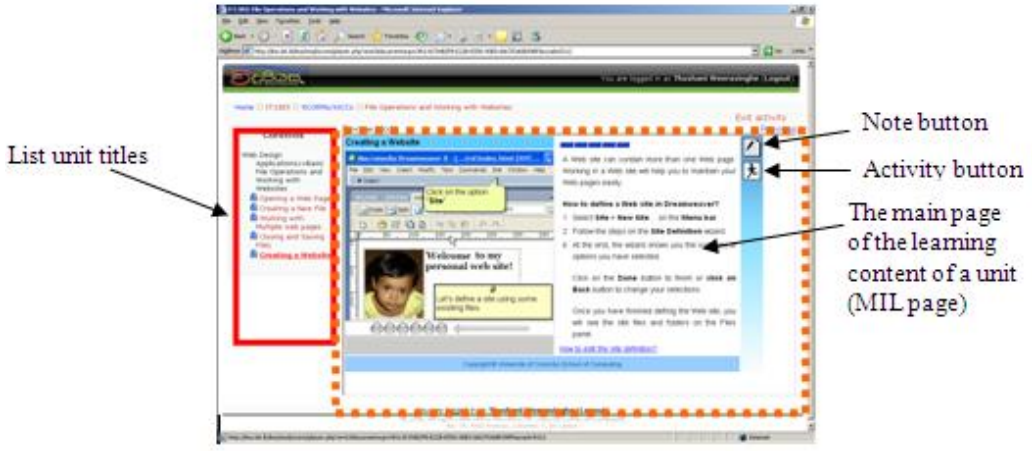


Figure 2: User interface with interactive learning content

- Add activities to each unit of the learning content. Activities were designed for each unit of the learning content. Students access an activity page by clicking on the activity button (Figure 2) on the appropriate MIL page
- Add at least one quiz to the end of each section of a course. Students evaluate their learning achievements after completing a section of the course. There was a link on the 'Topic Outline' page at the appropriate course section to access its quiz.
- Add discussion forums and chat rooms where required. Students access forums and the chat room of the course section from the hyperlinks on the Topic Outline page.

Presenting Learning Content with Multimedia:

The interactive learning content was designed with contexts having features of the "real world" settings (Jonassen et al., 1995) and they were built with different types of media like text, graphics, audio and animations. These were used to gain the attention of learners, present learning objectives and the learning content as described in Gagne's events of instructions and to design demonstrations and simulations to engage students in task-centred instructional strategies as described in Merrill's prescriptions for effective instructions.

Text:

Stemler (1997) notes that in designing computer based learning content the designers should consider that people read text on a computer screen 28% slower than that on a paper. Therefore, if we place lots of text on one page, the learners have to keep their eyes on one page for a long time and that may strain their eyes. Also, normally learners tend to print out the lengthy text and read them offline rather than reading them online. Therefore, if we need to make learners study the learning content online, we need to limit the amount of text that we place on one page and design the text to make them easily readable. Following are the set of text design guidelines that we used to design our text content.

- Limit the amount of text on one page - We extracted the most important texts that were needed to deliver information to the learner from the student manual and used them to design the text on the interactive learning page.
- Divide the text area into blocks of text as needed - In order to make the text content easily readable, we divided the text into blocks and kept space between blocks of text.
- Use lists to present text if possible or else design the text in short paragraphs. Usually learners make short notes in lists and that helps them to easily read and remember the notes. Therefore, we preferred to design the text in lists. However, we used short paragraphs in places like introductions where explanations should be included. We defined a rule to design text in paragraphs: use not more than three lines of text in one paragraph and use short sentences.
- Use simple English language - The learning content was designed for Sri Lankan students whose first language is not English. Therefore, we used simple English language to design the instructions in the online learning content.
- Use a tool tip to explain the technical/scientific terms used in the text area - Technical or scientific words or phrases on the online learning content were explained in tool tips (pop up text label) linked to the relevant words or phrases.
- Bold key words - We used boldface key words in the text content to make them easily identified and readable. Text on the online learning content was mainly designed in black and different sizes of text were used to differentiate titles from normal text.

Selecting or deciding media elements/clips:

The media elements should be carefully used in meeting the pedagogical requirements of the course. Designers of online learning content add audio clips with narrations to their learning materials to support the learners who are already used to learning by listening which is basically practiced in schools. However, the results of a study conducted by Kim and Gilman (2008) imply that simply adding narrations in voice does not enhance learning from visuals. Also, adding audio clips to content makes the learning material heavy and causes access problems. According to Nah (2003) Web users' tolerable waiting time for information retrieval is approximately two seconds and according to Galletta (2004), if the designer's goal is to motivate learners to continue their studies in the OLE or revisit the OLE, then the download time should be kept below 4 seconds. Therefore, it is important to design light weight content for Web-based instructional material. Berge (1998) reports that text and graphics can be accessed easily over low bandwidth networks. Our OLE was designed especially for students in Sri Lanka where students have fewer computer facilities and poor network bandwidth (Gunawardana, 2005). For this reason, voice narrations were not added to the online learning content. The learning content was presented using text with animations or graphics (Figure 3). In order to avoid accessibility problems that can be caused by having heavy files, we agreed upon a weight limit for all media elements selected or designed to have in the online learning environment. Other than that the instructional media for the online learning were selected based on the following set of guidelines.

Figure 3: a page with a simple animation

- Check whether a simple graphic can be used to clarify the meaning of the text - Graphics can be used to create interest in learning and clarify meaning.
- If not add/design a Flash animation to simplify the meaning of the text - Animations for presenting learning content should be used only where animations are essential.
- Check the database for available media elements before designing a new one - It is important to maintain a repository of media content used to design learning content. That helps the design team to share and reuse what they produce.

Graphics:

- Graphics were used to design the online learning content to create interest in learning and also to simplify the meaning of text. Lee and Boling (1999) report that simple and clear images are more effective for instruction and they can prevent loss of learner motivation while studying with the computer. In addition, we used the following set of guidelines to design the graphics in our online learning content.

In order to make the information on graphics clearly identified by the students;

Use the example on the foreground and non-examples on the background

Use bright colours to clearly show foreground picture while keeping the background in light colours

Use design effects to highlight the idea you want to transfer to the audience

Label the parts of the picture where necessary with clear text

Do not keep illegible or unnecessary text on graphics - When reusing images having text, we need to remove the text if that text is not needed for the new learning content. Text on some images may become illegible when we resize the images for the new design work and we should remove them from the images or replace them with readable text before inserting them to the learning material.

Sometimes we create or find graphics with text on the background and if we place them along with the text content on the learning material, the leaner may find it difficult to read the text. Also, Gestalt theory states that text and graphics should have sufficient differences to make them easily identified separately (Leflore, 2000). Therefore, we have to,

- Add picture borders if a picture also contains some text or change its background colour to a different colour which will not negatively influence the clarity of the text on the image or on the text area of the learning material.
- Keep some space between graphics and the surrounding text

Animations:

Images can be used to design animations. However, that may exceed the weight limit of the file that the students can access. Therefore, images which are used to design animations should be carefully selected.

We used Flash animations to gain attention, demonstrate flows of information, create simulations and to handle the learner-content interactions where animations were necessities to design the learning context. They were designed according to the following set of guidelines.

- Keep it as simple as possible
- Add user control buttons (Stop, Play, Replay, Pause, etc) where necessary
- Do not make your animation play in a loop. Add a replay button to the end of the movie.

Interactivity handling:

Animations can be designed to handle interactivity and according to Dewald et al. (2000) interactivity handling is "key to active learning and reinforcement" (p. 38). However, animations can be heavy and may not be a good selection for designing interactivity needed for some types of learner-content interactions. Therefore, we defined the following set of guidelines and followed them in handling the learner content-interactions in the online learning material.

- Check whether a simple script can handle the interactivity
- If not add/design interactivity using Flash animations
- Check the database for available media elements before designing a new one

Designing Learning Activities and Evaluations:

The interactions on the OLE can be designed to make it highly student-centred (Harasim, 1989). Most of the interactions in our OLE were designed to be associated with learning activities, quizzes and discussion forums.

Activities:

There were mainly two types of learning activities; activities designed on activity pages and activities designed based on forums. A learning activity on an activity page was designed based on the learning content of the course unit to which it belonged. That type of activity provided an opportunity for the learners to immediately apply new knowledge that they gained from the learning. Activities designed based on the forums were designed having at least some relevancy to the content discussed in a sub-section of the learning content. The instructional design of those activities was inspired by the problem-based learning. They helped learners to apply or integrate new knowledge into the contexts outside the OLE and also to interact with other students and teachers. The activities were designed according to the following set of guidelines.

- Check whether it helps students to achieve their learning objectives - It was important to make sure it addressed one or more than one learning objectives of the lesson because we designed the learning evaluations targeting at the learning objectives.
- Design different types of activities - Different types of interactive learning activities were designed using Flash animations and JavaScript or forums in the LMS.
- Divide complex activities into small activities if possible - Complex learning activities were provided through scaffolding where, at the beginning of a lesson, activities were provided with a guided or help text (Figure 4) and at the end of the lesson activities were provided without guided or help text (Figure 5). These types of activities were given in steps (set of small activities).

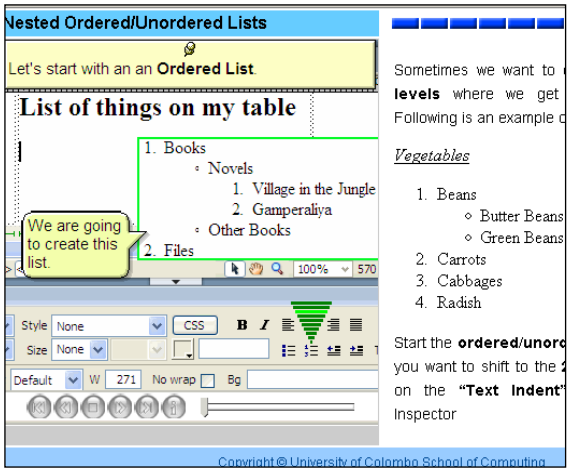


Figure 4: Practice simulation with guided text

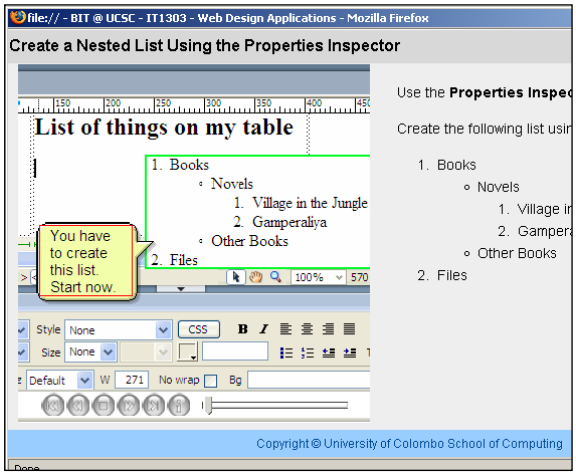


Figure 5: Activity simulation without guided text

- If one completing activity leads to another activity, then place them both on an internal navigational structure
- Give clear and appropriate instructions – The students should be able to clearly understand what is expected from them (what they should do as a whole and what they should post to the LMS). However, if students had questions regarding the activities they could discuss it with others using forums.

- Add guided or help text where appropriate – If a learning activity was designed based on a simulation, we added guided or help text to motivate the learners to complete the activity. Activities which might need further clarifications for individual students were designed based on forums (Figure 6) and students could ask questions and get help from other students and the teacher.
- Add relevant feedback for the students' interactions - Students in an OLE need to receive feedback to their responses. Therefore, we added automatic feedback to most of the activities. The activities which led to learner-learner interactions and learner-teacher interactions where students could receive feedback from the teacher and the other students were designed based on forums in the LMS.

In addition to activity forums, we had discussion forums (Figure 7) which provided a discussion topic. The students had to learn by expressing ideas, commenting on others' ideas, asking questions and replying to others' questions with respect to the topic in the discussion forum.

Figure 6: Activity forum

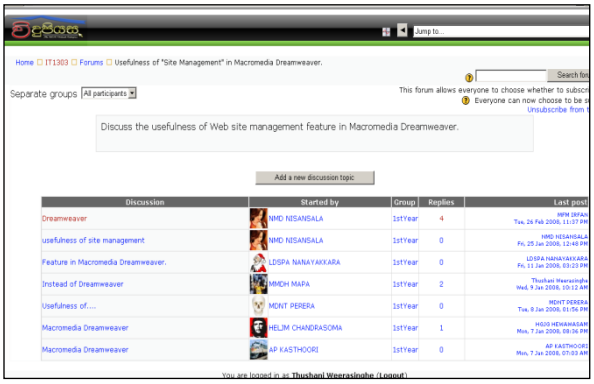


Figure 7: Discussion forum

Evaluations (quizzes):

We attempted to constructively align interactive learning content on the course units, activities and other components of the OLE with the relevant learning objectives. In order to determine whether students achieved the desired learning objectives, we created quizzes with a set of multiple choice questions. Those quizzes provided an opportunity for the students to evaluate their learning achievements by themselves.

Our instructional designers did not have much to do with designing the quizzes. The subject matter expert (course coordinator or the person responsible of providing teaching materials to the instructional designers) provided the questions for quizzes and assignments. The instructional designers added them to the LMS. However, in designing a quiz, we needed to make sure we:

- Used only the questions given or accepted by the subject matter expert
- Placed the quiz at the end of each course section
- Added questions to the appropriate quiz. The questions on a quiz should be based only on the course section where it is placed.

Student Experiences using the OLE

In a previous paper we reported that the students of our OLE were satisfied about the OLE and they were managed to learn more efficiently only using the OLE once they got used to it (Weerasinghe et al., 2008). Also, the results reported on in that paper implied that the OLE could support learners having different learning style preferences. In this paper we report;

(1) what design components lead to the student satisfaction towards the OLE and its content, (2) what design features and strategies lead to the learning effectiveness as perceived by the students and (3) whether there is a relationship between students' learning styles and their learning design preferences.

The students' experiences were gathered using debriefings and four types of questionnaires;

1. LSQ: 40-item Learning Style Questionnaire obtained from Peter Honey and Mumford publications- Students rated a set of 40 statements. Each statement asked whether the student agreed or disagreed with it. (The same questionnaire and result sets were reported in our previous paper.)
2. LEEQ (Learning Environment Evaluation Questionnaire): A questionnaire addressing students' specific attitudes towards the facilities and features available in the OLE in the LMS.
3. LCEQ (Learning Content Evaluation Questionnaire): A questionnaire targeting at students' experience and attitudes towards elements of interactive learning content such as graphics, animations, simulations and activities.

LEEQ and LCEQ were developed by the authors of this paper and they consisted of questions on a Likert Scale, dichotomous questions, filter or contingency questions and unstructured or open-ended questions which let students write their comments freely.

The students' learning experiences reported on in this paper were gathered from three face-to-face meetings; two meetings during the semester and one after the final examination. The LSQ was distributed among the students during the first meeting which was reported on in a previous paper (Weerasinghe et al., 2008). The students who expressed their willingness to participate in future meetings were invited for the second and the third meetings. Only 27 students participated in all three meetings. Among them, there were 9 females and 18 males and the majority of them belonged to the 20-25 age group.

The students answered the LEEQ and participated in the debriefing session at all three meetings. At the third meeting students answered the LCEQ as well.

The first author of this paper played multiple roles in the design experiment reported on in this paper. She worked as the instructional designer, content developer, the author of the student manual and the teacher of the course. Another instructional designer of the UCSC who was officially responsible for the course development work helped the first author of this paper in packaging and uploading the learning content to the LMS.

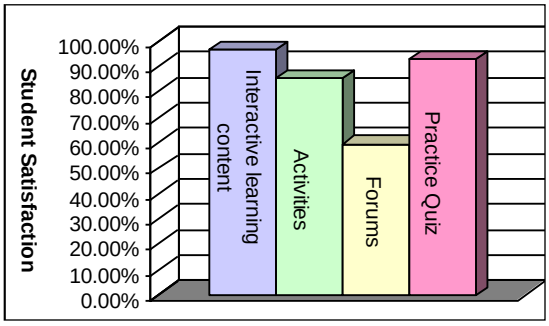
Design components that led to student satisfaction

The students' reports on the LCEQ and the debriefings were used to find the design components and features that led to the student satisfaction towards the OLE.

Student experiences reported on in debriefings:

At the first meeting the majority of the students appreciated the OLE for delivering downloadable student manuals and providing quizzes. However, when moving from the first meeting to the third meeting, the students appreciated the interactive learning content and the forums as much as the quizzes. At the third meeting the students did not even talk about the student manuals instead they expressed their satisfaction towards the components like interactive learning content, private messaging, chat room, forums and quizzes on the OLE. They reported that those components were quite useful in their studies. However, they added that they would have liked to have more scheduled chat sessions and audio-video content.

Student experiences reported on in the LCEQ:



Graph 1: Student satisfaction towards the components of the OLE

We drew a graph (Graph1) based on the student satisfaction towards the components of the OLE reported on in the LCEQ. Students' appreciated interactive learning content more than the other components on the OLE (Graph 1). The features of the interactive learning content were appreciated especially for their helpfulness and usefulness for learning.

Design features and strategies that led to learning effectiveness
(as perceived by the students):

Structure of the learning content:

At the third meeting the students reported on in the LEEQ that the available navigation structure to access the learning content was quite appropriate and user-friendly. More than 70 % of the students commented that contents in OLE were properly organized on the Topic Outline page (menu page).

Design of the learning content:

About 60% of the students, who participated in the third meeting, reported on in the LCEQ that online learning material had been very useful and altogether more than 96% of the students replied that it had been useful in their studies (Table 1). One student reported, "Studying material gave me a big help that I never expected. When there was a problem we received so many related answers from our colleagues. I would like if this LMS will help us in our future studies too." Another student noted that she could apply the knowledge she obtained from the OLE in her other studies. She reported, "The LMS content encouraged us to do the BIT exam well. The LMS content was very useful to us. We learned a lot from them. I could use the knowledge I obtained from BIT online learning content in my other exams in IT."

Table 1
Students' appreciation of design elements of the learning content

Online learning content was useful for the studies	96.30%
Learning Objectives were clear and could achieve them	83.95%
Online learning content was useful for the studies	96.30%
Animations clarified the text content	92.59%
Animations with guided text explained the steps or procedures	85.19%
Simulations helped to study the lesson	92.59%
Graphics clarified the meaning of text	92.59%

The students' ratings for the design features of the learning content were very high (Table 2). A student who did not attend any formal teaching sessions for BIT degree courses reported: "This was the first time I experience such a learning method. As a student who was totally dependent on the LMS content, I regard that everything in it is good, especially the interactive learning content. It was easy to memorize facts when they were presented in lists and with interactive animations."

The students found that simulations, other animations and graphics were very helpful to them in learning the lessons (Table 2). Following are three quotes taken from LCEQ.

1. "Slides were very interesting to see. So, we could study without getting bored."
2. "Animated lessons were very good and easier to remember than studying them through notes."
3. "Interactive learning contents were very useful to understand the theories."

The text on the online learning content was appreciated for its simple language, font size and font type (Table 2). Also, the presentation of text content in lists was appreciated by the students. For example; one student reported on in the LCEQ "OLE presented all the lessons in summaries. Therefore, we could finish the lesson quickly having knowledge about what we saw and read in the content." Another student reported, "Lesson content was presented in bullets and it is useful to learn without wasting time."

About 56% of the students found that there was not adequate amount of text on a page and 52% found that there was not enough white space between the blocks of text (Table 2). In the debriefing session students said that there were some pages with too much text. Their comments relating to this problem referred to another course in the LMS but not to our online learning content. However, we appreciated this comment because it helped us to improve our set of instructional design guidelines presented in the next section of this paper.

Table 2
Design features of text

Simple Language	81.48%
Adequate amount of text on one page	44.44%
There was enough white space between the blocks of text	48.15%
Size of the text is appropriate	81.48%
Font type is good to read the text for a long time	81.48%

Design of the Learning Activities:

The students of our OLE found that the learning activities on the OLE were quite helpful in their studies (Table 3). Also, according to our students' reports, they could be online and study using the OLE for an average of 2.5 hours per visit. That can be interpreted as that the students found learning in the OLE interesting and, when the students were given autonomy for their own learning, they could learn for a longer duration of time.

At the first meeting we found that there were only 26% self-studying students who reported that they did not get any formal teaching for BIT degree studies in our sample. However, at the third meeting, more than 85% replied that they were already or could be self-studying students in the OLE. Also, about 96% of the students reported that they could learn actively in the OLE. In elaborating their own replies in the questionnaire, the students reported that OLE made them actively involved in learning with different types of learning activities and they could collaboratively study with other students through forums and private messages in the LMS.

Table 3
Impact of the learning activities of OLE for learning

Activities were helpful for learning	85.00%
Activities could be completed after studying the learning content	77.78%
Forums helped to discuss the learning activities	59.26%
Forums helped to discuss other learning problems	60.12%
Practice Quiz helped to evaluate learning achievements	92.59%
Could actively learn in the OLE	96.30%
Was or can be a self-learner in the OLE	85.19%
Maximum duration of learning time per visit	2.5hrs

Even though we designed discussion and activity forums we did not design any group learning activities due to administration and online facilitation problems in the BIT degree programme. However, surprisingly more than half of our students found forums helpful for discussing the learning activities with others in the LMS. Also, the students found the forums useful in discussing their problems related to learning. Following are some of the comments given by the students regarding the helpfulness of forums.

1. "Subject Discussions were helpful to share our knowledge with others and to get more opinions from them."
2. "I could ask questions from the teacher and the students."
3. "When there was a problem we received so many related answers from our colleagues."

The students could evaluate their learning achievements by themselves using Practice Quizzes. The students reported that quizzes helped them to study the important areas of the lessons and face the exam confidently. One of the students commented "Almost all the LMS questions were based on the syllabus. When I completed a section I could go to the particular LMS quiz and evaluate my knowledge. That was a huge benefit to me".

LSPs and their relationship to students' learning design preferences:

The LSQ (Learning Style Questionnaire) reported that there were 8 Activists, 12 Reflectors, 7 Theorists and 5 Pragmatists in our sample (Weerasinghe et al., 2008). The students' preferences for design components on the OLE (students' learning design preferences) reported on in the LCEQ were analysed with the students' learning style preference (LSP)s. The results revealed that the students had appreciated the features of the learning content which supported their own learning styles. For example, *activists* were happy about the online learning content because they could do the activities and discuss them in forums with the other students and the teacher; *reflectors* were happy about the animated lessons which helped them to remember the lessons more easily than the text based notes (shaded area A in Table 4). Further, the students had requested more features or facilities that would again support their own learning styles. For example, pragmatists needed to have more support for the practical activities while theorists requested the UCSC to provide them with a search facility to find text in the learning content (The shaded area B in Table 4).

Table 4
Relationship between the students' LSPs and learning design preferences

	Activist	Pragmatist	Theorist	Reflector
I like online learning material.	Content presented in point form; could learn without wasting time	Could discuss subject problems with the teacher and other students	Could study the lessons with pictures, animations and activities of interest	Lessons in summaries; could study quickly
	Interactive learning content; very useful in our studies	Received hands on experience in using software without having it running in the computer	Interactive learning content; could solve our problems	(A) Animated lessons; easier to remember than going through notes
	(A) Could do the activities and discuss in forums	Practice quiz and activities; very useful.	The learning content; very clear and easy to understand	Could ask questions from the teacher and students
	Interesting and could complete lessons without getting bored.	Encouraged us to do the examination well.	Had all learning content	Practice quizzes; helped to study the key areas of the lessons and evaluate learning achievements
	Simulations explaining how to do the tasks	Could use that knowledge in other activities /examinations	Subject discussions; useful to share my knowledge and get more ideas from others	Had all learning content we need to study
I like to have some more features /facilities	Add more challenging activities, activities that lead to experiments and group activities	Provide more activities and quizzes	Upload all content earlier so that we can go through them several times before the exam	Upload all content earlier so that we can go through them several times before the exam
	Provide more quizzes	(B) Give more support for practical activities	(B) Add search facility to find text in the learning content	Add a help page and a guide to use the LMS

Improvements to instructional design guidelines

The student experiences reported on in this paper assert that we have used appropriate instructional design guidelines to design our online learning content. Further they provided implications to add a few more guidelines to enhance learner satisfaction and learning effectiveness in the future design of the OLE.

Design components that lead to student satisfaction

The results shown on Graph 1 and the students' experiences reported on in the debriefings show that student satisfaction towards the OLE was led by its interactive learning content and practice quizzes and learning activities. Learner-content interactions were a major factor in those components. Therefore, our results can be interpreted as that learner-content interactions lead to student satisfaction in the OLE. This complies with results reported by Rovai and Barnum (2003).

Design Features and Strategies that Lead to Learning Effectiveness

Structuring learning content:

The students' experiences reported on in the LEEQ assured that the contents of our OLE were well organized and placed on an appropriate navigational system. Also, the students of our OLE reported that OLE helped them to learn without wasting time. Therefore, the students' comments reported on in this paper imply that the structure and organization of the learning content on an appropriate navigational system enabled students to quickly select what they wanted to learn. However, during the debriefings the students requested addition of:

- student guides to use the OLE, and
- contact information of student support services like technical guidance to the Topic Outline page.

Presenting learning content with media:

Selecting media for learning:

The students' comments on the overall functionality of the interactive learning content were mainly focused on features such as learner engagement, interactivity and accessibility of the learning content. Therefore, in deciding what media is suitable for a learning content, the instructional designers should consider whether it;

- can motivate the learners
- can entice the learners
- is constructively aligned with the learning objectives
- can handle or support interactivity
- will not exceed the weight limit that the network can have

Text:

Text in blocks having short paragraphs or lists with bold key words helped the students to go through the learning content easily and quickly. Further, the reports of our students implied that they were motivated to go through the detailed information and do the activities placed on hyperlinks. However, about half of the students of this study reported that they found too much text and too little white space on the online learning content pages in the LMS (Table 2). Therefore, we added two more guidelines to the set of text design guidelines.

- Keep one line of white space between blocks of text to increase readability
- If main page is having text that cannot be easily accommodated in the available space on the template then redesign the text (Identify the key text and place it on the main page and add the other text to the links on the main page or place the text on consecutive main pages.)

Graphics:

More than 90% of our students found the graphics on the learning content useful for understanding the meaning of the text content. This implies that we have designed the graphics on the online learning material to support learning and it may agree with Carney and Levin (2002) who concluded that carefully constructed graphics can enhance learning from text. However, there were a few students who reported access problems to some of the graphics. This comment helped us to improve one of our design guidelines.

- Check the weight of the graphic before adding it to the online learning content. If it exceeds 500KB then split it into two using graphic-editing software and add them close to one another on the online learning content.

Animations:

Almost all the students who participated in this study replied that animations in the online learning material helped them to understand the concepts. Also, according to the students' comments the simulations on the online learning material enabled them to get the hands on experience in using the Web-design application without even having it installed in their computers. Therefore, the students' experiences reported on in this paper can strengthen the reasoning of Syrjakov, Berdux & Szczerbicka (2000) who noted that not only the quality but also the efficiency of an e- learning material can be enhanced by using animations. However, the debriefings reported that the students needed more time to read the text on animations. Also, our students' suggested that if an animation plays text, then it is important to have control buttons to allow them to control the pace of it. Therefore, we added two more guidelines to our set of guidelines to design animations.

- Play the text more slowly in an animation which contains text and graphics
- Design the animation with steps and add control buttons to allow learners to control the pace.

Audio:

There were only a few audio files in our learning content. The rest of the audio files were not added mainly to avoid the exceeding of weight limit of the animation file. However, at the debriefing the students replied that they would have liked to have audio playing with animations. Therefore, we decided to improve the last guideline in our list as follows to design the animations for online learning content.

- Add audio where necessary if it is not going to exceed the weight limit of the file
    - Add audio control buttons
    - Make sure that students without having audio playing facilities can also receive the same message in text or in text and graphics

Designing activities and quizzes:

The results we reported on in a previous paper implied that our students could efficiently use the OLE and its content in their studies (Weerasinghe, et al., 2008). Based on the analysis of student experiences, we can conclude that most of the students found online learning activities (Table 3) and learning content (Table 1) useful in their studies and they could learn actively in the OLE. This implies that our students could actively construct knowledge using the OLE. Even though forum participation was not compulsory for doing the activities, more than half of our students reported that discussions with other students and the teacher via forums were useful in their studies. However, the students' reports on debriefing revealed that they preferred to have links to access the relevant forums from the interface of the interactive activity or the learning content. This leads us to add the following guideline to our list of guidelines to design learning activities.

- If a lesson activity leads to a forum discussion, link the discussion to the activity.
- If there is an activity based on a lesson page or a sub-section of a lesson which leads to a forum, then give the link to access that forum within the learning content itself.

Students' learning styles and their learning design preferences

Consider the learning style preferences in designing online learning content - By analysing the students' experiences it became clear that our students appreciated the features of the OLE with respect to their own learning styles. However, according to Honey (2007) students can have more than one learning style preference and their learning style preferences can change over the time. Therefore, it is important to consider the requirements of the learners with different learning style preferences in designing distance OLEs.

Conclusion

An OLE which was reported as successful in achieving learner satisfaction and learning effectiveness was further studied to determine which design components led to the learner satisfaction and what design strategies and features led to the learning effectiveness. Student learning experiences in the OLE were gathered using questionnaires and debriefings. Data was analysed to find relationships between students' learning style preferences and students' learning design preferences. We found that our students were satisfied with the design of the interactive learning content, learning activities and the evaluations. Learning effectiveness was influenced by the structure of the learning content and design of the interactive learning content, activities and quizzes. We found that there was a relationship between the students' learning styles and the students' learning design preferences. These findings helped us to improve our instructional design guidelines for novice online learners of distance learning programmes using computer applications and information technology.

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Editor's Note: Learning styles continue to challenge researchers and those who design instruction. Learning is more efficient and effective when presented in the preferred style of the learner; however, in the real world, learners must be capable of working with all learning styles in order to be successful.

Informing the Design of Personalized Learning Environments through Iterative Analysis of Learner Interaction and Feedback

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Abstract

Personalization in web-based learning environments is receiving growing attention from practitioners, educational researchers and technologists worldwide. One of the aspects that has been heavily studied, with varying levels of success and consistent results, is personalization through adaptation with respect to learning - cognitive styles and preferences. Educators and researchers have mixed opinions on the impact of learning styles/cognitive styles on the learning experience with particular reference to adult learners and web-based learning environments. The validity of learning styles questionnaires has often been put in question. This article describes a method that can be followed to minimize inconsistencies and possible subjectivity of learner responses in questionnaires that will increase the validity of the learning style surveys. This paper further describes a 4-phased iterative life-cycle model that is in the process of adaptation to individual learning preferences and learning styles.

Keywords: Personalized instruction, learning styles, cognitive styles, instructional and pedagogical design, web-based learning.

Introduction

Personalization in web-based learning environments is receiving growing attention from practitioners, educational researchers and technologists worldwide. The current belief is that the 'one size fits all' philosophy as advocated by early web 1.0 approaches is limited in pedagogical effectiveness. The web is no longer seen as an innovative delivery medium only but as a platform where rich pedagogical scenarios, adapted to specific learning needs of learners, can be delivered on a 'just-in-time' basis. While the concept of personalization inevitably results in adaptation to specific learner preferences, there are a variety of ways in which online educators can provide the so-called personalization. The first aspect relates to the way the learner wants to 'see' the environment. In this case, he/she can select layout templates, colours, fonts and other display attributes. He/she can also select the level of educational material he or she wants to access depending on his or her educational needs, previous education, and experience. This kind of personalization is achieved through features to "customize" the learning environment.

Another possibility is to have the system provide the learner with a customized learning scenario.. The system is based on prior recorded parameters such as performance assessment, prior skills, and pre-requisites of the course. Personalization in this context is achieved in a somewhat hegemonic way where the system (the teacher in a traditional environment) provides individually tailored content to the learner. In the past, researchers considered a number of features that can be used in the personalization of instructions in web-based learning environments. One aspects that has been heavily studied, with varying levels of success, is personalization hat adapts to cognitive styles and learning style preferences.

Educators and researchers have mixed opinions on the value of learning styles/cognitive styles on the learning experience with particular reference to adult learners and web-based learning

environments. The validity of learning styles questionnaires has often been put in question. This article describes a method that can minimize inconsistencies and learner subjectivity while filling the questionnaires to improve reliability and validity of learning style surveys.

The paper further describes a 4-phased iterative life-cycle model in the process of adaptation to individual learning preferences of the learners according to their learning styles. The aim is to have a learner profile that is as accurate as possible and which evolves over time. It is based on the learner's interaction with the learning environment and the teacher, the student's perception of the learning material, and learner achievement in terms of performance and understanding of the content. Furthermore, by capturing learner feedback and perceptions, learning paths can be established. It will determine if adaptation to learning styles contributes to learning enhancement, and improved learning outcomes in web-based learning environments.

Personalization, Learning Styles and Web-based Learning Environments

Terrell and Dringus (2000) investigated the effects of learning styles on student success in an online learning environment. They tracked 98 Masters level students in an information science programme using the *Kolb Learning Style Inventory*. While they found that a majority of students can succeed in an online learning environment regardless of learning styles, they also found that there have been more drop-outs where the students learning style fell in the *accommodator* category.

A study from Ross and Schulz (1999) based on the Gregorc Style Delineator revealed that learning styles significantly affected learning outcomes and that abstract random learners may do poorly with some forms of computer-aided instruction (CAI). From definition within the Gregorc Style Delineator, abstract random learners tend to be "non-linear, multidimensional, and prefer active, free and colorful environments. They thrive on building relationships with others and dislike extremely structured assignments."

Underperformance in computer aided instruction environments can be explained where these environments lack the collaborative, collective features of web-based learning environments. Furthermore, computer-aided instruction often focuses on highly structured assignments such as fill-in-the-blanks and multiple choice questions while web-based learning environments can provide less-structured learning activities and scenarios to fit learner preferences.

Butler and Pinto-Zipp (2005) conducted an experiment similar to Ross and Schulz (1999) with mature learners in an online learning environment (rather than a traditional CAI setting). The feedback from learners suggested that, for mature students who are practicing professionals focused on their career goals, the real effect of learning styles cannot be established in a cause and effect way. This is because their thrust to complete the course is influenced by intrinsic and/ or extrinsic motivation factors. The study also revealed that a significant number of online learners developed a dual learning style. Butler and Pinto-Zipp (2005) further argue that today's learners are more flexible, stretch their learning styles to accommodate a variety of instructional methods, or simply transcend through preferred methods.

Luk (1998) studied differences in academic achievement with respect to cognitive styles of nursing students. He found that field-independent students performed better than their field-dependent peers in both traditional education and distance learning settings. The culprit factor in distance education was attributed to the highly impersonal nature of the modality given that the teacher and learner are not in a face-to-face relationship on a continuous basis. However, this argument does not hold strong for two reasons. The first one is that even in face-to-face relationships, the interaction is not on a continuous basis. The second is that new and advanced communication technologies help to recreate the face-to-face setting in an improved way. An example is the promotion of a greater number of one-on-one interactions with the teacher.

One interesting argument provided by Luk (1998) is the concept of structure in self-directed instructional packages. It is argued that field-dependent and field-independent learners would perform equally well if the instructional package is highly structured while field-dependent learners would have difficulty in semi-structured or unstructured learning contexts.

Ford (2000) argues that virtual environments enable a given information space to be traversed in different ways by different individuals using different roots and tools. He argues that cognitive styles are useful factors that can help in the personalisation of instruction in virtual environments. He suggests the need of more robust student models to achieve better learning systems design. He proposes virtual environments that enable differential patterns and sequences of access to information to suit the different types of students. Such access should be prescribed, autonomous or recommended.

Furthermore, Hall and Moseley (2005) argue that translating specific ideas about learning styles into teaching and learning strategies is critically dependent on the extent to which these learning styles have been reliably and validly measured, rigorously tested in authentic situations, given accurate labels and integrated into everyday practices of information gathering, understanding, productive learning and strategic and reflective thinking.

Critiques of learning - cognitive styles instruments

The model of Kolb (1984) has been criticized by different authors and there is need for a more reliable and valid instrument for measurement of learning styles (Kinshuk, 1996). The construct of the Learning Style Inventory (LSI) was found to be unsatisfactory by different authors (Freedman & Stumpf 1978; Wilson 1986) while the face validity, an important aspect of the LSI was not well-accepted by managers (Kinshuk 1996).

From a pedagogical perspective, Atherton (2002) writes that one of the strengths of the model is that it "*provides one of the most useful descriptive models of the adult learning process available. The most direct application of the model is to use it to ensure that teaching and tutoring activities give full value to each stage of the process*."

From a lifelong learning perspective, Reijo (2000) states that Kolb's learning cycle does not illustrate the fact that empirical (i.e. experiential) thinking based on action has limitations such as:

- It may result in false conclusions.
- It may not help us understand and explain change and new experiences.
- It may cause mental laziness and dogmatic thinking.

Reijo (2000) also suggests that Kolb's experience and reflection occur in isolation and it is necessary for the individual to interact with other humans and the environment in order to enhance the reasoning and conclusions drawn. This critique comes mainly from a constructivist point of view. However, from an e-learning perspective, web-based learning does favor the design of constructivist learning environments that can be combined with the Kolb learning model to meet the critique above.

Garner (2000) argues the poor theoretical foundations of Kolb theory and questions the reliability of the instrument. Despite acknowledging a number of positive works based on Kolb's model, Garner argues that a "*misunderstanding is generated by the confusion around whether Kolb is arguing for learning styles as traits (and so stable) or states (and so flexible)—a clear answer to this is needed"*.

In addition, Zwanenberg et al. (2000) investigated the psychometric properties of the different learning styles instruments such as the ILS (Index of Learning Styles) and the LSQ (Learning

Style Questionnaire). He challenged the poor psychometric features of the instruments and questioned their reliability to obtain satisfactory results in experiments.

Veenman et al. (2003) demonstrated the limitations of self-assessment reports in determination of learning styles and proposed think-aloud techniques as a more reliable approach. However, it must be pointed out that this technique of read-aloud can pose some practical limitations when the number of learners is elevated and if they are at dispersed geographic locations.

Improving reliability of data gathered from learning style instruments for personalized web-based environments

This section presents a method to address the critics and issues raised by previous studies concerning the validity of self-assessment instruments to determine preferred learning styles as well as criticisms that some learning styles are a mere determination of personality preferences. If we look at learning style questionnaires, students can answer up to 90 questions and be classified in one category only. Educational designers will then derive a set of guidelines to tell teachers about the learning activities that will suit that particular 'category' of student. This means that at some stage there is a grouping done with the learners at a particular granularity level which cannot be broken down further. Analyzing individual answers will help to further understand the learners' preferences even if their profile is categorized by the different 'creators' of learning style instruments.

An analysis of the Honey and Mumford (1986) LSQ, the Kolb LSQ and the V-A-K questionnaire (Barbe & Milone, 1980) reveals many similar questions to determine learner preferences. Furthermore, with respect to the questionnaires studied, while there may be some questions that are not relevant to an educational context, there are some statements which are direct determinants of a learner's preferences.

Furthermore, it has been noted that some questions do in fact repeat themselves in a masked way. While some writers have criticized this approach, it is believed there can be a logical rationale behind the inclusion of some redundancy. The reason is to minimize the subjectivity and inconsistencies of the learners while filling the questionnaire. Such similar questions can be grouped together after the learner has filled in the questionnaire to see if the learner was consistent in his choice or not. It might be assumed in a first instance that a learner who gives contradictive answers for redundant questions is either unsure of his preferences or is just filling in the questionnaire in an ad-hoc basis. Therefore, the researcher can be informed of this inconsistency and decides to remedy the situation as he/she deems appropriate. For such cases, an interview may be conducted with the learner to probe into his preferences and update his profile accordingly.

An alternative solution to the filling out a questionnaire by learners is to have their navigational patterns and online behavioral patterns analyzed in a feed-forward neural network (Lo & Shu 2005). The network's output then predicts the student's 'learning style' with some accuracy. The experiment, though limited to the V-A-K instrument after training on the network, produced satisfactory outputs. However, this network only predicts one learning style for the student based on the neuron that 'fires'. In this case, when the neuron 'fires Visual Learning Style' for a student, the system will have to look for content matching 'visual preferences' only. The technique therefore, can be seen as an alternative automated technique for determining learning preferences of a student. However, it does not address the issue of subjective answers by the learners as the training set used is based on the answers the student gave originally. Training a neural net at this stage, even if the system predicts accurately the learner's style, might be predicting an inconsistent outcome.

A more conventional approach can help reveal the inconsistencies and subjectivity of the learner while filling the original questionnaire. The approach used here can be both adaptive and

adaptable. If the adaptable approach is selected, then the learner will not be given material preselected by the system, but will in fact be given the freedom to choose his own set of learning materials. His/her navigation history will then be kept and, depending on the learning path he/she undertook, his/her preferred learning preferences will be revealed. This can also be seen as a useful method to adjust the learner profile with respect to his/her original selection. However, for every page navigated by the learner, feedback needs to be obtained on his/her perception of the learning content. This is because, a learner might 'accidentally' or 'by curiosity' click on a link which he/she does not really perceive as valuable and this link can be counted as forming part of his/her learning path. The idea of basing oneself purely on the concept of 'visited links' v/s 'unvisited links' can be misleading.

In the case of the adaptive approach, the learners will be given the most appropriate content as chosen by the system based on his initial profile setup. Depending on the learner's preferences the system applies the appropriate algorithm (Santally & Senteni 2005) to select the *most appropriate* content. However, what can be the *most appropriate* content for the system after applying the algorithm or for a teacher after taking cognizance of a learner's preferences might not actually be what the learner feels like is *most appropriate*. Therefore learner feedback is important in every cycle of learning activity. Learner feedback will not only help to update his/her profile, but grouped evaluation of learner feedback on the same content will also help in pointing where the pedagogical designers got it inaccurate with their perception of a particular content. Learner feedback will also reveal any other factors other than learning/cognitive styles that might be influencing the learning experience.

The Lifecycle of the Process: An Expansive and Iterative Approach

The above discussion leads to the development of a structured approach that can be seen as a lifecycle model for the development of personalized learning environments with respect to learning preferences of the learners. An iterative approach is proposed in phases that evolve expansively in cycles for adjustment of the learners changing preferences over time. This model assumes the pre-existence and classification of learning content by the pedagogical designers.

Phase [1]: Data collection and analysis from learning - cognitive styles instruments

This phase relates to the learners filling out respective instruments that will classify them into different learning/cognitive styles that currently exist. This can be carried out through web-based questionnaires administered as a pre-requisite before starting the course. The information collected is stored in a central learner profile repository. Contradictive answers for redundant questions are identified and appropriate action (such as follow-up interview) is taken to improve accuracy of the information collected.

Phase [2]: Logging students' navigation history and feedback

Once student profiling is carried out, they can start navigating through the content (either in the adaptable or adaptive configuration) and each of the link (content) they navigate and provide feedback on, is recorded for form a documented learning path for each student. In the case of the adaptable configuration, content on which learner do not provide feedback will be discarded from the learning path of the student. It will be assumed that the learner visited that content either "accidentally" or "by curiosity". Even if a learner is engaged in a learning process where the configuration mode is set to be adaptable, an 'expected' learning path will be generated using the adaptive configuration which will be running as a hidden layer.

In the adaptive configuration, the learner will have to give his feedback before he moves on to the next learning content. The feedback he/she gives will be based on questions that are devised after careful analysis of the answers in the questionnaire he/she filled in phase 1.

Phase [3]: Analysis of navigation history and Student feedback

Once the learner completes a learning unit/course, his navigational patterns are displayed. If he/she was in an adaptable configuration, the actual learning path will be compared with the one predicted by the adaptive mode. His/her feedback on each learning content will be analyzed and compared with his/her original answers. On the other hand, group feedback will be used to determine if it's the student profiles need to be adjusted or if the learning content metadata needs to be reviewed. This is where analysis of individual answers will help further the initial classification granularity where learners are grouped in categories such as 'reflectors', 'pragmatists' etc to provide a more accurate profile of the learner.

Phase [4]: Evaluation of learners performance and learning outcomes

A variety of techniques can be used to evaluate learner performances in the learning units/ activities and to check if they have met the learning objectives. Viva-voce examinations, written work assignments and examinations as well as the level of understanding attained, are all indicators of the degree of successful adaptation to the learners' preferences. After this phase, the cycle starts again with either the same batch of learners moving on to a higher level of education or with new batches of learners joining the same programme.

Discussion

The issue of incorporating learning styles into the design of instruction occurred initially in traditional classroom settings. With the emergence of web-based instruction, a number of researchers have focused on the possibility for extrapolation of the concept for learners engaged in online learning. Most of the experiments were focused on one particular style and based on rigid 'if-then-else' statements limiting the flexibility of the system and defeating the argument that has been established by previous researchers that learning styles do change over time.

The real issue when it comes to design of personalized learning environments is not about getting the students preferred learning style on a perfectly accurate scale. The important thing is to get an initial profile of the learner as accurately as possible. The other important aspect is to design and deliver content in a format that is appropriate to each learners' preferences. There cannot be any combination of content and methodology that will perfectly match any learner preference, and there cannot be a student with only one learning preference who will not achieve the intended learning outcomes solely because the learning content or teaching method did not meet his preferences. The aim therefore, is to enhance the students learning experience by giving them, *as far as possible,* content in a form that matches his/her learning preferences.

The "iterative analysis of learner interaction and feedback" helps to address the issue of changing learning styles as well as the one on subjective filling of self-reporting instruments. This can help improve learner profiling in online learning environments as well as provide adequate grounds to determine any adjustments needed in learning content profiling. The method presented is an important layer of instructional specification for the design of personalized learning environments. Such an instructional specification is a multi-layered structure consisting of:

- A pedagogical framework for the design of learning activities and scenarios. It also provides information with respect to actors involved in the learning environment. Such a framework follows an activity-theoretical approach for the learning activities and constitutes level 1 of the learning design framework.
- A process model, as elaborated in this paper, consisting of appropriate mechanisms for student and learning content profiling. It also consists of records of student navigation history, interactions with learning content and learner perceptions of the content. This constitutes level 2 of the learning design framework

- An adaptation mechanism consisting of a fuzzy algorithm to match the most appropriate content and methods based on the learner profile stored in the system. It decides learning object selection and sequencing, and determines the proposed learning path for the learner for a particular learning activity. This is level 3 of the learning design framework.

Personalization in web-based learning environments using the learning styles approach also implies that a variety of content targeting similar learning outcomes should be available in a variety of formats. However, with increasing availability of web-based resources such as open-educational resources and learning object repositories, there is a possibility of having content with multiple modalities. Furthermore, the lack of conformance to learning metadata standards and high granularity level of some content can be a constraint for reuse, interoperability and compatibility of the learning content.

While the learners profile can be obtained through methods such as self-assessment, read-aloud, iterative interaction and feedback; or through automated techniques like feed-forward neural networks, it is a much more difficult process (in terms of practicalities) for pedagogical experts to spend a significant amount of their time to initially evaluate content, and fill in content metadata related to personalization factors. This also de-facto implies that learning object design must be very carefully looked (or re-looked) at to match a variety of learners. Learning activities must be re-engineered to fit, for instance, field-dependent learners who as previously stated, often suffer from the 'impersonal' nature of some types of learning environments (Luk, 1998) and the extent of structure in the instructional package.

Finally, as correctly argued by Hall and Moseley (2005), the outcome of engaging with style should be strategy and that the "*goal of 'personalized education' or 'learning to learn', whether couched as learner agency or learner autonomy, is simply freedom, and descriptions of learning style should be tools to break chains of habit and limitation".*

Styles, as described in this paper, can therefore be the starting point of an iterative process that will result in the identification of relevant teaching and learning strategies to focus and motivate the learner to achieve established performance objectives. Furthermore, the concept of selection of 'most appropriate' learning material and strategies tallies with the ideas that students should be encouraged, especially in online learning environments, to develop and adapt to other styles of learning engagement.

Conclusion

It is clear that while a number of critiques are addressed to the validity of learning style instruments, there are no alternative constructs to address these issues. On the other hand, the trends in research suggest that learning and cognitive styles are getting the attention of researchers with particular reference to online learning environments. This paper presented a process model that allows, in an iterative way, for the learner to improve his/her profile and preferences through his/her own interaction with the learning content and perception of the learning experience. The process model fits in a wider context of an instructional design specification for personalized web-based learning.

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Editor's Note: Learning a second language provides challenges for teachers and instructional designers. It also introduces factors of cultural and age differences that impact teaching methods and learning environments. Computer assisted learning has much to offer because of its interactivity and ability to accommodate learner differences. It also facilitates performance so that observable and measurable evaluation can be easily accomplished.

Effects of CALL Method and Dyned Language Programme on Students' Achievement Levels and Attitudes Towards the Lesson in English Classes

Gökhan BAŞ and Orhan Kuzucu
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Abstract

The purpose of this study was to examine the effects of the Computer Assisted Language Learning (CALL) method supported with the DynED language learning programme on students' achievement levels and attitudes towards the lesson in the 6th grade students' English lesson. The research was carried out in the 2008 – 2009 education-instruction year in Karatli Sehit Sahin Yilmaz Elementary School, Nigde, Turkey. A total of 60 students in two different classes in the 6th grade of this school participated in the study. The pre/post-test control group research model was used in this study. The data obtained in the study was analysed using the SPSS 11.0 statistics computer programme. The arithmetic means and standard deviations were calculated for each group. In order to test the significance between the groups, the t-test was used. The significance level was taken as .05. The results of the research showed a significant difference between the attitude scores of the experiment group and the control group. It was also found out that the CALL method supported with the DynED language learning programme was more effective in positive development of achievement levels of students. The research revealed that the students educated by the CALL method supported with the DynED language learning programme are more successful, have a higher motivation and better retention than the students who are educated by traditional methods of instruction.

Keywords: Computer Assisted Language Learning, English Teaching, DynED language learning programme, student achievement, students attitudes, online course, instruction method, English as a foreign language, elementary school, 6th grade students

Introduction

The rapid growth of computers has aroused interest in the area of education (Acikalin, 2006; Baturay, 2007). Although the notion of face-to-face classroom instruction is still very prevalent in many organisational and educational settings, with a steady increase rather than a decrease, there is a rush and enthusiasm for computer-based ventures. The global popularity of the computer over the past decade has brought about innovative uses of the computer in education and in foreign language learning and teaching. Many studies affirm that learners consider the computer a useful tool to discover and learn new vocabulary (Alshwairkh, 2004; Baturay, 2007; Johnson & Heffernan, 2006; Kocak, 1997) and to supplement in-class instruction (Kung & Chuo, 2002). Computer use is increasingly embedded in everyday life. It is not surprising to find a similar trend in the academic world. In the last decade, research has illustrated how computer technologies supports meaningful educational experiences (Belz & Kinginger, 2003; Blattner and Fiori, 2009).

Computers are becoming important components of education and the number of computers used at schools is increasing. They are utilised throughout the field of education and in language learning and teaching (Baturay, 2007; Kocak, 1997; Makaraci, 2004; Tuzcuoglu, 2000). Computer technology can be regarded as an educational tool supporting English Language

teaching (Liang and Bonk, 2009). In fact, a wide range of electronic technologies have been developed to supplement second language teaching and learning (Liang and Bonk, 2009; Warschauer, 1996). Although primarily used with adult language learners, these technologies include hardware delivery methods such as audiotape recorders, videotape recorders, computers and the Internet, combined with an educational approach to teaching other languages. In addition, there are many innovative electronic tools oriented to language such as speech production and recognition, text analysis, text translation, and software for visualisation and animation, electronic mail, listserve discussion groups, streaming audio and video and real-time synchronous as well as asynchronous communication opportunities that bring the target language environment to the learner (LeLoup & Porterio, 1997). One recent educational technology for language teaching, more specifically English Language teaching, is the *Computer Assisted Language Learning* (CALL) method. In recent years, countries such as China, France, Malaysia, Korea, Miyanmar, and Turkey are using an English Language teaching computer programme named DynED, which stands for *Dynamic Education.* In these countries, this programme is used in a way that assists teaching English language in schools.

Computer Assisted Language Learning

Until quite recently, computer-assisted language learning (CALL) was a topic of relevance mostly to those with a special interest in computers. Recently, computers have become so widespread in schools and homes and their uses have expanded so dramatically that the majority of language teachers must now begin to think about the implications of computers for language learning (Warschauer, 1996).

CALL (Computer Assisted Language Learning) is the term most commonly used by teachers and students to describe the use of computers as part of a language course (Kocak, 1997). Computer-assisted language learning is a form of computer-based assisted learning with two important features: (1) *bidirectional learning* and (2) *individualised learning*. It is not a method. CALL materials are tools for learning. The focus of CALL is learning, and not teaching. CALL materials are used in teaching to facilitate the language learning process. It is a student-centered, self-paced learning material, which promotes accelerated learning (Alkan, 1997; Hardisty and Windeatt, 1989; Kocak, 1997; Levy, 1997). CALL originates from CAI (Computer-Assisted Instruction), a term that was first viewed as an aid for teachers. The philosophy of CALL puts a strong emphasis on student-centered lessons that allow learners to learn on their own using structured and/or unstructured interactive lessons. CALL can be used to reinforce what has been learned in the classrooms. It can also be used as remedial to help learners with limited language proficiency (Chapelle, 1990; Chapelle and Jamieson, 1986; Levy, 1997; Liddell, 1995).

The design of CALL lessons generally takes into consideration principles of language pedagogy, which may be derived from learning theories (behaviourist, cognitive, and constructivist) and second language learning such as “Krashen's Monitor Theory”. Others may identify CALL as an approach to teaching and learning foreign languages whereby the computer and computer-based resources such as the Internet are used to present, reinforce and assess material to be learned. CALL can be made independent of the Internet (Liang and Bonk, 2009). It can stand alone for example in a CD-ROM format. Depending on its design and objectives, it may include a substantial interactive element especially when CALL is integrated in a web-based format. It may include the search for and the investigation of applications in language teaching and learning (Warschauer, 1996). Except for self-study software, CALL is meant to supplement face-to-face language instruction, not replace it (Pius, 2003). CALL has also been known by several other terms such as technology-enhanced language learning (TELL), computer-assisted language instruction (CALI) and computer-aided language learning (CAL) but all of these are essentially similar (Ehsani and Knodt, 1998).

A number of pedagogical approaches have developed in the computer age, including the communicative and integrative/experimental approaches. Others include constructivism, whole language theory and sociocultural theory although they are not exclusively theories of language learning. With constructivism, students are active participants in a task in which they "construct" new knowledge based on experience in order to incorporate new ideas into their already-established schema of knowledge (Brooks and Brooks, 1999). Whole language theory postulates that language learning moves from the whole to the part rather than building sub-skills like grammar to lead toward higher abilities like reading comprehension. Whole language insists the opposite is the way we really learn to use language (Alkan, 1997). Students learn grammar and other sub-skills by making intelligent guesses based on the input they have experienced. It also suggests that the four skills (reading, writing, listening and speaking) are interrelated (Stepp-Greany, 2002). Social interaction involves second language (L2) learners' interaction with others in social learning environments inspired by the concept of the *zone of proximal development*- i.e., context of assisted learning and development, socio-cultural theory states that learning is a process of becoming part of a desired community and learning that rules of behaviour for that community (Vygotsky, 1978).

The reasons for using Computer-Assisted Language Learning include: (a) experiential learning, (b) motivation, (c) enhancement of student achievement, (d) authentic materials for study, (e) greater interaction, (f) individualization, (g) independence from a single source of information, and (h) global understanding. The barriers inhibiting the practice of Computer-assisted Language Learning can be classified in the following common categories: (a) financial barriers, (b) availability of computer hardware and software, (c) technical and theoretical knowledge, and (d) acceptance of the technology (Chapelle, 1990; Hardisty and Windeatt, 1989; Levy, 1997; Liddell, 1995; Warschauer, 1996).

Using CALL, visual and auditory input delivered in a well-ordered sequence can lead the learner to understand the grammar, syntax and vocabulary of the target language with no need for text support. Learners can interact with the presentation, and have their interactions recorded into their study records and even influence the pace and level of the presentation. (Knowles, 2004).

DynED Language Learning Programme

DynEd was founded in 1987 by the former director of the total immersion program at the Language Institute of Japan and a team of engineers. DynEd's founders created the world's first interactive multimedia language learning CD-ROM in 1988 and received a U.S. patent for this invention in 1991 (Stark, 2004).

From its inception, DynEd has been dedicated to quality and integrity. With the improvement of English language education as its mission, DynEd has teamed with leading authors and publishers in the field of *English Language Teaching* and developed courseware in line with the leading theories of language acquisition. Fundamentally, each DynEd course is based on sound, time-proven approaches to language teaching, curriculum design, and human interface design. Evidence for the effectiveness of its courseware is based on over twenty-five years of experience in language programs from around the world and on recent findings in the neural sciences (http://www.dyned.com/about/).

DynEd also has access to the real-time study records of thousands of students from around the world. DynEd's research-based courses cover all proficiency levels and include a range of age-appropriate courses, from kids in school to adults in leading corporations. In addition, DynEd courses are supported by an award-winning Records Management System, Mastery and placement tests, and extensive teacher-support materials, including teacher-training and mentoring (http://www.dyned.com/about/).

The program consists of ten increasingly advanced units. Students click on the appropriate unit and a screen appears with five choices for study: *Warm-Up lessons, School-Life lessons*, *School-Subject lessons, World Talk Cards and Language Extension lessons, and Speaking Up lessons.* There is constant audio support and feedback which users can choose to replay (Stark, 2004: 2).

In the Warm-Up Session, a narrator describes a scene, pausing about three seconds between statements for student processing. "It's very hot. It's very hot. The sun is shining and the water is clear." The next screen shows the same image with responses to an audio question. The student clicks on an answer. If it is incorrect, the student will hear, "No, that's not correct. Please try again." When the answers are correct, an encouraging voice will say, "That's right!" or another will say, "Good!", then a new image appears and the process is repeated (Stark, 2004: 3).

School-Subject lessons focus on math, English grammar, science, world history, and geography. Key vocabulary and grammar forms are recycled for each lesson, giving students exposure to the material in different contexts. The basic explanations also provide background knowledge for students who need it. Students learn the language of school instruction: explanations, giving examples, classification, comparisons, asking questions, and more. Lessons cover various areas of a subject. For instance, math will offer lessons on: geometric shapes, positive and negative numbers, fractions, temperature, measuring, and others (Stark, 2004).

World Talk Cards and *Language Extension Lessons* offer general topics such as preferences, weather, occupations, and places of business. The language is presented in a game format, usually "Concentration" and, like all the lessons, has frequent checks for comprehension. After the game, a grammar focus lesson explicitly addresses correct usage. Language Extension lessons and speaking up lessons allow students to profit from speech recognition technology to practice and perfect their speaking fluency and accuracy. It is not a pronunciation program, although students can compare their speech to the narrator's. There are three levels of expertise: beginner, intermediate, and expert. With each advancing level the feedback is more detailed and demanding. There are four mastery tests that assess two or three units at a time. The tests are challenging and require somewhat *higher-level thinking--comprehension*, and application as well as recall of the target language structures and information. If students achieve these tests after the stated units, they can pass to the next units (Stark, 2004: 4 -5).

DynED is a program designed to help English Language Learners (ELLs) aged between 11-18 acquire the language they need for success at school in their classes and with their new schoolmates. It is based on brain and language acquisition research, exploiting both to form a blended model where multimedia activities and classroom interaction complement each other. The language structures and vocabulary provided are specific for the content classes and for social situations that normally occur in classroom situations. It is common for ELL students to acquire basic English, but it is uncommon that they fulfil their academic potential. This comprehensive program addresses their need for a boost in academic and social language for academic use as they move into an English-speaking education system (Stark, 2004).

Method

Research design

In this study, an experimental method and a control group have been used in order to find the difference between the students who were taught with the Computer Assisted Language Learning (CALL) method supported with DynED education programme in the experiment group and the students who were taught by traditional language teaching methods.

Both groups were employed a pre-test prior to the experimental process. The subjects were given an achievement test and an attitude scale test towards English lesson as a pre-test. Meanwhile, the

same tests (achievement and the attitude scale tests) were employed to both groups after the experimental process as a post-test.

Pre-test / post-test experimental design with a control group was used in the study. A small number of homogenous subjects provided us with information over a period of five months. To begin with, the subjects described what they actually did in the process of Computer Assisted Language Learning (CALL) method supported with DynED education programme.

Subjects of the study

Individual EFL / ESL learners are the main source of the data in the study which requires the use of the Computer Assisted Language Learning (CALL) method supported by the DynED education programme for data collection.

Two classrooms of 6th grade class students from Karatli Sehit Sahin Yilmaz Elementary School, Nigde, Turkey formed the sample of the study. The total number of the students participated in the study was 60. Thirty students from the 6-A class formed the experiment group and the thirty students from the 6-B class formed the control group in the study.

In order to investigate students' achievement and attitudes towards English lesson, some spesific English lesson subjects in the elementary currciulum such as "school subjects, simple mathematical calculations, simple personel instructions (asking and answering questions, etc.), weather forecasts and occupations, vs." which were taken by the 6th grade class students were selected. These subjects were also included in the DynED language learning programme.

The attitude scale test towards the English lesson consisting of 30 items and the achievement test containing 75 items were administrated to both groups in a single session as a pre-test. In four weeks, the experiment group was given various strategies for the Computer Assisted Language Learning (CALL) method supported with DynED education programme in the teaching session, but not the control group. Five months later, each of the students was administrated the achievement test and attitude scale test towards the English lesson given as a post test. The difference between the pre-test and post-test results was accepted as an achievement.

Procedures of the study

In the experiment group, the following procedures were applied. In the control group, traditional language teaching methods have been used in the process of the study. The procedures in the experiment group are as follows:

First, the students were given both the pre-achievement test in English and pre-attitude scale towards the lesson.

The students were assigned to different computers to study the stated subjects. All of the necessary equipments such as microphones, headphones, etc. were supplied to the students.

The students were educated on the usage and the benefits of the DynED language learning programme for a week. For example, the students were instructed how to listen to tapescripts, and how to talk and record their speech on the programme.

The students were instructed in the stated subjects by some language teaching / learning methods two hours a week. Target vocabulary and grammar patterns were introduced to the students in these lessons. After that, the students were educated formerly two hours a week by using the DynED language learning programme. In this phase, the students found opportunities to practise their learning in English classes using the language learning programme after formal lessons.

The teacher visited all of the students using DynED language learning programme in the classroom and offered help when students needed it. The teacher also helped the students with technical problems.

Students practised their learning (especially *the vocabulary*) in the DynED language learning programme both at home and school.

Students discussed what they learned in the lessons and in DynED language learning programme at school.

Students took short exams after each unit and received feedback on their performance. Students who passed these exams took the next unit; if not, they had opportunity to practise until they passed to the next unit. Students passed if they achieved 70 points on the exam.

The students were given both the post-achievement test in English and the post-attitude scale towards the lesson.

Instruments

Achievement test

The multiple-choice test included 75 items (each item is 1 point; total score is 75). Reliability and validity were verified before it was givien to the students. This test measured students' achievement levels resulting from the CALL / DynED education programme.

The reliability of the achievement test was done by the KR-20 method (Yilmaz, 1998). The reliability value of the test was found to be r = .88 which confirmed that the test is reliable. It was given to students in both experimental and control groups.

Attitude Scale test

The attitude scale test has been applied to measure the attitudes of the students towards the English lesson. The scale test is a *three-point Likert type scale* (which was used to differentiate orientations from 1 as low and 3 as high) reliability and validity of which have been made by t-test, including 30 items that measure students' interests / attitudes towards the lesson. The reliability value of the attitude scale test was found as r = .76 and the *Cronbach Alpha* value was found as α = .83. In light of these data, it can be said that the attitude scale test is both reliable and valid to be used in the current study.

Analysis of the data

In this study, the statistical techniques such as *Mean* (X), *Standart Deviation* (Std. Dev.) and *t-test* were used in the analysis of the data. *P value* was held as 0.05. The statistical analyses were accomplished using the *SPSS 11.0 statistical package programme for windows*.

Limitations of the study

A small sample size is one limitation of the study. The number of the participants in the study was limited to the number of 6th grade class students (total 60 students) in *Karatli Sehit Sahin Yilmaz Elementary School*, Nigde, Turkey. Another limitation arises from the subject of English course since "school subjects, simple mathematical calculations, simple personel instructions (asking and answering questions, etc.), weather forecasts and occupations, vs." were used in the experiment and the control groups. In the experiment group, the Computer Assisted Language Learning (CALL) method supported with the DynED education programme was used. In the control group, traditional language teaching methods were used. This study was limited to "*First English software*" of DynED language learning programe in the experiment group.

Hypotheses

In order to identify the differences between the students of the experiment group and the students of the control group, following hypotheses were tried to be tested in the light of the acquired data in the study:

1. There is a significant difference between the achievement levels of the students in the experiment group and the students in the control group in terms of the usage of Computer Assisted Language Learning (CALL) method supported with DynED language learning programme.
2. There is a significant difference between the attitude levels of the students in the experiment group and the students in the control group towards the lesson in terms of the usage of Computer Assisted Language Learning (CALL) method supported with DynED language learning programme.

Findings of the Study

The results given in tables were obtained from the students' answers to the achievement test and to the attitude scale test towards the English lesson. In this part of the study, the acquired data will be presented with calculated analyses in tables below.

Analysis of Hypothesis #1

The first hypothesis of the study was "There is a significant difference between the achievement levels of the students in the experiment group and the students in the control group in terms of the usage of Computer Assisted Language Learning (CALL) supported by the DynED language learning programme".

Table 1
Comparison of pre-test achievement scores of students in the experimental and control groups

Groups	N	$\overline{X}$	SS	df	t	p
Experiment	30	18.4	12.6	58	-0.237	0.81*
Control	30	19.2	12.5			

*p > .05

Table 1 compares the pre-test achievement scores of the students in the experimental group and the control group. The average score of students in the experiment group was X = 18.4±12.6; and the average pre-test score of the students in the control group was X = 19.2±12.5. The difference between students of these two groups, analysed independently using a t-test, was $t_{(58)} = -0.237$. According to these results, there is no statistically significant difference between the pre-test scores of the students of these two groups at the 0.05 level (p =.81; p> .05).

Pre-learning levels in English for both groups were equal.

Table 2
Comparison of post-test achievement scores of students in the experimental and control groups

Groups	N	$\overline{X}$	SS	df	t	p
Experiment	30	59.8	11.7	58	4.01	.0002*
Control	30	46.7	13.7			

*p< .05

Post-test achievement scores for students in experimental and the control groups are compared in Table 2. The average post-test score for students in the experimental group were X = 59.8±11.7;

and the average post-test score of the students in the control group were X = 46.7±13.7. The difference between the two groups, analysed independently using a t-test, was $t_{(58)} = 4.01$. Students in the experiment group (X = 59.8) showed significant achievement compared to the students in the control group (X = 46.7). These results showed a statistically significant difference between the post-test scores of the two groups at the 0.05 level (p = 0.0002; p< .05).

Table 3
Comparison of achievement scores of students in the experimental and control groups

	Groups		PRE TEST		POST TEST		ACHIEVEMENT			
Achievement		N	$\bar{X}$	SS	$\bar{X}$	SS	$\bar{X}$	SS	t	p
	Experiment	30	18.4	12.6	59.8	11.7	41.4	3.97	4.670	.000*
	Control	30	19.2	12.5	46.7	13.7	27.5	4.48		

*p< .05

Table 3 compares achievement scores and the t-values based on the pre-test and the post-test, The distribution of the post-test scores applied to both groups at the end of the research process. The average score of the experiment group was X = 59.8±11.7; and the average score of the control group was X = 46.7±13.7. Achievement was calculated using the difference between the pre-test and the post-test of the students in the experimental and control groups. The average achievement of students in the experimental group was X = 41.0±3.97; and the average achievement of the students in the control group was X = 28.0±4.48. The t-value between average achievement scores of the two groups was t = 4.670. This shows that the difference between the two groups is statistically significant (p = .000; p<.05). Students in the experimental group reached a significantly higher achievement level compared to those in the control group and showed that the Computer Assisted Language Learning (CALL) method supported with DynED language learning programme, was more effective than the traditional language teaching methods in the control group. This finding supports first hypothesis #1..

Analysis of the Hypothesis #2

The second hypothesis of the study was "There is a significant difference between the attitude levels of the students in the experiment group and the students in the control group towards the lesson in terms of the usage of Computer Assisted Language Learning (CALL) supported with DynED language learning programme".

Table 4
Comparison of pre-test attitude scores of students in the experimental and control groups

Groups	N	$\bar{X}$	SS	df	t	p
Experiment	30	1.53	0.571	58	0.227	0.82*
Control	30	1.57	0.568			

*p > .05

Table 4 shows the pre-test attitude scores of the students in the experimental and control groups. The average pre-test attitude score for students in the experimental group was X = 1.53±0.571; the average pre-test attitude score for students in the control group was X = 1.57±0.568. The t-

value between average scores of the two groups was $t_{(58)} = 0.227$. This is not statistically significant at the 0.05 level since pre-test attitude scores of these two groups are similar.

Table 5
Comparison of post-test attitude scores of students in the experimental and control groups

Groups	N	$\overline{X}$	SS	df	t	p
Experiment	30	2.53	0.571	58	4.38	.0001*
Control	30	1.90	0.548			

*p< .05

Post-test attitude scores of students in the experimental and control group are shown in Table 5. The average post-test attitude score for the experimental group was X = 2.53±0.571; the average attitude post-test score of the students in the control group was X = 1.90±0.548. The t-test value obtained from the average scores of the two groups is $t_{(58)} = 4.38$ which shows a statistically significant difference (p = .0001; p<.05). In light of data acquired in this research, it can be said that the students in the experiment group achieved higher attitude scores compared to those in the control group. The experimental method (Computer Assisted Language Learning supported with DynED language learning programme) enabled the students to develop a significantly better attitude towards the English lesson and supports the correctness of the second hypothesis.

Discussion and Conclusion

The conclusions stated below are based on the findings of this research:

1. There was a significant difference between the achievement levels of students educated using Computer Assisted Language Learning (CALL) and the DynED programme and students who were educated using traditional language teaching methods. Students educated by CALL with DynED were more successful than the students educated by traditional language teaching methods. This confirms the findings of other researchers.

   Kocak (1997) investigated the effects of Computer Assisted Language Learning on vocabulary instruction for Turkish EFL students. In his research, students who were educated by CALL had higher achievement levels on English vocabulary than those who learned using traditional language teaching methods.

   Cevik (2001) investigated the effects of Computer Assisted Language Learning on students' achievement in foreign language classrooms and found that CALL educated students had significantly higher levels of achievement than the students educated by traditional language teaching methods.

   Studies by Kaplan (2002), Harmanci (2009), Yilmaz (2004), Inan (1997), Yarar (2005) and Kilickaya (2005) found a significant difference in knowledge learned by CALL (experimental group) and traditional language teaching (control group).

   Makaraci (2004) investigated the effects of Computer Assisted Language Learning for learning grammar in English classes. Students educated by the CALL method achieved higher than students educated by traditional language teaching methods, but the result was not significant at .05 level. Makaraci (2004) found a significant difference between the retention levels of the students in the experimental and the control groups. Students educated by the CALL method had higher retention levels than students educated by traditional methods.

Ygit (2007) researched academic success and retention on primary school 2nd grade mathematics using educational computer games. Computer-aided math games were applied to the experimental group while the traditional (paper and pencil) methods were used by the control group. There was no significant difference between control and experimental groups in this study.

2. In terms of attitude towards English lessons, there is a significant difference between the experimental group and the control group. Students educated by Computer Assisted Language Learning (CALL) supported with the DynED programme have more positive attitudes to English classes than those educated by traditional language teaching methods.

   Kocak's (1997) study investigated the effectiveness of CALL on vocabulary teaching and learning. The hypothesis was that students are more positively motivated to use software materials than the usual textbook and that vocabulary development would be significantly better for the software (experimental) group than for the textbook (control) group. Both groups were given pretest and posttest for 20 vocabulary items practised in isolation and in context over a two session, four-hour treatment period. The experimental and control groups were given a questionnaire to measure their attitudes towards using computers as a part of their course. It was found out that students educated by the Computer Assisted Language Learning method developed more positive attitudes towards the lesson than the students in the control group.

   Pekel (2002) investigated students' attitudes towards web-based independent learning at Bilkent University School of English Language. In her study, fourteen volunteer upper-intermediate level prep students from different disciplines were the participants. A six-week web-based independent learning course was designed and implemented. The teacher and students communicated through e-mail only. The pre- and post-treatment questionnaires were analyzed quantitatively. Comparison of the results of initial and final questionnaires revealed that students' attitudes towards web-based independent learning changed positively, and in particular, their knowledge of how to learn on the internet increased considerably as a result of the study.

   Onsoy (2004), Yalcinalp (1993), Meyveci (1997) and Ayturk (1999) carried out studies to explore student's attitudes towards lessons by Computer Assisted Language Learning. They found that there was a significant difference in attitudes. Students who were educated by CALL developed more positive attitudes towards the lesson than students who were educated by the traditional language teaching. These results correlate with the results of the current study. It can be said, based on the findings above, Computer Assisted Language Learning method was more effective on the development of students' attitudes towards lesson than the traditional language teaching methods.

3. Other studies measured teacher attitudes. Tuzcuoglu (2000) investigated the teachers' attitudes towards using Computer Assisted Language Learning in foreign language classes. This study revealed that the teachers at Osmangazi University Department of Foreign Languages, Eskisehir, Turkey had positive attitudes towards using CALL and were willing to teach in the computer lab for a few hours a week. They agreed that using CALL would increase students' interest and language learning abilities. The teachers wanted to use computers for both teaching and practising skills. They stated the most important skills to be focused on are grammar, reading and vocabulary. They indicated a need for computer training to be able to use CALL effectively.

   Zereyalp (2009) studied teacher attitudes to reveal barriers to using CALL or computer technologies in their teaching in state universities in Turkey. This study was carried out

with 80 teacher educators from English Language teaching departments in 13 Turkish State universities. The study found strong positive attitudes among teachers to use CALL in their instruction and identified barriers such as lack of hardware, lack of time, and insufficient technical and administrative support.

The findings of the current study, supported by the literature, conclude that Computer Assisted Language Learning helps to develop positive attitudes among students towards language learning. This method is supported by teachers because Computer Assisted Language Learning helps to motivate students and increase their learning and achievement.

In this study, the achievement level of experimental group students was *significantly* higher than the group taught using traditional language teaching methods. Students educated by CALL and the DynED programme were more eager to learn English and actively participate in learning. It was observed that students in the experimental group developed listening and speaking skills beyond those of the control group. The researcher did not find a significant difference in writing skills between the two groups. This may be because students educated with CALL and DynED did not need to use pencils. Both groups had chance for writing in formal instruction processes in class. Neither group received specific training to write better than the other.

In conclusion, on the basis of findings gathered in this study, it can be said that Computer Assisted Language Learning (CALL) supported with DynED can be used advantageously in EFL / ESL classrooms. Researchers are encouraged to conduct further studies on Computer Assisted Language Learning and the DynED education programme in English classes and other subjects.

Suggestions

As a result of this study, the following suggestions are offered for additional research:

The teachers should use consider CALL and DynED to increase motivation and learning in language Instruction.

Seminars, courses, and in-service workshops should be organised upgrade computer skills and to train teachers to use CALL and DynED methods effectively in their classrooms.

Elementary English School curriculum in Turkey does not correlate with Computer Assisted Language Learning supported by the DynED programme. The elementary English curriculum should be integrated with the DynED language teaching programme fort schools.

English teaching classes are very limited (4 hours a week) at national schools in Turkey Duration of English lessons should be increased to better apply the Computer Assisted Language Learning method and DynED language teaching programme.

Students should be taught computer skills so they can effectively use computers for learning.

Opportunities should be created for students to discuss, reflect on, and share of what they learned.

Teacher education programmes should be reorganised to contain both the usage (practice) and the theoretical knowledge/framework of Computer Assisted Language Learning method and the DynED language teaching programme.

Most schools in Turkey are in need of computers and computer labs. The Ministry of National Education of Turkey, known as MEB, should develop the technological infrastructure to implement Computer Assisted Language Learning and DynED language teaching methods. CALL and DynED language teaching programmes should be mandatory for all schools.

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Editor's Note: Innovation is necessary to upgrade our educational systems, but change is a complex process that requires imagination, creative planning, and constant feedback to improve on the original design. Introduction of ICT technologies in Andalusia is typical of innovative projects in having unanticipated problems. The feedback from year one shows how changeover to a new system requires enough time for buy-in, training, and orderly integration of technology into the curriculum. The key players are teachers and students and administrators and those appointed to manage the integration project. The outcomes are improvement of teaching and learning.

The ICT Centre Model in Andalusia (Spain): Results of a Resolute Educational Policy

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Spain

Abstract

This paper displays some results from research carried out in Andalusia (Spain) to evaluate the impact of the educational innovation policy developed by the regional government through widely introducing Information and Communication Technologies (ICT) in primary and secondary schools (ICT Centres). Specifically, it analysed the effect of the measures used to integrate ICTs on the educational administration and education centres. This integration is analysed not only at an institutional level, concerning the organization of the centres, but also regarding the classroom and its repercussions in teaching-learning processes.

Keywords: Technology planning, technology integration, ICT use.

1. Introduction

Our study stems from the rigorous analysis of the integration of computers as a common resource for teaching and learning. This process started to be developed some years ago, all over the world. Not long ago, computers were only occasionally found in schools or only in specific classrooms. We are now witnessing a huge political and economic effort working towards universalization of information and communication technologies (ICT). This is made evident by convocations, projects and programmes supported in most cases by international, national or even regional and local education administrations and institutions. This investment in facilities and maintenance of IT equipment – software and hardware – may not have adequate policies to support efficient and coherent use of these resources in schools. Problems include distribution, implementation and maintenance of these resources, ICT training for teachers, and evaluation of the impact of technology on the teaching-learning process.

In the last few decades, experiments and studies on integration of information and communication technologies (ICT) at different levels of education have occurred throughout the world. Area (2005) points out the abundant "empirical information about ICT in schools" and highlights studies[1] on quantitative indicators that describe and measure introduction and use of computers in school systems. He also lists studies on the effects of computers on the students' performance and

[1] Area (2005) has carried out an interesting revision of the main research areas in integrating technologies in the school system. Some examples, which frame more specifically every perspective, are underlined: quantitative indicators which describe the introduction and use (Euridyce 2001; Cattagni and Farris 2001; Twining 2002; OCDE 2003); effects of computers on performance and learning (Kulik 1994; Reeves 1998; Parr 2000; Block et al. 2002); perspectives, opinions and attitudes of educational agents and teachers towards use and integration of technologies (Escudero 1989; De Pablos and Colás 1998; NCES 2000; Cabero, 2000; Solmon and Wiederhorn 2000; Cope and Ward 2002); practice of use of computers in schools and classes which are developed in real contexts (Gallego 1994; Alonso 1993; Bosco 2000; Zhao et al. 2002; Martínez 2002). For further information, read the whole article in this website: www.uv.es/RELIEVE/v11n1/RELIEVEv11n1_1.htm.

learning, on perspectives, opinions and attitudes of external educational agents (managers, supervisors, support teams), teachers, and students towards the use and integration of technologies, and also studies on the use of computers in the centres and classrooms, for many disciplines, carried out in real contexts.

In addition to this, "it is necessary to build a theory about this particular phenomenon in the school environment to help us understand the effects of computers in schools, the causes of the teachers' resistance to integrate these methods in their classrooms, or how to successfully implement incorporation strategies of ICT in a specific national or regional context."

With this goal for R&D projects in Spain[2], research was developed to determine the most recent impact of telematic technologies in education in Andalusia. The research is specific to centres known as "ICT Centres" that are characterized by their technological facilities for primary and secondary education. These centres have arisen as a consequence of a political and social commitment by the Andalusian government to widely implement ICT in schools based on similar projects throughout the country. Since the school year 2003/04, the "ICT Centres" plan has been developing, with yearly convocations, to which more and more centres respond.

Our study is focused on a significant sample, the first graduates from Andalusian ICT Centres. The telematic resources have been analysed, as well as the use of free software, not only at an institutional level, taking into account the organization of the centre, but also in the classroom, paying attention to its direct effects on teaching-learning processes.

Implementing free software in Andalusian centres represents a commitment to future proactive educational innovation. With this study, our aim is to describe the current use of technology in ICT schools and to analyse the overall profitability of these programmes. We have obtained contrasting information about the degree of implementation of the new free software resources and their impact on teaching-learning procedures which are generated directly in the classroom. In this article we will show specific contributions and research results to support this educational innovation policy based on integrating technology and using free software.

The data has been obtained through a descriptive methodology to analyse the introduction of technology in Andalusian schools and high schools and its repercussion throughout the educational system. With this objective, several instruments have been used such as surveys, group interviews or focus groups, analysis of centre organization documents, and non-participating systematic observation performed through control lists and estimation scales.

2. Antecedents of ICTs in Andalusian schools.

Various reports and research on integration of ICT in education can be found (Cabero 2001; Cattagni and Farris, E. 2001; Marchesi and Martín 2003; Area, 2005; Balanskat, Blamire and Kefala 2006; Becta 2006; Pérez and Sola 2006; Cebrián, Ruiz and Rodríguez 2007). They document increasing efforts of the administrations to provide and adapt schools for technology. However, not all results and conclusions are positive, as stated above. In this same area, this paper is oriented towards the study of the measures taken by the Spanish government, and more specifically by the Andalusian government, to promote effective integration of ICT in education using free software.

[2] R+D Project SEC2004-01421, "Observatics": Implementing free software in Andalusian ICT Centres. Analysis of its repercussion in teaching-learning procedures", included in the R+D National Announcement Plan 2004-2007, Spanish Science and Education Ministry. It was developed by "@gora" Research Group (PAI-HUM-648), under the direction of the main researcher, PhD. J. Ignacio Aguaded.

The European SchoolNet (EUN) report prepared by Balanskat, Blamire and Kefala (2006) examines the impact of ICT in schools in Europe. Its makes recommendations for creation of policies and plans for ICT integration: emphasises the role of group work and independent study, and includes them in curricula and in evaluation plans, develops new ways of continuous training for teachers, and supports use of ICT and motivation for teachers to use ICT in their classes.

Extremadura was the first region in Spain to include free software in public administration and in primary and secondary schools in 2001. At the beginning of 2003 Andalusia began to apply this system, promoted by the *Consejería de la Presidencia* (regional ministry) Decree 72/2003, March 18, on Measures to Promote the Knowledge Society in Andalusia and set administrative and legal grounds for the universalization of information and communication technologies. Three clear objectives arose from its development:

1. Guaranteed access to ICT for every Andalusian, without any kind of discrimination regarding place of residence or social status.
2. Facilitate internet access to information and services offered by the administration (www.andaluciajunta.es).
3. Adapt basic public services, especially health and education services, for the demands and potentialities of the "knowledge society".

From that moment on, a number of official documents were drawn up as public announcements to shape this ambitious project: to give Andalusian public schools sufficient and necessary infrastructure for information and communication technologies to carry out this initiative, not only regarding material, but also training. As a result, several plans and programmes were developed: Red-Aula Program, Alhambra Plan and Zahara XXI Plan, finishing with Averroes Project, still active today. "Alhambra and Zahara Plans involved really significant efforts to systematically incorporate ICT into educational institutions".

> "They involved the first rigorous attempts to promote their presence in schools as well as training for teachers. In some aspects we must admit that they were the first ones in our country to incorporate ICT in non-University education" (Cabero 2003a).

Specifically, the Averroes Project relied in the gradual increase in equipment during the period 2001-04. At the end of this period, every pre-school and primary school centre, even in less favoured areas, would be equipped with a basic IT network that would give them access to information and communication technologies[3].

In the framework of this technological philosophy, the ICT Centres Project officially took off on April 4, 2003[4].

[3] This equipment included five multimedia computers with network card and access to the internet through a router, a digital line with cables to connect the equipment, scanner, inkjet colour printer, office automation software, an electronic encyclopaedia and the suitable furniture for the equipment. Moreover, from that year on, the aim was to offer every rural school the basic reduced equipment consisting of a multimedia computer with modem, inkjet colour printer and the same electronic encyclopaedia. At the same time, a pilot project began: offering several pre-school centres a microcomputer per classroom to create "the computer corner". Redaula Plan, to offer PC rooms to pre-school and primary education centres owned by the *Consejería* (regional government), in the framework of the Telematic Network of Schools in Andalusia (BOJA 17-03-01) (http://averroes.cec.junta-andalucia.es; www3.cec.junta-andalucia.es/index.html).

[4] March 27, 2003, *Boletín de la Junta de Andalucía* (Oficial Andalusian Government Gazette). This order regulates the announcement for the selection of educational projects to include information and communication technologies in teaching.

2.1. The ICT Centre model

An ICT Centre in Andalusia is mandated for every public primary, secondary, or compulsory high school. It is equipped with IT material for students, to be also used by staff. The equipment consists of: one computer for every two students, tables that are adapted or computers in the classrooms, chairs for every table, computers with laser printer and scanner in didactic departments, library, teacher's room, the AMPA (association of mothers and fathers) office, the secretary's office and in the directive board offices, big capacity printer in the reception area, digital photo and video camera, video projector, laptop, broadband internet connection and connection to the Educational Platform where multiple activities can be found. Another distinctive characteristic of this equipment is the choice to use free software and open code in teaching using the Guadalinex operating system, based on Debian (Linux).

To be considered an ICT Centre, the school has to respond to the announcement of the ICT projects and meet several requirements.

Andalusian schools have access, throughout the school year 2006/07, to 49,000 new computers. Of these, 42,255 are assigned to the 315 schools and high schools which joined the ICT Centre Network in September. With the new schools that joined the program, the Network is composed of 823 centres, 30% of active centres in Andalusia.

The most innovative factor in this widespread integration of technologies is use of the computer asan educational tool in learning and teaching. In addition to IT equipment, Centres can access an intranet and an educational platform: Anda@red. These centres integrate ICT.

The Andalusian government published the first notice[5] to select centres that would work with information and communication technologies. Once the educational projects to integrate technologies were launched, 50 public centres were selected. Among these 50 centres, 14 were primary schools and 36 were Compulsory Secondary Education (ESO) schools. All these centres had 81,000 computers with the same operating system, Guadalinex, developed from Linux by the IT research group in the *Junta de Andalucía* (Andalusia Regional Government) to be used in Andalusia.

The projects that centres had to present in response to said notice was to put forward an action plan to integrate technology in teaching. They had to include, information about the experiences of the teachers regarding ICT, experiences of the ICT coordinator, the reasons or circumstances that made its introduction advisable, the objectives and the list of areas of knowledge in which ICT would be used. It is important to highlight the relevance of the coordinator, whose function was essential to advise the teachers about available resources, solve technical problems, establish ways to spread experiences and exchange information, and promote improvements in the project.

2.2. Support measures to ICT Centres

The Andalusian administration specified, from the beginning, a series of measures to support ICT Centres. These highlight: a broadband connection and equipment; educational programmes and materials to be used with free software; appointment of a coordinator; an increase up to 10% in working expenses for centres; specific training, assessment for better use of the information resources and their integration into teaching; publishing the experiences on the internet; publishing the produced educational materials; and acknowledgement of participation in the project as a specific merit.

[5] Regulation on 2003-03-27 by the *Consejería de Educación de la Junta de Andalucía* (Andalusian Government Education Ministry). It regulates the announcement to select school educational projects to include information and communication technologies in teaching.

Research results have shown the challenges and possibilities for project improvement. It has proven that a lot of material does not imply an advance in methodology, and the centre must determine how far and how fast it can change the teaching-learning process. This is why today every centre decides how to integrate ICTs in teaching practices according to different classroom organization models which have to be included in the curricular development plan.

Perhaps the most outstanding measure to foster ICT Centres is the use of platforms and webs as modulating elements. Since the beginning of the project, the educational administration has offered ICT Centres a resource which until then had been little used in public compulsory education: the E-ducational platform. Every centre is given the chance to develop this virtual space, which must be managed by the ICT coordinator, as a complement to the traditional methodology. Both methods require the internet but use it differently.

3. The Study

Our study is framed within the teaching research trends of the last few years (Area 2005; Cabero 1995; Castaño 1994). Comparative studies are abandoned in order to research processes of integration in teaching-learning contexts. As Area (2005) points out, "the process of using and integrating computers in the school systems is a complex process, subject to many tensions and pressures with different origins (political, business, social, pedagogical). Thus, problems and research methods have evolved from the concerns of individual learning with computers in specific learning situations using experimental methodologies, to more longitudinal studies and with qualitative techniques to study cases in real teaching contexts". From this perspective the research was to discover the effect of ICT in schools among students and teachers.

In this article, we want to show results of the study regarding measures to implement and aid growth of "ICT Centers" in primary and secondary education. We consider that the mere presence of equipment, programs and technology does not imply improvement of educational processes. According to Ávila and Tello (2003: 179), today's society needs changes in school systems, basically to promote "innovative experiences in teaching-learning processes based on ICT, affecting the teachers and teaching strategies, communication, learning materials, and distribution systems. Success will be measured by teaching and learning outcomes rather than availability and potentialities of technologies. IT resources must be set in powerful and collaborative learning environments as tools to support the active process of learning construction and skill development". Thus, educational program management, organization factors, teacher training, programs promoted by the centre, and educational conceptions by the teachers, and their use of technological resources, will determine their didactic use.

The study was carried out with 634 teachers from 16 schools that took part in the first ICT Projects. The centres were chosen as a random sample, five are pre-school and primary education centres, and eleven are secondary education centres.

3.1. Techniques and tools for data collection: interviews, focus groups

Given the objectives and information we planned to obtain, we chose to carry out descriptive research in school contexts. We want to describe ICT integration, as Cabero (2003b) points out, from the point of view of them being not only information transmitting instruments, but also "thinking and culture instruments". This article will be limited to results obtained in interviews and focus groups. These results are more qualitative and provide detailed information to guide promotion of ICT Centres in Andalusia.

In the last quarter of 2005, dates were set for the interviews and focus groups**.**

For the interviews, a category system was established to facilitate the definition and formulation of questions to get the precise information according to the research objectives for later analysis.

Two interviews were carried out in every centre, one with the director; the other with the ICT project coordinator. It was expected that their perceptions would be different as well as complementary. The outlines were different in some questions to access these different perspectives, especially regarding organization, technical or administrative subjects. The research was focused on a sample of 16 centres. There were 31 interviews because the director was also the ICT project coordinator in one of the centres. The interviews were recorded, and later transcribed into Word format to be qualitatively analysed with a specific program, HyperResearch. They were finally analysed following the category system defined earlier.

Focus groups were created as "a carefully planned conversation, designed to obtain information about a defined interest area, in a permissive, non-directive environment (…) guided by an expert moderator" (Krueger and Case, 2000:24). The first meeting brought together people in charge of ICT Projects, both direction and coordination of the project, as well as researchers, and people important in the start-up and development of the Projects. These focus groups were aimed at collecting opinions, expectations, interests, etc. about the incorporation and use of ICT in schools. Nine discussion groups were formed, and the following topics were discussed: resources and organization handicaps, alternative measures, teacher training, didactic use of materials, educational platforms and free software and student and teacher competence. Once the sessions were over, and their contents had been transcribed and analysed, a second focus group with the same participants was carried out. Its aim was to make the conclusions known and to corroborate the data, as well as to include new contributions, experiences, opinions and suggestions for improvement in the projects or in the centres.

4. Results

4.1. Interviews

The interviews allowed us to evaluate, from a qualitative point of view, the results obtained through different sources. We were able to contrast and widen the information obtained and create the appropriate relationship and environment among the researchers in the centres.

The transcripts from the 16 centres in the study are constituted by a total of 31 interviews, which generated documents with thousands of informative parameters about situations that were analysed.

The documents related to the directors have been codified in 1466 units, while those related to the coordinators, giving a total of 1278, have been divided as shown in Table 1.

Table 1

Coding Frequency		
Codes	**Directors**	**Coordinators**
Project gestation and design	276	216
Project development	481	285
Teaching-learning	163	189
Support from the Administration	189	261
Teacher training	190	191
Evaluation	161	136
TOTAL	1.466	1.278

This gives us an idea of the interest of those in charge of the centres and ICT projects for the "project development", that is to say, the issues arising from its implementation, the changes in the centre, the direction and coordination, the start-up of the resources, spaces and technical assessment, key aspects which motivate reflection and often the claims from the direction.

The "Project gestation and design" received a large amount of codifications from the directors (276), together with "Support from the administration" and "Teacher training". The directors focused their interest on the training modalities developed in the centre. In "Support from the administration" the highest frequency was in collaboration of administrators when facing difficulties (34) and the management and problem-solving model (31).

The coordinators focused their reflections on "Support from the administration" (261), as they are the main referent in the centre regarding its relationship with the administration and they act as mediators between the administration and the members of the education community (teachers, parents and students). The coordinators frequently criticized the management and problem-solving model, with 56 negative codifications and 25 positive codifications. They also criticized collaboration with the administration when facing difficulties: there were 17 positive codifications and 26 negative ones.

Analysis of the data obtained in the interviews is the central subject in this article Measures to foster ICT Centres in Andalusia must be focused on information related to *Project gestation and design,* and *Project Development and Support from the Administration.* Both directors and ICT coordinators highlight the outstanding direction given by the centres teams d for its start-up. Personal initiatives are the most significant, because they indicate the individual impulse to improve the dynamics of the teaching staff and the educational community.

> *It was almost a personal initiative which some teachers with previous experience in the field of new technologies quickly joined*
> *(DIR16, GDI, TEXT, char 1311 to 1470 of page 1 of DIR16A.TXT).*

The thoughts and opinions of the coordinators show us that the initiative in launching the project, their previous experience in IT, their belief that ICT would be positive for the centre, the administrative promises about the revolutionary nature of the project and the accompanying investment were defining factors for this first stage.

> *An idea was very clear to us: the enrichment that this could mean from every point of view (students, teachers, family...). Although later everything has been developed at a pace that (...) has been criticized, we did know it was a way of getting on the new technologies train, especially thinking of the novelties that it would bring to the teaching-learning process*
> *(DIR01, GIP, TEXT, char 1026 to 1522 of page 1 of DIR01A.TXT).*

Another piece of information that arises from the coordinators and directors is that the centres have actively taken part in other plans or projects that were linked to technologies and computers, so we could say they were previously motivated to use ICT. The initial expectations for most of them were very high, taking into consideration what it meant in terms of change of furniture, technologies and infrastructures, communication, teaching models and even of environment.

One of the basic factors for the success and thrust of ICT Centres is the logical implication by those in charge. The directive board manages the projects as it is seen in many comments:

> *The project was particularly motivated by a director who is not here anymore, and he was very enthusiastic about projects in general. There was another colleague who was very skilful with computers, so it was almost natural that they*

> *put themselves forward. It was suggested in a teachers' meeting*
> *(COOR06, GDI, TEXT, char 3071 to 3371 of page 1 of COOR06A.TXT).*

The role of the coordinator stands out as the key to understand the whole process around him. He is the central dynamization element, together with the directive board. However, disappointment, disillusionment and weariness, especially due to false expectations which were not satisfied, appear in some coordinators. Expectations of change and novelties are the factors which were underlined by the coordinators. The satisfaction of having taken part in a project with great social and educational scope and which has dramatically changed the environment in the centres is an often-highlighted aspect.

> *There is indeed a bit of personal implication, but the importance it has in my life, I don't know if that is the question... At a personal level, well, let's say it has dropped when I have seen the daily routine of the project. I understood it from a didactic point of view, more pedagogic, about work among colleagues, etc., more than being the school technician. That really does not motivate me much*
> *(COOR07, GIR, TEXT, char 4639 to 5072 of page 1 of COOR07A.TXT).*

As far as the implication for students is concerned, directors and coordinators point out that, in general, the project generated a high level of acceptance and motivation, especially among the less wealthy communities who did not have access to these resources at home.

> *Most of our students are not wealthy and having the computers allows them to access the internet and any resources that can be accessed through them*
> *(DIR07, GIA, TEXT, char 4439 to 4672 of page 1 of DIR07A.TXT).*

The families' implication is strongly connected, in most cases, to the communicative capacity of the centre towards the parents. The mobilization, which the massive entrance of computers required, generated both uncertainty and optimism. Some centres prepared communication strategies: open days, communication through AMPA, town councils, leaflets, press releases or even local television programmes.

> *At the beginning there was a lot of expectation, but the participation rate has not been very high until now*
> *(DIR10, GIF, TEXT, char 1304 to 1415 of page 1 of DIR10A.TXT).*

Regarding the teachers' receptivity, in the first place, they admit the fears, doubts and initial lack of knowledge that the implementation of the project created. The fear of the unknown, especially among those teachers who were less skilled with technologies, could be felt in the stage of initial receptivity. Consequently, beginning a macro project with little time and almost "blindly" created a state of confusion that differed according to the teachers' level of technological culture.

> *At the beginning everyone was scared because they thought that it would mean a dramatic change in their work. They thought it would mean leaving the chalk and the book and being forced to use the computer for hours*
> *(DIR02, GRP, TEXT, char 3878 to 4126 of page 1 of DIR02A.TXT).*

Perceptions from the directors and coordinators regarding *Project development* give us an idea about the consolidation of ICT Centres. The delays at the first stage of the process are underlined, as well as the revolution caused by the change of furniture and communication in the centre and the students' motivation faced with these changes. They were surprised and delighted by the massive appearance of computers in the classrooms.

> *We began without internet connection, the platform did not work; in short, a little bit... a lot of work had to be done*
> *(DIR12, DIP, TEXT, char 3449 to 3564 of page 1 of DIR12A.TXT).*

The teachers' adaptation was initially more varied and even internal conflicts arose.

> *During the first years there was more effervescence and more conflicts. I think some teachers even had internal conflicts thinking "I look like a bad teacher because I don't use this enough, I don't feel able to do it, it is too late for me..." I think by now it is all more balanced*
> *(DIR09, DIP, TEXT, char 8492 to 8867 of page 1 of DIR09A.TXT).*

Implementing the project did not imply an overall revolution in its functioning concerning timetables, organizational and academic aspects, etc. Its start-up was harmoniously integrated in the daily life of the centres. On the other hand, an important sector states that the ICT Project has developed many wanted transformations regarding the organization and especially in the curricular field. According to them, the traditional model began its crisis when the computers for didactic use appeared. To solve it, they demand more flexibility for the centre regarding timetables and curricula.

> *The project itself implied from the beginning a completely different organization from what we were used to working with in the centre. In our school only the smallest classrooms have no computers, as the equipment could not fit in them because of their size. In all the other classrooms there is one computer for every two students, so the centre organization had to change: behaviour rules, use and maintenance rules... all that needed new organization*
> *(COOR10, DCC, TEXT, char 6541 to 7054 of page 1 of COOR10B.TXT).*

The directors themselves became aware of the important investment that the project implied, was sometimes excessive, in their opinion. The directors underline the huge benefits that the ICT Centre project has brought to the life of schools and high schools: material resources, computers, furniture, etc. They openly describe it as a revolution, especially for those centres which originally had less equipment. The economic allowance for the operation grew exponentially.

> *The idea of ICT is very positive. Many means have been offered and as we can see they have sometimes been excessive: 500 computers are too many, but it is the only way to access the ICT Centres*
> *(DIR07, DIN, char 2735 to 2946 of page 1 of DIR07C.TXT).*

The administration criticizes the deficiencies caused by the absence of a professional technician in the centre. The model of a centralized technical service has its advantages, recognized by the coordinators, but it also creates malfunctions. These, often, have to be assumed by the coordinators, who initially had to play a merely didactic role.

> *The technical help should not be the ICT coordinator's responsibility. The figure of a technician should be created, who would not always be in the centre, but could go there when necessary*
> *(DIR05, DTI1, TEXT, char 6820 to 7010 of page 1 of DIR05B.TXT).*

Among the measures taken to guarantee the success of the ICT Centres, the *Support from the Administration* was revealed to be fundamental by comments from both directors and coordinators. Opinions were expressed about help when facing difficulties, the management and problem-solving model and observations about introduction of demands from the centres influenced new proposals.

Taking into consideration the fact that all the analysed centres belong to the first year, we should point out that, in their opinion, administrative support has decreased with the inclusion of the new ICT centres in the following years, both in attention and response. They stress a lack of sensitivity when facing the difficulties generated in the project: the training problems, the technical difficulties, breakdowns and even the Service Inspection in some cases, because the organization

of these new centres is substantially different from the traditional model. This lack of attention is made evident by the lack of acceptable and satisfactory answers to the technical problems that undoubtedly arise. The feeling of carelessness is the one that causes most frustration and stress, especially among directors and coordinators.

> *The administrations should be much more sensitive if they want all to give this the importance it deserves.*
> *(DIR01, ACO, TEXT, char 5252 to 5487 of page 1 of DIR01C.TXT).*

The mobility of the teachers completely breaks the philosophy of the project. Some teachers who began it leave and other teachers arrive and don't know the dynamics of an ICT Centre. As far as training responses are concerned, there is a lack of general contentment: moral support is of a higher demand than strictly conceptual support.

> *Our demand is commitment from the administration, especially in those centres where some of the teachers are temporary staff. These members of staff should have more stability, especially when they are engaged in this kind of project. There has not been a high level of commitment in this sense*
> *(DIR01, ACO0, TEXT, char 8803 to 9111 of page 1 of DIR01B.TXT).*

Directors and coordinators are also aware of the doubts about the future. Doubts about equipment maintenance, warranties, repairs and the exponential growth that this projects supposes for the educational administration. Problems of saturation of the centralized service are very common when describing the difficulties.

> *The service obviously gets worse as the number of ICT Centres increases*
> *(DIR12, AGE0, TEXT, char 6979 to 7084 of page 1 of DIR12D.TXT).*

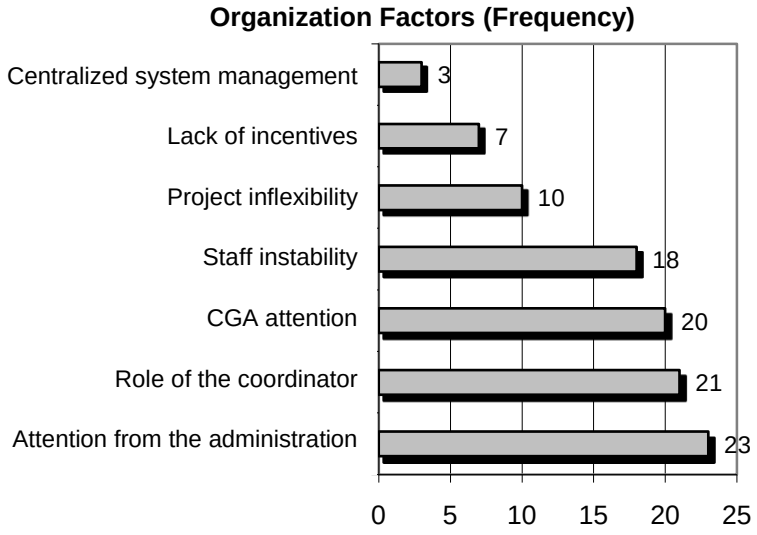
Finally, among the suggestions made to the administration, they demand higher consideration for the ICT coordinator. His role should be more focused on didactic assessment and less linked to technical problems. Moreover, this function is not rewarded economically or regarding transfers and promotions, so this is a cause of complaint.

4.2. Focus groups

The analysis of the information provided by the focus groups corroborates much of the data supplied by the interviews. Regarding the resources and organization handicaps, which are basic for the development of ICT Centres, these sessions allowed us to share more explanations and opinions concerning the identification of organization problems: necessary equipment, space management, attitude and implication by the educational community, staff stability, effects on teaching routines, etc. The issues that caused most debate are organization factors, such as *support from the administration*, *coordinator role, CGA attention* and the problem with *staff instability*. Everything indicates that these are the main problems that the centres must solve in order to optimally develop their projects, as shown by the analysis of the interviews.

In frequent references to the administration, both ICT coordinators and centre directors indicate their need for support in developing their projects. Their comments refer to a lack of attention or unfulfilled promises by administration representatives. Almost unanimously, they stated there is insufficient relationship between centres and the administration so that directors and coordinators lack confidence in receiving adequate assistance. Opinions like this one are shown:

> *A growing gap exists between the administration and the centres, between what facilitates the implementation and assessment and what is actually done... Moreover, people in the CGA think that those in higher positions don't pay attention to them... The inspection does not really get involved...*
> *(Informant 23).*



The assessments about ICT Centres don't capture the actual problems and reality of these centres. Furthermore, the educational inspection, the main communication between the administration and the ICT Centres, seems to be, in general, insufficiently carried out in the project monitoring.

> *The crucial problem is that in many centres less than 50% of what was presented in the project has been carried out... not that the projects are not properly designed... but other changes and much more support are needed...*
> *(Informant 23).*

Finally, the alternative measures, which are emphasized in the results we have analyzed, are those regarding the *Project assessment and update*. An external and internal assessment in the ICT Centres is demanded, as well as improvement plans that are consistent with the results and with the support from the administration. In short, the aim is to really integrate the ICT Project in the PEC (Centre Educational Project). It will then become a living instrument that can be developed and adapted to the centre's specific characteristics and needs.

One of the most frequent suggestions for improvement is constant maintenance of the equipment and programmes. Technical assistance is indispensable in order to allow the coordinator to have more time to devote to focus group dynamization and to adopt a leadership role in the project:

> *But we also understand that if we go into a classroom and the computers do not work, what do we want so much dynamization for? The project must be complemented with other things. We have suggested the creation of a sort of internal ICT commission*
> *(session 1.3.a, maintenance, 8, char 18311 to 18537 of page 1 of S13A~1.TXT).*

The role of the coordinator should be recognized and, in order to promote the development of the project, his consideration as a member of the directive board is demanded:

> *The coordinator of an ICT Centre should be part of the directive board… If not, the directive board and the director should be extremely involved in this project and in many cases this is not the case. So the only solution is including the ICT coordinator in the directive board*
> *(session 1.2.a, coor_equipo_directivo, 2 char 283 to 685 of page 1 of S12C~1.TXT).*

Regarding the answers to the staff instability and the lack of implementation by teachers, it is suggested that specific positions be defined for ICT Centre teachers. This measure would allow the temporary workers arriving at the centre to get involved in the project, supporting and reinforcing the work of the teaching staff as a whole.

> *I do not know if the teachers' mobility has a solution, but at least those who come to an ICT Centre should have specific training because there are people out there looking forward to being in an ICT Centre*
> *(session 1.2.a, plazas_especificas, 3, char 9042 to 9662 of page 1 of S12C~1.TXT).*

Another suggestion is related to the incentives for teachers. The directors could recognize work done by the teachers in an ICT Centre, and this could be implemented as an incentive.

5. Conclusions

The success of the measures taken by the Andalusian government to create a "knowledge society", specified in the ICT Centres' program, requires ICT to be integral to day-to-day life in these centres. This integration is achieved through innovative projects leading to improvement in teaching-learning processes. This must be generated gradually, not through mass instalment of technology and equipment. This would cause conflicts and organizational chaos due to lack of planning, training, and real integration of technologies in the curriculum and school system.

These measures require an appropriate policy. Teachers have made significant efforts, but due to lack of incentives, encouragement and administrative support, there is a risk of decreasing teacher involvement. This plan is about teaching and learning and students and teachers. It is more than material, equipment, furniture and technical support. The logistical system should facilitate development of innovative projects. Integration of ICT and pedagogy can be facilitated by nvolvement and recognition of teachers to maintain their enthusiasm and successful outcomes.

The role of the ICT coordinator, who manages the dynamics of the processes of didactic innovation, is essential and indispensable. However, lack of support and resources has distorted this function to technical assistance instead of dynamizing focus groups. This situation ends up in disappointment and resignation. A maintenance IT technician is needed. Other measures would be introduction of ICT coordinators in directive boards, and limited working hours so they can devote more time to the issues for which this role was conceived.

Centralization of the system may raise objections if it favours project standardization and limits its capability to adapt to the individual centre needs. The possibility to adapt programmes so that every centre has its own will make it possible for the projects to define their own characteristics. An ICT Project is part of the curricular project of the centre and, consequently, it must respond to an educational project with its own identity.

The process of professional development based on focus groups (in the area or the department) are restrained by temporary worker turnover. This causes discouragement among the colleagues who stay in the centre because the momentum of the project decreases and wears down the staff. The administration should consider the requests for permanency from teachers who are involved in focus groups created to implement ICT Projects. They should also consider creating specific posts within these centres, which would allow the centre to choose part of its temporary staff depending on their training, interests and commitment towards the use of ICT. Teachers will accept these measures and we think they are appropriate, at least during the curricular integration process of ICT in the centres, and until their use is normalized in the educational system.

Assessment and monitoring of projects is essential for improvement and growth, regarding teaching, organization and administration. It would be appropriate to strengthen the role of the ICT inspector and his specific training to allow for strong criteria in the evaluation of projects.

Suggesting *a priori* computer equipment for every classroom in a centre is a mistake, because in many subjects and in certain contexts their use is not necessary and the equipment impedes developing other activities. The presence of ICT, in its different formats, requires new organization of space. The didactic possibilities must be exploited without preventing other dynamics to be carried out. In the last proposals, other material options have been suggested with implications in classroom organization.

Creating a centralized and up-to-date software database has to be one pillar of a policy to promote ICT in educational centres.

The impulse for these projects, taking into consideration the above considerations, will be faster with the support of new technologies and if the administration promotes growth of professional networks of teachers from several centres playing different roles: advisors, ICT coordinators, disciplinary and interdisciplinary focus groups, material developers, etc.

6. Limitations and Suggestions for Future Research

This research has been focused on the first years of the ICT project. Future studies will be needed to corroborate or discard our prediction for the near future regarding curricular integration and organization of ICT. We consider it is urgent to promote policies that encourage the cooperation among schools and universities for the development of innovative R&D projects in this area.

The development of professional networks for didactic innovation, the creation of original and adapted materials, the collaborative learning experiences among centres, the cooperative work through platforms, the generation of accessible databases which are friendly, intuitive and easily accessible, and the internal and external institutionalization of mechanisms to promote innovation... are areas of work which can solve the problems and dilemmas we have presented.

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Editor's Note: Instructional design was first recognized as a science by Jerrold Kemp in his 1971 publication "Instructional Design: A Plan for Course Development". Theories of learning and empirical research continue to add additional dimensions to the design process. This paper will be a summary for some and a point of departure for others with different theories of teaching and learning and ways to optimize learning for a broad spectrum of learners.

A Framework for Understanding Instructional Design Contexts

Joel Gardner
USA

Abstract

Instructional design takes place within a larger system of activity, and this larger system has significant influence on the kind of design that takes place. It is therefore important to understand how the environment or system in which the instructional designer works affects the design outcome. This article defines systems and shows their relevance to instructional design. It then synthesizes and improves on four previously proposed frameworks for understanding systems of activity and proposes a framework for understanding instructional design contexts. This article then describes how this framework applies to an ideal instructional design context.

Introduction

In defining and describing instructional design, many authors create a *prescriptive* system for creating instruction (Dick, Carey, & Carey, 2005; M. D. Merrill, Drake, Lacy, & Pratt, 1996; Smith & Ragan, 1999). These systems give designers guidance on how to control the process by which instruction is created. This view of a system most closely matches the definition of a system as "a procedure or process for obtaining an objective" (Wordnetweb). While a systematic approach to creating instruction is important, this article is focused on identifying and describing the components of the larger system or context in which instructional design takes place. This larger *descriptive* system more closely matches the definition of a system as "a group of independent but interrelated elements comprising a unified whole" (Wordnetweb).

The systematic process of instructional design takes place within the larger context or system. Understanding how instructional design is influenced and impacted can provide insight for Instructional Designers (IDs) about ways to improve the quality of instruction. Understanding the larger system in which instructional design takes place is vital for improving the design process. This article proposes a framework for understanding the system or context in which instructional design takes place.

Instructional design is a key practice in the field of Instructional Technology. It is through this practice that many learning environments, courses, classes, and trainings are created; and the decisions made by the IDs have great influence on the context in which learning takes place. Because instructional design plays such a key role in the creation of educational experiences, it is important to understand how it is influenced by the context or system in which it operates.

Literature Review

When designing instruction, it is important to understand the variables that influence the effectiveness of instruction. In research, this can mean "identifying the variables to be considered (descriptive theory), identifying potential relationships between these variables (prescriptive theory), and empirically testing these relationships in the laboratory and the field"(M. D. Merrill et al., 1996, p. 4). This definition is related to Dick and Carey's (2005) application-oriented description of the systems approach and models for instruction which they call a "logical, iterative process of identifying all the variables that can impact the quality of instruction

including its delivery and then integrating information about each variable in the design, development, evaluation, and revision of the instruction" (p. 367). Both approaches advocate an analysis or understanding of variables that influence how instruction is designed and how people learn. This article is specifically focused on understanding those variables as they interact in a system.

The environment or context in which design places has a great impact on the outcome of instructional design. As Banathy (1994) notes, "the essential quality of a part of component of a system resides in its relationship with and contribution to the whole" (p. 28). In the world of instructional design, this means that the quality of instructional design, a component of a larger system, resides in its relationship to that system. This article defines what that system is and how it can be more effectively understood.

Just as Norman (1991) notes the shift in the field of psychology toward "pay(ing) serious attention to the role of the situation, other people, natural and artificial environments, and culture", I am concerned with the role of these outside variables on the cognitive practice of instructional design. In this article, I propose a framework that identifies categories of those variables to enable an understanding of their influence on the specific settings and practice of instructional design. This article is not intended to be comprehensive in nature; rather, its intent is to create a framework for understanding the system in which design takes place.

What are systems?

Before identifying and describing the system in which IDs work, it is important to understand what is a system? There are many perspectives from which systems are viewed. Systems can be defined as "a regularly interacting or interdependent group of items forming a unified whole" (Merriam-Webster Online). Rogers (Rogers, 1995) (reference- diffusion of innovations) notes that systems can be viewed from a social perspective as "a defined set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (p. 23). Acker (2009) writes that a system is a set of two or more elements in which the behavior of each element is independent, and each element affects the behavior of the whole. He also notes that the essential properties of a system come from the interaction of the parts and not their independent actions.

Some researchers analyze and improve educational systems (Bela H. Banathy, 1994; B. H. Banathy, 1995; Reigeluth & Garfinkle, 1994). These authors develop educational systems and describe and implement methods for changing and improving these systems as a whole. Educational systems are most closely related to the framework that is proposed in this article; however, in this article we focus specifically on understanding the system in which instructional design takes place. Under this systems view, we can more easily understand the contextual or environmental influences on instructional design.

Creating the framework for understanding design contexts

To create an improved framework for understanding the system in which instructional design takes place, I will describe and synthesize the writings of several authors. The first is Norman's (1991) system view of cognitive artifacts. Cognitive artifacts are "an artificial device designed to maintain, display, or operate upon information in order to serve a representational function" (Norman, 1991). Instructional designers often use these artifacts to aid and enhance the tasks they perform. Norman (1991) writes that under a systems view, the activities performed using artifacts includes the *person*, the *task*, and the *cognitive artifact* used to complete the task. He emphasizes that, seen from a systems perspective, the artifact enhances the cognition performed by the person. See Figure 1. This systems view of cognitive artifacts is summarized in Column A of Table 1. In the world of Instructional Design, these cognitive artifacts are often called tools. They are diverse and can include a computer, design software, pen and paper, or a Learning

Management System (LMS). Each of these tools modifies the design task and potentially enhances the designer's cognitive abilities to complete the task.

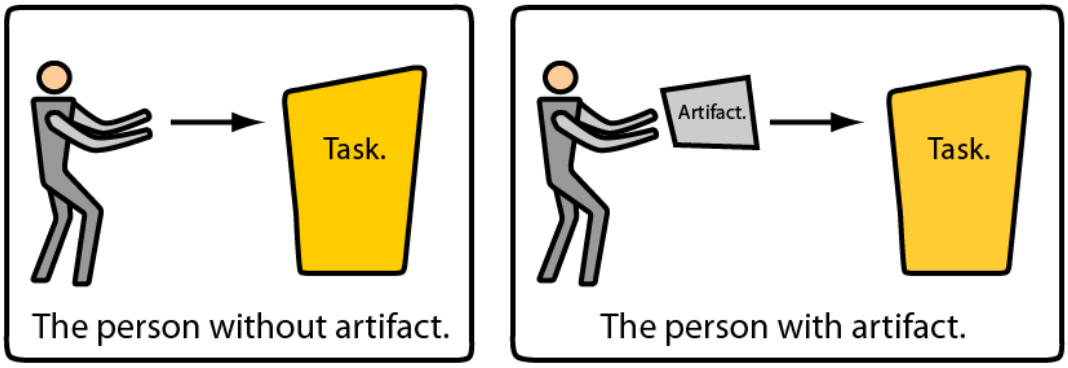


Figure 1. The systems view of cognitive arfitacts, adapted from Norman (1991).
Under this view, the person's cognition and ability is enhanced through the use of the artifact. Instructional designers' abilities are potentially enhanced through the use of tools.

In addition to Norman, Engeström proposes the Human Activity System (Engström, 1990), another system describing how an individual interacts with his environment. In studying the activities of professionals in a health center, Engström identified fundamental elements of human activity. These elements can be viewed on a personal level, which, like Norman's analysis, involves the subject or person, the object or task, and the tool or artifact. Engström adds to this view and includes the community level, which adds community, rules, and division-of-labor to the system. Each of these elements is seen as interacting with the other elements to form a system that influences the subject or person's object. Later sections of this article describe how these elements are applied to the work of an instructional designer. The elements of Engström's system are summarized in Column B of Table 1.

The components identified by Norman and Engström correlate strongly with de Souza and Preece's (2004) framework for analyzing and understanding online communities. They propose a framework to analyze interactions between members of online communities and their purposes, the software they use to interact, and the policies they create for how to interact. These elements are summarized in Column C of Table 1. Just as De Souza and Preece's framework informs our understanding of human systems within the context of online communities, this article informs our understanding of human systems in instructional design settings.

In addition, one can see a strong correlation between the elements identified by the above-cited authors, and those mentioned by Morgan (1994) as components of the system influencing school learning contexts. Morgan writes that "administration and management, teacher roles, nature of the client students, physical facilities, parent and community involvement, and instructional resources" all influence the environment in which students learn (p. 49). These elements are summarized in column D of Table 1. Focusing on elements that influence students' learning environments is an important part of understanding these systems and how these elements influence the instructional design that creates those learning environments.

Table 1 compares the elements described by Norman (1991), Engström (1990), de Souza and Preece (2004), and Morgan (1994). Each row shows the relationships between the components described by each author. In Column E of Table 1is a synthesis of elements described by each of these authors and a proposed Framework for Understanding Instructional Design Contexts. This framework is designed to understand what influences affect the task of instructional design, thereby influencing the extremely important context in which students learn.

Table 1

Systems Frameworks

A	B	C	D	E
System View of Cognitive Artifact (Norman, 1991)	Human Activity System (Engström, 1990)	Online Communities Framework (de Souza & Preece, 2004)	Elements affecting student learning (Morgan, 1994)	Synthesis: Instructional Design Contexts Framework
Person	Subject			Instructional Designer
	Community	People	Administration Management Students Parents Community	Community
Task	Object	Purposes	Teacher roles	Goals
Artifact	Tools	Software	Instructional resources	Design Technologies
	Rules	Policies		Rules and Policies
	Division of Labor			Division of Labor

Table – Line 1. The elements identified by Norman (1991), Engström (1990), de Souza and Preece (2004), and Morgan (1994) are synthesized and contextualized within the context of instructional design

This understanding will provide instructional designers with insight into how their design is influenced and potentially will empower them to change or alter these influences to optimize design experiences for the learner. This article is not intended to present methods for changing educational systems; rather, the purpose is to create a framework for understanding elements that influence the effectiveness of instructional design.

A Framework for Understanding Instructional Design Contexts

The systems and frameworks described above are synthesized to create a framework for understanding instructional design contexts. Column E of Table 1 summarizes these elements and provides instructional design-focused terminology shaped by the terms provided by the above-cited authors. This framework is general in nature and is designed to provide a structure for understanding specific instructional design settings, contexts and/or tasks. See Figure 2. This section describes each of these elements.

Instructional Designer

In this framework, the individual of focus is the Instructional Designer (ID). This individual correlates to the "subject" (Engström, 1990) or "person" (Norman, 1991) described earlier. The ID's work has great influence over student learning, as it is concerned with specifying and often developing many of the conditions of learning (http://www.aect.org). The influence given by the designer is different from designer to designer. Understanding, for example, how an ID's pedagogical beliefs, technology skills, communication skills or work ethic influence design contributes to our understanding of the system in which design takes place.

Community

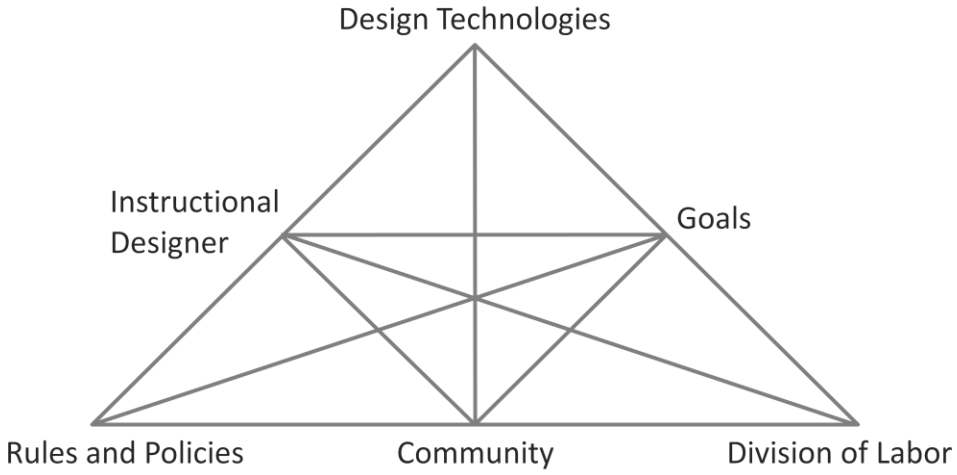
Another element of this framework is the Community. This corresponds to what de Souza and Preece (2004) call "people," and in the school setting can include administrators, managers, students, and parents (Morgan, 1994). The community is comprised of individuals and groups who have a shared responsibility to influence design decisions and ultimately the learning environment.

Community members can include those directly or indirectly associated with the ID's work. These can include "content specialist, a media production specialist, evaluation specialist, and a manager" as the team with whom the instruction is designed and developed (Dick & Carey, 2005, p. 10). The ID working with these community members is limited or liberated based on their skills, abilities, attitudes and actions.

Community members can also include those who do not specifically design or develop instruction, but who have indirect or direct influence on the design. These can include administrators, parents, or even lawmakers. We will not focus on these members in great detail, but the potential impact on instructional design and learning environments can be significant.

Division of Labor

Accompanying this community is the division of labor within that community, which can occur naturally or be made explicit. Some roles can be seen as directly influential on instructional design. For example, content, media, and evaluation specialists all take different roles to bring about the instructional design and development of instructional products. Other roles and labor divisions can be more indirect but still influence instructional design. Roles like technical support, facilities management, and LMS administration have an indirect but very real influence on design.



The Figure 2. Framework for Understanding Instructional Design Contexts.
Adapted from Enström's (1990) Human Activity System. Demonstrates the elements which interact in the system in which instructional design takes place.

Goals

The ID's goal is to design instruction by designing learning events that will bring about specific outcomes (based on performance objectives). The instructional goals are strongly influenced by other elements in the system including the organization and the community in which the instruction is being developed. For example, the mission or culture of a business in which design

takes place heavily influence *what* is designed, the ID's pedagogical beliefs or technical skills heavily influence *how* it is designed, and the design technologies available to the designer influence the *completed instruction* and its *design*.

Design technologies

Design Technologies are integral to the field of Instructional Technology. These technologies are similar to the "artifacts" (Norman, 1991), "tools" (Engström, 1990), "software" (de Souza & Preece, 2004), and "instructional resources" (Morgan, 1994) described earlier. Summarizing these definitions, a design technology is an artifact or tool, often computer software, which enables the creation of instruction.

In addition to the definition of technology as a physical tool, many design technologies are defined as techniques or ways to make learning more efficient (www.aect.org). These intellectual, internal technologies include "*theory*, which includes concepts, constructs, principles and propositions which serve as a body of knowledge; and, *processes*, which are a series of activities or operations that are directed toward a specific goal" (http://www.aect.org, italics added).

These physical and intellectual design technologies are very similar to Merrill's (1996) summary of the use of technology in instructional design: "instructional design is the use of these scientific principles to invent instructional design procedures and tools." It is clear that the design technologies available and selected for creating a learning environment heavily influence student learning.

Rules and policies

The final element in this framework is Rules and Policies. In the context of instructional design, these can include public policy, laws, instructional design standards, and work regulations. If a designer works for an organization that requires the same format and structure for every course designed and developed, the learning environment is clearly influenced.

Summary

The elements identified in this system reveal the complex, systemic nature of instructional design. Each element interacts with others to influence and alter one another; these elements all influence the student's learning, which is the crucial outcome of an educational system. The next section describes how this framework applies to one specific instructional design context.

The Framework Applied

To illustrate how this system can be used to understand a design context, I will describe a system in which a colleague, Tae K. Jeon, and I designed training at Utah State University (USU). As instructional designers for the Department of Information Technology, we were given the assignment to develop training for university employees on how to use Banner, an "administrative suite of student, financial aid, finance, human resources, and advancement systems" (www.sungardhe.com). As we worked to design this instruction, we noticed that several elements seemed to shape how we created our instruction. This section briefly describes the instructional design project and concludes with a table describing each of these elements and their influence on our design.

As employees of the IT department, we had access to technologies and professionals who could assist us in the design and development of training. We decided to base our instructional strategy on Merrill's First Principles of Instruction (2002, 2006) and implemented several web-based technologies to create a task-centered instructional strategy. For a more complete description of this case, see Gardner and Jeon (2009). Table 2 demonstrates how our design activities fit within the framework for understanding instructional design contexts. It briefly describes these elements and shows how they influenced the design of the training.

Table 2
Framework Elements Affecting Banner Training

This table shows how each of these elements of the framework affected the design outcome of the Banner training described in (Gardner & Jeon, in press).

Instructional Design Contexts Framework	Elements within Banner Training (Gardner & Jeon, in press)	How element influenced design
Instructional Designer	Gardner is design principles expert ; Jeon is process and programming expert	Shaped selection of technologies
Community	IT Department at USU; have access to several other designers, graduate student workers; supervisor on USU committee for Banner	Shaped attitudes about instructional design, resources available, and time constraints for designing instruction.
Goals	Create training to teach faculty to use Banner; Reduce faculty frustration with Banner	Influences media selection
Design Technologies	Access to many technologies; integrated desktop capturing software, HTML, FLASH and Blackboard Vista into training	Opportunity to use several technologies. Those chosen influence the appearance and functionality of the design as well as the strategies used
Rules and Policies	Banner as USU's administrative suite; Blackboard Vista as LMS of choice for USU; FERPA influencing development	Created need for the instruction; constrained instructional environment; limited process by limiting access to parts of Banner;
Division of Labor	Jeon as lead programmer and process lead; Gardner as design lead; SME as provider of content; graduate students as instructional developers	Availability of community members enabled design flexibility; assignments affected design outcome

Table 2 describes the elements of the system that affected design of the Banner training. As instructional designers with personal preferences for technologies, we selected specific theories and programs based on our experience that we thought would help fulfill the goal of the training. Our department provided us with the resources we needed to create this instruction, including cutting edge technologies, graduate workers and programming assistance. The policies shaped the need for the training, the LMS in which the training occurs, and what sections of Banner could actually be trained. Having a division of the labor for this project influenced the outcome by having several designers, developers, and content experts shape the final learning outcome through their interaction with of design and development activities.

Note that the focus here is on the influence of the system elements on the design process and ultimately the learning environment. This system can also describe the interaction and influences between each of the elements. However, the focus for this paper is the effect of these elements on instructional design.

If any of these elements were different, the outcome of the design would likely have been very different. Different designers, availability of technologies, the SME working on the project and the LMS would profoundly impact and alter the finished product. Understanding the interrelated nature of system elements in which design takes place allows designers and researchers to see these influences and potentially maximize the benefits of the system.

Discussion

It is important to create new ways to view and understand instructional design, and this framework provides one method for viewing the key practice of our field in a unique way. The

proposed framework enables designers and researchers to view instructional design from the global, systems view instead of from a personal perspective. This approach requires a shift from a focus on one specific element to a view of the whole, and this shift can be very beneficial. The systems view allows us to see the whole in which instructional designers interact, and understand how other elements in the system impact and influence instructional design outcomes.

This framework can be used as the basis for many potential activities. It provides a framework for *designing* ideal systems and setting standards toward which systems can move. Designers understand the usefulness of designing conditions before they are developed. And this framework can serves as a template for the creation of new design contexts to maximize the effectiveness of instructional design and positively impact the conditions in which learning takes place.

Future research on and application of this framework will use this framework to analyze and understand multiple instructional design contexts. It will also involve the design and development of new, more effective systems. This research and application will improve our understanding of the systems in which design takes place and increase the quality of instruction in those systems.

Summary

This article proposes a framework for understanding the context or system in which instructional design takes place. It is intended to be a general description of that system and proposes a unique way to view instructional design from a system level. This view allows us to more clearly see the elements that influence instructional design.

This framework allows us to borrow from authors of other fields to look at design from a different perspective and create clear framework for understanding the system in which activity takes place. Although discussed here only briefly, this system is based on the work of these authors and can be used by instructional designers to analyze the components that influence the design decisions in their own contexts. This analysis could promote an awareness of one's environment and can provide insight into how to leverage the strengths of one's design environment.

Instructional design does not occur in a vacuum. To be effective, instructional theories, processes, and technologies must be contextualized to the environment in which they are used. This framework provides a way to understand one's own context from systems-level and provides IDs with the ability to more fully understand their own context.

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