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From the editors…

Welcome to the July 2009 issue of Learning Technology Newsletter.

Science education is considered as a challenging part of most national curricula, and is becoming increasingly important in the knowledge society and knowledge-based economy. This issue addresses science education from a number of different perspectives.

The first article, by Hsue-Yie Wang, Ben Chang and Charng-Tzer Harn, describes PICNIC, a parent-child coupled, inquiry-based learning camp, where each parent-child couple uses a mobile data logger and a city-wide weather database to facilitate climatology learning.

Subsequently, Rita Kuo and Maiga Chang introduce a system that automatically generates multiple choice questions to evaluate students' cognitive abilities. The system has been used in an elementary school for teaching a lesson about "Knowing the Plants".

The next article, by G. Barbara Demo, discusses current initiatives in Italy aiming to introduce computing into the school curricula. They also discuss the use of programmable robots in different educational levels (kindergarten, primary school and junior secondary school).

Tri Kurniawan Wijaya and Gunawan discuss the use of LEGO Mindstorms for learning robotics, while Enid J. Irwin proposes a set of guidelines for enhancing online collaborative science studies.

The last four articles belong to the regular article section. Mohamed Amine Chatti, Matthias Jarke and Marcus Specht propose PLEF, a conceptual framework for mashup personalised learning environments which can be used for science education.

Jalel Akaichi proposes a pervasive assistance system for mobile learners able to localize, to match learners' free time with scheduled courses, and to make reservation of learning resources while being in motion.

Mike Whitty, Ijaz. A. Qureshi, Maimoona Saleem and Mehwish Shafiq discuss a case study where e-learning is used for educating people in a developing region.

In the last paper, Bob Strunz and Gareth Waller present the Irish National Digital Learning Object Repository, a collaborative project which involves all six Irish Universities and all 13 Institutes of Technology aiming to use communities of practice as a mechanism for the dissemination of best-practice in technology enhanced learning using reusable learning objects.

Finally, the issue includes a list of conferences which are related to learning technology. This is a first attempt to elaborate the newsletter, so as to include as much useful information as possible for people working in learning technology.

We hope that this issue helps in keeping you informed about the current research and developments in science learning!

We also would like to take the opportunity to invite you to contribute your own work in progress, project reports, case studies, and events announcements in this newsletter, if you are involved in research and/or implementation of any aspect of advanced learning technologies. For more details, please refer to the author guidelines at http://lttf.ieee.org/learn_tech/authors.html.

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Using Mobile Data Logger and City-Wide Weather Database to Facilitate Parent-Child coupled Climatology Learning

Abstract: This study shows a science learning activity design that couples one child one parent to form a team to carry out an inquiry-based learning activity on climate. In the two days camp, every couple uses tablet PC equipped data logger to collect weather data and compare and/or contrast with the database of a city-wide wireless weather sensor network. A trial event took place and provided positive feedback.

Keywords: *Inquiry-based learning, mobile technology, wireless sensor network, parent-child coupled learning*

Introduction

Higher order thinking skills (HOTS), such as inquiring, exploring, and problem solving, are regarded more and more important for students. The ability to questioning, hypothesizing, designing and carrying out investigations, and making conclusions based on evidence foster students' HOTS that they need to face the challenges in the 21st century [1]. Among the pedagogies, inquiry activities provide a valuable context for learners to acquire, clarify, and apply an understanding of science concepts, which help learners develop cognitive abilities and science content. Edelson *et al*. [2] noted that there are many challenges to successfully implement inquiry-based learning for children, including that they have difficulties to conduct systematic scientific investigations, gather data, analyze data, interpret findings, and communicate results. This study designed an inquiry activity in a technology-rich setting to help children and parents learn climatology. Parents were included because parental involvement in child education generally benefits children's learning [3]. Additionally, parents can learn the importance of affectionate contact with their children, especially at times when the child may be fearful or anxious [4]. This may ease the difficulties when children face the challenges in the inquiry-based learning activities.

Parent-Child Coupled Inquiry-based Learning Camp (PICNIC)

The purpose of the inquiry framework was to make the inquiry process explicit for students from backgrounds where science inquiry may not be encouraged, or for those with limited experience of school science [5]. The parent-child coupled inquiry-based learning camp (PICNIC) was introduced to facilitate students carrying out a complete process of inquiry-based learning with their parents company. In PICNIC, every parent-child couple uses mobile devices in the outdoor climate investigation to collect weather data. They can further use the collected data to compare and/or contrast with the data which is automatically sensed and recorded by a city-wide wireless weather sensor network.

The PICNIC is an extracurricular event in two full days. It comprises with four parts. Figure 1 shows the course details and the technologies used in PICNIC.

Technologies in PICNIC

Computing and networking technologies offer dramatic, new opportunities to support inquiry-based learning [2]. Mobile and wireless sensor network technologies played an important role in PICNIC. They are not only the working platform for the couples to gather data, analyze,

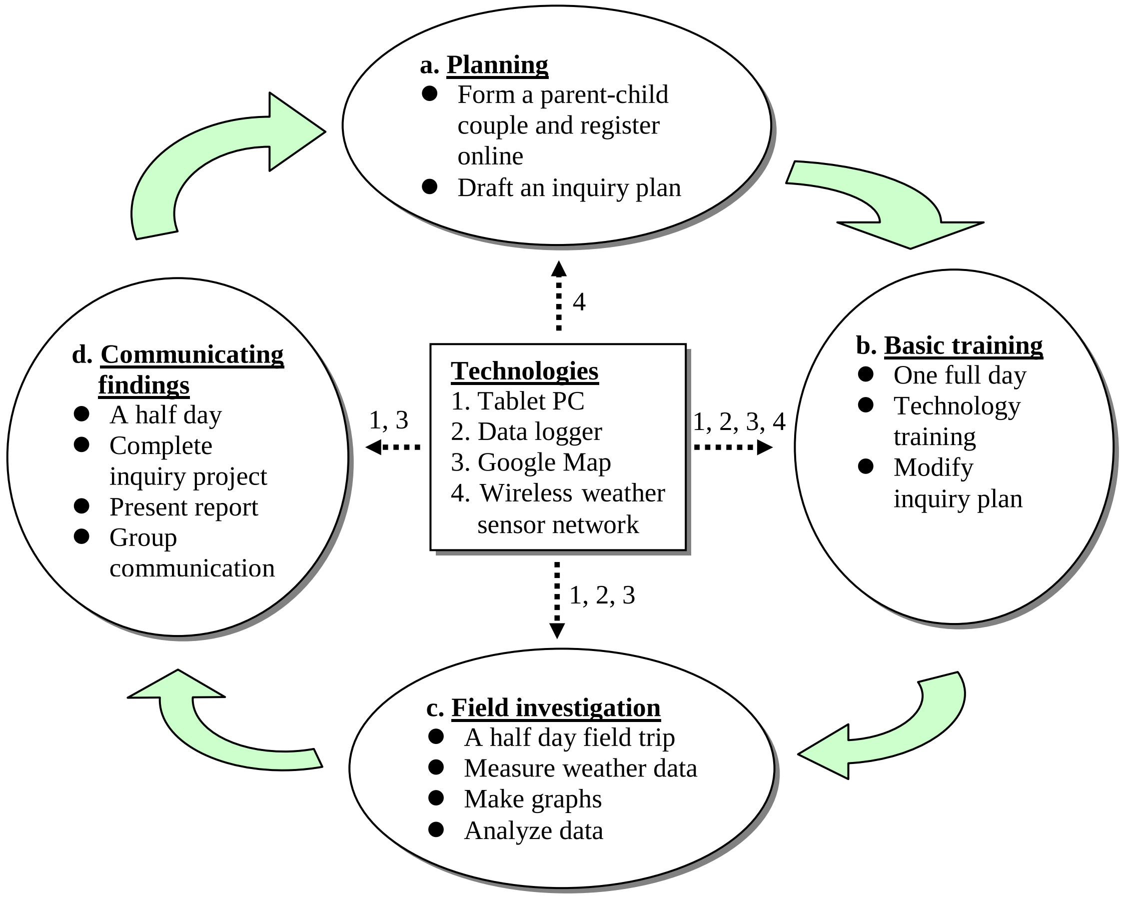

Figure 1: Course and technologies in PICNIC

and making the inquiry report, but also the mediator between the child and the parent to make them focusing on the inquiry project itself. During the field investigation, every couple uses their table PC and running Google Maps. They can mark the investigation locations, retrieve distance and elevation of each location in Google Maps, and upload the measured data into it.

The availability of large-scale data collection mechanisms has led to an explosion of data available to support the scientific investigation of climate [6]. The city-wide wireless weather sensor network was comprised with sixty wireless weather stations located in sixty schools in Taipei City [7]. Every station can sense temperature, humidity, atmospheric pressure, UV radiation, rainfall rate, wind direction, as well as wind speed every five minutes and transmit to a console connected to a data receiving PC instantly. The server receives data transmitted from the sixty stations and stores it in the database. Every couple can use the constantly recorded weather data in the fixed locations to compare and/or contrast with their field investigation data.

Conclusion

Inquiry-based learning is essentially a question-driven, open-ended process and students must have personal experiences with scientific inquiry to understand this fundamental aspect of science [8]. For the learners who are used to the “traditional” learning ways, they may not feel comfortable with it. The PICNIC couples one child one parent to form a team to carry out an inquiry activity with the support of mobile and wireless sensor network technologies. There were thirty couples attended in the trial event in 2007. Positive feedbacks were received both from the children and the parents. A formal event will take place in the near future to make further evaluation.

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Elementary Level Botanical Item Generation

Cognitive Ability Items

Bloom and his colleagues (1956) defined three domains for classifying teaching objectives: cognitive, affective, and psychomotor. They use cognitive domain to measure human mental skills (e.g. memorization). Many educators use Bloom's Taxonomy to evaluate students' cognitive levels of the knowledge. Anderson and Krathwohl (2001) revised the original Bloom's Taxonomy to a two-dimension matrix which covers knowledge process and cognitive processes of human beings.

Our previous system generates true/false items automatically (Chen et al., 2008). The generated items can be used by teachers to evaluate students' two basic cognitive abilities: list and describe. The system uses generative grammar and transformation rules proposed by Chomsky in 1957 to generate correct and incorrect statements for constructing the true/false items. This paper describes the automatic item generator which extends the idea to construct multiple choice items to evaluate students' four cognitive abilities: list, describe, summarize, and classify.

System Architecture

As Figure 1 shows, the automatic item generator needs three steps to construct multiple choice items for the students, and is also an adaptive test system:

1. Teachers can create different knowledge topics for their different courses and/or lessons with Knowledge Map Editor as Figure 2 shows. They can add, insert, delete, and modify concepts stored in the knowledge maps for each topic anytime before their students take the exams.

2. After the teachers create the knowledge maps, the students can take the exams with the Item Selection module. The Item Selection module requests the Item Generation module to construct items according to the concepts retrieved from the knowledge map and stores the items in the Answer Sheet database. Students' answers are also stored in the Answer Sheet database. As Figure 3 shows, the item generator delivers items one by one after the student clicks on the "ready to take the exam" button. The stem of the multiple

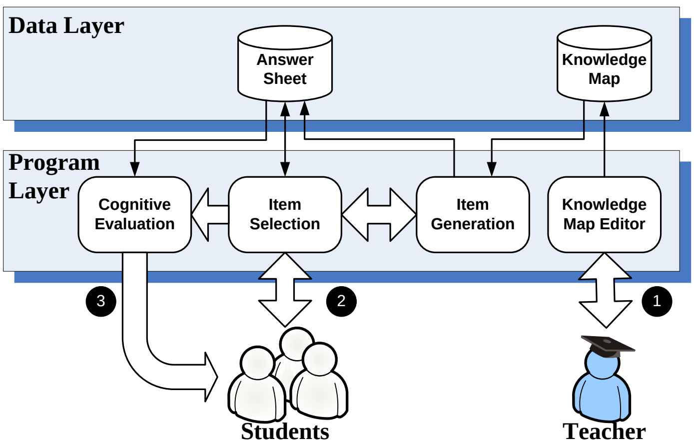

Figure 1: System Architecture of the Automatic Item Generator

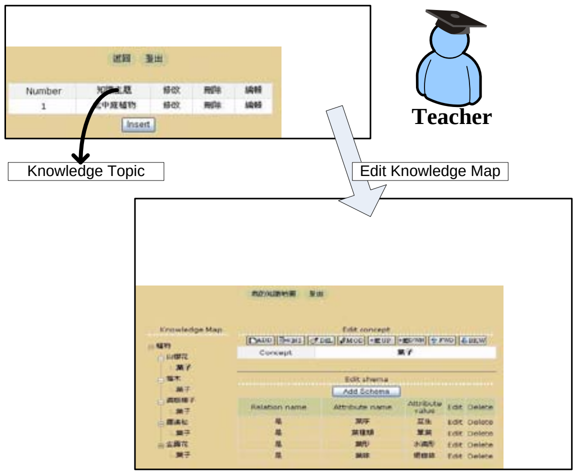

Figure 2: Knowledge Map Editor

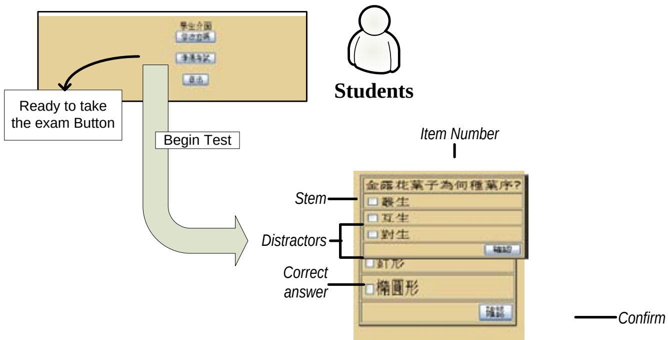

Figure 3: The multiple choice item constructed by the Automatic Item Generator

choice item in Figure 3 asks students to answer what the arrangement of leaves the Duranta has. The correct answer is option 3, and the other two options are the distractors and incorrect answers. The students can check the answers they think are correct and click on the "confirm" button to send their answers back.

3. When the students complete the exams, the Cognitive Evaluation module presents the students the evaluation results about their cognitive abilities toward to each concept.

Experiment and Evaluation

Nineteen fifth grade students (around 11 years old) from the northern part of Taiwan participated in this study at May, 2009. The participants included ten boys and nine girls. The item generator dynamically constructed different multiple choice items of the lesson, "Knowing the Plants", according to the students' answers. The students spent 15 minutes in average to write their exams. We conducted an eight-item questionnaire with 5-point Likert scale for collecting the students' perceptions towards the item generator.

According to the questionnaire feedback, 73.68% of students agree or strongly agree that the Automatic Item Generator is easy to use. Only 15.79% of students indicate that they encountered difficulty in using the item generator. A really encouraging feedback for us is that 78.95% of students think the items generated by the system are helpful. The teachers also suggested to us to make the item generator insert relevant pictures besides the items in order to reduce the difficulty of the items.

Conclusion

This research extends our previous true/false item generator to build an automatic multiple choice item generator. The new item generator not only constructs multiple choice items, but also constructs the items which can be used by the teacher to evaluate more students' cognitive abilities: to summarize and to classify.

Teachers can use the Knowledge Map Editor to build their own knowledge bases for different knowledge topics and/or courses. The students can take the adaptive exams which cover both of true/false and multiple choice items. When the students complete the exams, the item generator delivers the diagnosis reports to the students.

The item generator also records the students' actions during the exam and we will ask experts and teachers to evaluate the system accordingly. Our ongoing tasks include: (1) analyzing the relations between students' computer attitudes and academic performances; (2) finding the teachers' perceptions in relation to the difficulty of the generated items; and, (3) comparing the students' cognitive abilities as thought of by their teachers and as found by the generator.

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Programming Integrated in K-8 Traditional School Curricula

During the 2008/2009 school year several new ICT projects have been initiated in Italian primary and junior high schools aiming at improving pupils achievements particularly in scientific subjects. The explicit aim of some proposals is to develop computing competencies such as problem solving and, in general, logical skills, thus introducing in schools a conception of computing different from the one in most current projects, normally limited to the use of software applications. Actually, already in school-year 2001-2002, F. Honsell and C. Mirolo promoted one of the first projects aiming at cultivating computing as a science in schools that involved fifteen primary schools in the Friuli Italian region [3]. Yet, only during the current school-year 2008/2009 we had the first nation-wide initiatives in schools under this approach. The Italian Kangaroo Association organised the First Italian Kangarou Informatica contest for junior high schools, 5-7 May 2009. A. Lissoni with a group of researchers from the Milano University collected several problems, or as they call them "quesisti", to show in junior high schools what kind of questions computing concerns [4]. Also, the Italian Ministry of Instruction, University and Research (MIUR) supported Problem Solving Olympic Games for the first time during the current school year for the fifth degree of the Italian primary school and the third degree of the junior high school after the initiative of G. Casadei. These projects share the idea that pupils must get used to a structured, algorithmic way of dealing with problems and of solving them. Some of the proposed problems also introduce young students to data structures typical of computing, thus showing how properly structuring the data of a problem influences finding a solution. According to the title "Algorithms+DataStructures=Programs" of one of Wirth's books, in these projects pupils acquire programming competencies.

Other researches explicitely address programming in primary and secondary high schools. As an example, in educational robotics, pupils write programs for moving mini robots. We have proposed activities with autonomous mini robots of different types to children in kindergarten, primary and junior high schools. Pupils program by pushing buttons, in pre-writing age, or using different iconic languages or a textual Logo like language within an Integrated Development Environment (IDE) designed and implemented for them in our Departement. An advantage of programming autonomous mini robots is that it offers to pupils problems to be solved (and programmed) that they understand and are interested in solving. Beginning problems with robots are based on making them move in different environments: avoiding obstacles or doing different actions depending on where obstacles are positioned or depending on when a noise is made, etc. These moving-activities are something that young people know quite well by themselves. Teachers do not have to find problems: robots have wheels and, consequently, pupils first of all want to write programs that make them move.

While designing, writing and verifying programs for controlling the motion of mini-robots, schoolchildren and students both acquire programming competences in a young people oriented context and have the chance of concretely manipulating concepts present in their school curriculum with a conctructivistic learning approach. Educational robotics is a learning environment where robot programming activities are integrated into standard subjects, rather than being a form of ICT added to school curricula as one more, separate, subject or as a number of (software) tools for practicing topics from standard subjects. Until nowadays, such integration has rarely been present in the proposals for introducing computing technologies in schools, though considered a most fruitful educational usage of computers already in Papert's researches of the 70's.

During the last couple of years we could work with k-8 pupils on several topics from traditional curricula. In the following, we mention types of robots used and some curricular components addressed in our activities, distinguished by school levels.

In *kindergarten* we propose robots programmable to go forward, backward, left and right (the same measure of movement) by pushing buttons. We have addressed basic counting competencies and topological problems also with respect to the robot (that is someone different from the child who decides the commands).

In *primary school* we propose both already assembled robots and kits. Pupils program with iconic or textual languages. While designing robot programs we cover measuring, counting, comparing (longer, shorter, as-long-as paths), drawing of geometrical shapes. Also, again while designing or correcting their programs, pupils are naturally introduced to manipulate beginning physics concepts such as speed, time, friction and their relationships. Activities concerning geography have also been performed and a step-by-step methodology has been experimented where learning the textual Logo-like language for robot programming is coordinated with the parallel acquisition of logical and linguistic abilities [1].

In *junior secondary school level* we used several types of kits that pupils assembled in different forms. During the 2008/2009 school-year we went from more evident activities such as working with direct and inverse proportionality concepts (typically addressed in this level of schools) to introducing algebraic expressions[2]. This has been done by discussing with pupils how we can write the length of the path covered by the robot during one execution of a program. Our current work concerns the automatic synthesis of the algebraic expressions resulting from the discussions we had this year in junior high schools. This will be a support for teachers in motivating algebra that pupils often perceive only as a syntactical exercise.

Other activities integrating robotics in standard curricula are carried out by G. diBenedetto and R. Didoni with their Friend-Robot School-Net [5] in Milano area and by researchers involved in the European project "Teacher Education on Robotics-Enhanced Constructivist Pedagogical methods" (TERECoP) [6]. Didoni's experiences began around 2001 and nowadays every year their School-Net organises the Robotics Festival [5]. Italian researchers from Padua University and Rovereto Science Museum are involved in the TERECoP project with other seven European countries for developing robotics competencies in teachers in k-12 schools [6].

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Learning Robotics using LEGO Mindstorms

Introduction

Many people argue that learning robotics is a hard thing to do due to its complexity. On the other hand, learning robotics can bring many advantages: we can learn mathematics, physics, programming, mechanics, and science not only in theory, but also in practical way. In this context, the LEGO Mindstorms platform appears as a state-of-the-art and an innovative way to answer the challenges in learning robotics in all education level, even in primary or secondary education.

History of the Lego Mindstorms

The story behind LEGO Mindstorms is, in reality, a fascinating narrative of how three organizations (Resnick and Papert's Epistemology and Learning research group, the LEGO Corporation, and the MIT Media Laboratory) engaged in a complex social interaction, which shaped the evolution of the technology (Mindell, 2000). Each group had its own interests and ideas of what success means. Thus, each organization influenced the development of the Mindstorms product and its Media Lab prototypes in different ways.

The Epistemology and Learning group, for instance, endeavored to create and disseminate new constructivist approaches to learning. In constructivist approach, it is stated that *knowledge should not be simply transmitted from teacher to student, but actively constructed by the mind of the student* (Mindell, 2000). In addition, learning is an active process in which people actively construct knowledge from their experiences in the world. The LEGO Company also aspired to provide constructivist approaches to learning, while aiming for their brand "to be the strongest in the world among families with children". Finally, the MIT Media Lab sought to create a new and publicly visible model of academic research that emphasizes the public impact of ideas, fosters idea transfer between academic research groups and corporate sponsors, and encourages community outreach. Ultimately, the Lab provided an environment for the research that led to the Mindstorms product to grow and mature.

Learning Robotics

Robotics is an interdisciplinary subject, combining and integrating different areas of knowledge, such as mathematics, physics, mechanics, electronics, control, computer programming, artificial vision and artificial intelligence (Ricca et al., 2006; Karatrantrou and Panagiotakopoulos, 2008). Indeed, robotics is appealing for the integration of multi-disciplinary skills and teams.

Learning robotics requires the usage of new methodologies that apply the concepts of *learning by doing* and *learning by enjoying*, allowing to motivate and involve the students in the learning process (Leitao et al., 2007). In addition, learning robotics also requires a deep understanding about the structures (building) of the robot, sensors and programming. The building of the robot determined how the robot should move or work. The sensors enable the robot to acquire many different values from the environment, e.g. light intensity, sound, and temperature. Furthermore, to bring the robot "alive", a good program is needed.

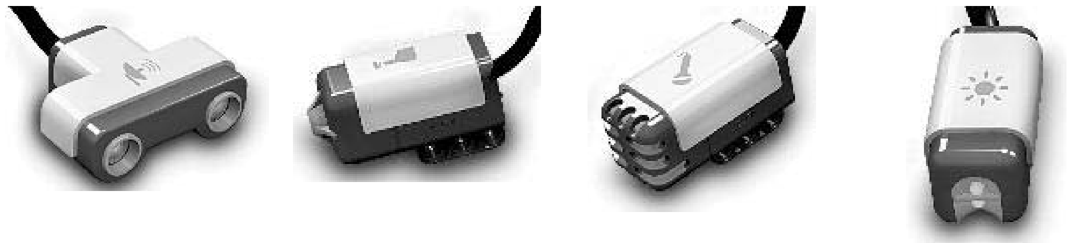
The advantages of Lego Mindstorms

LEGO Mindstorms platform appears as a simple, flexible, attractive, educational and suitable tool for learning robotics. The main reason to sustain this argument is that it is a tool that everybody is familiar with. The LEGO parts allows connectivity, eliminating the need of using screws or glue, thus making the construction of mechanical models much more clean and easy. It is also an ecological tool because although the plastic is not easy to recycle, the parts are never made unusable, so they never become garbage, being used over the time.

At high-level studies, the difficulty to build quickly mechanical structures for the robot retracts the time and motivation to learn robotics topics (Kelly, 2006). The possibility to build quickly robots with different configurations provided by the LEGO platform offers a good opportunity to learn this topic by doing and enjoying.

Moreover, to support interactivity, Lego Mindstorms NXT has four kinds of sensors (see figure 1) to interact with environment. Lego Mindstorms NXT comes with:

- Touch Sensors: It is like a bumper; it enables the robot to detect press-and-release events. This kind of sensor can be used to detect very near obstacles.
- Light Sensors: It is a rudimentary device that lets the robot “see” in a very limited sense. Measuring the amount of light that reaches the sensor’s inlet, it allows for distinction between bright and dark, similar to an amoeba.
- Sound Sensors: It is the robot’s “ear.” It can detect and measure sounds.
- Ultrasonic Sensors: It is eyelike shaped and might be considered to be like the robot’s eyes, indeed enabling it to have a look at what’s around it.



a) Ultrasonic Sensor **b) Touch Sensor** **c) Sound Sensor** **d) light sensor**

Figure 1: Lego Mindstorms NXT sensors

The Lego Mindstorms NXT software (see figure 2) enables us to program our NXT robotic applications and upload the programs to the NXT via USB or Bluetooth connectivity. The intuitive Mac and PC compatible drag and drop software, powered by National Instruments LabVIEW, comes with building instructions and programming guides to easily begin constructing and programming with Mindstorms NXT.

Conclusion

The LEGO Mindstorms platform uses the basic concepts of LEGO to build mechanical models. Due to the intrinsic features exhibited by the LEGO Mindstorms platform, such as reusability, modularity, flexibility, and cost-effectiveness, the introduction of that platform in some Engineering curricula is useful, for example to improve learning in several areas of knowledge, such as robotics, computer programming, artificial intelligence, distributed systems and electronics.

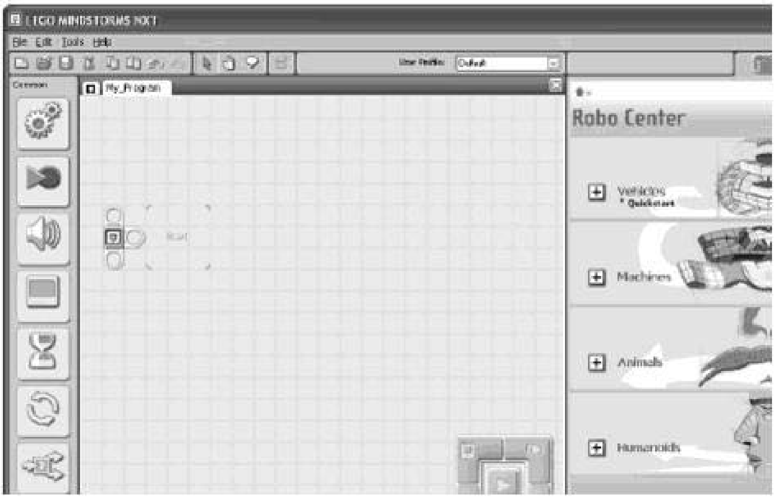


Figure 2. Lego Mindstorms NXT software

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General Guidelines for Enhancing Online Collaborative Science Studies

Introduction

Although the class the instructor teaches is in the San Jose State School of Library and Information Science (Information Retrieval), the course deals with database base design for article collections, creating and testing controlled vocabularies, evaluating results, and drawing conclusions from observations. A scientific study and report is an outcome of the class.

Since the class is taught totally online to students scattered over a wide geographical area, teamwork and collaboration are real issues for both students and instructor. Students need to have a collaborative team effort to complete the assignments and the instructor needs to create a social yet professional atmosphere in order for learning to take place.

The class is taught in Angel and previously in Blackboard. Although either Learning Management System (LMS) has discussion boards that allow for asynchronous sharing, the technology that greatly facilitates teamwork and collaboration is a program called Elluminate since it allows students to meet as teams to discuss, share, and modify documents in real time. Elluminate can also be used to quickly create recordings of Powerpoint presentations that cover any questions or assignment overviews that come up during the class. A transcript can easily be added to comply with accessibility requirements. A wiki is also used for the midterm essays and students often used Google docs for collaboratively working on their analytical team reports about database and controlled vocabulary design.

Teamwork Process

At the start of each semester the instructor uses a survey to ascertain student skills, computer and online experience, and fears about the technology oriented class. After five years of teaching the course, student anxieties are in order of mention:

1. Teamwork
2. Time
3. Technology
4. Readings
5. Workload
6. Isolation
7. Confidence

Student comments indicate that teamwork exacerbated by the online environment was their primary worry. The other concerns listed all related to the online environment and only increased student anxiety as well as their unwillingness to participate in the class.

Instructors need to take a proactive role in building a collaborative environment for students to work online.

The first step towards this goal is to look at what the instructor wants to accomplish in the class and what type of teamwork meets those goals. Most teamwork fits into one of the- three following types:

1. Solve problem ➔ Present consensus
2. Set policies ➔ Work Independently
3. Build product ➔ Evaluate

Quite often more than one type is used; selection is dependent on the assignment and outcomes.

The second step is to determine what skills are needed by students to meet the course goals. Generally these skills are:

1. Teamwork policies
2. Meeting facilitation
3. Project Management
4. Brainstorming
5. Consensus building

Having a proactive strategy for teamwork leads to success and involves student attitude and an established process.

Student Attitude

- Participation
- Collaboration
- Team Goals (not egos)

Instructors can guide student attitude by setting expectations for participation, collaboration, and team goals. Guidelines can be established for assignments and grading criteria expressed in a rubric. Students want to do well and will be more likely to follow clearly defined requirements and examples.

Established Process

- Planning
- Communication

Having an established process relates to the second step above that deals with establishing skills students need for planning and communication. The skills needed are formed by the outcomes of assignments and the technology available to students for communication. Using methods such as discussion boards, Google docs, or wikis are more inclusive than emails which are often viewed as exclusive and tend to inadvertently leave people out. Again detailed examples and/or guidelines from the instructor are important since most students will not have much experience. The level of detail depends on the grade level and assignment expectations.

The end result of these two steps of determining course goals and needed skills is: Success versus Chaos! The results of student work are greater than the sum of the parts.

Disastrous behavior

- Silent
- Absent

- Controlling
- Stubborn

When team members do not comment or show up on discussion boards or at meetings, they are exhibiting behavior that detracts from success. Everyone needs to participate and all view points need to be discussed. This is behavior that takes place on the job and in professional groups. Students need to learn these skills since science especially is an exchange of ideas. Also the opposite, controlling or stubborn behavior is just as costly because other team members will often stop participating. Egos need to be left out and the team focus stressed. Instructor leadership is critical.

Successful team strategies

Successful teams develop guidelines that strengthen participation, the key to success. Some successful strategies are:

- Learn about teammates' skills
  - Set team guidelines
- Discuss assignments
  - Set up a process
  - Mentor: Leave no teammate behind!
- Collaborate
  - Brainstorm
  - Build consensus
- Use tools wisely

Review

Teamwork is not always easy and takes practice. Teamwork is constantly changing because each team or team task is different. Teamwork becomes easier and confidence increases with practice.

Teamwork success is determined by
- Attitude
- Planning

Teamwork is an opportunity to practice leadership and mentoring in a safe environment.

Team Responsibilities
- Always show up.
- Always do the job.
- Always prepare for meetings.

Teammates Responsibilities
- Always communicate with each other.
- Always respect each other.
- Always support each other.

Using these simple steps will help ensure successful collaborative science projects at any grade level.

The observations and conclusions about teamwork resulted primarily from student surveys, observations of team discussion boards, increased team participation and enthusiasm, and improved grades. Each class brings different challenges and new insights so teamwork is a constantly evolving process and must remain flexible.

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PLEF: A Conceptual Framework for Mashup Personal Learning Environments

There is a wide agreement that the new era of education (especially science education) is defined by rapid knowledge development. Among others, Hase & Kenyon (2000) argue that this rapid rate of change suggests that we should now be looking at a learning approach where it is the learner who determines what and how learning should take place, and point out that self-organized learning may well provide the optimal approach to learning in the twenty-first century.

Self-organized learning provides a base for the establishment of a model of learning that goes beyond curriculum and organization centric models, and envisions a new learning model characterized by the convergence of lifelong, informal, and ecological learning within a learner-controlled space.

In recent years, self-organized learning is increasingly supported by responsive, open, and personal learning environments, where the learner is in control of her own development and learning. The Personal Learning Environment (PLE) concept translates the principles of self-organized learning into actual practice.

From a pedagogical point of view, a PLE-driven approach to learning supports a wide variety of learning experiences outside the institutional boundaries. It puts the learner at the center and gives her control over the learning experience.

From a technical point of view, a PLE-driven approach to learning gets beyond centralized learning management systems. A PLE suggests the freeform use of a set of lightweight and loosely coupled tools and services that belong to and are controlled by individual learners. Rather than being restricted to a limited set of services within a centralized institution-controlled system, the idea is to provide the learner with a plethora of different services and hand over control to her to select, use, and remix the services the way she deems fit. A PLE does not only provide personal spaces, which belong to and are controlled by the learner, but also requires a social context by offering means to connect with other personal spaces for effective knowledge sharing and collaborative knowledge creation within open and emergent knowledge ecologies.

In the following, we focus on the technical development of PLEs. A PLE is a learner's gate to knowledge. It can be viewed as a self-defined collection of services, tools, and devices that help learners build their Personal Knowledge Networks (PKN), encompassing tacit knowledge nodes (i.e. people) and explicit knowledge nodes (i.e. information). Thus, mechanisms that support learners in building their PLEs become crucial. **Mashups** provide an interesting solution to developing PLEs. In Web terminology, a mashup is a Web site that combines content from more than one source (from multiple Web sites) into an integrated experience. We differentiate between two types of mashups:

- **Mashups by aggregation** simply assemble sets of information from different sources side by side within a single interface. Mashups by aggregation do not require advanced programming skills and are often a matter of cutting and pasting from one site to another. Personalized start pages, which are individualized assemblages of feeds and widgets, fall into this category.

- **Mashups by integration** create more complex applications that integrate different application programming interfaces (APIs) in order to combine data from different sources. Unlike mashups by aggregation, the development of mashups by integration needs considerable programming expertise.

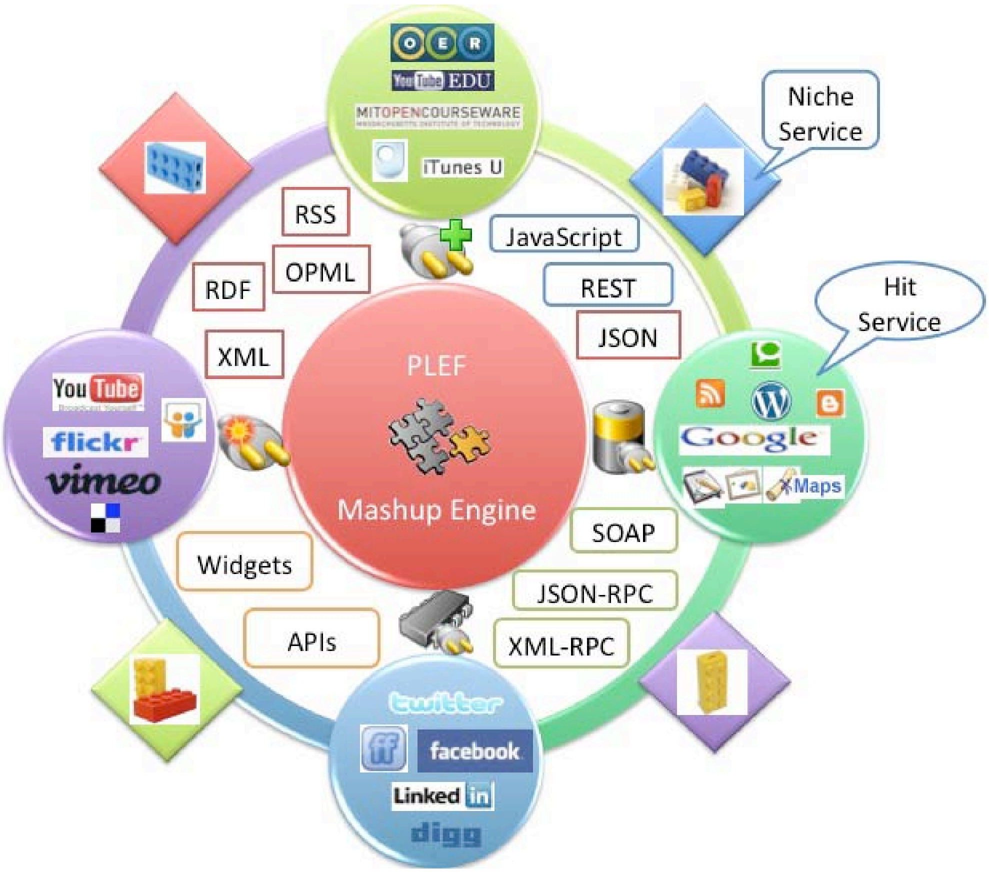

Figure 1: PLEF Abstract View

The Personal Learning Environment Framework (PLEF) provides a framework for mashup personal learning environments. An abstract view of PLEF is depicted in Figure 1. PLEF leverages the possibility to plug learning components from multiple sources into a learner-controlled space. This ranges from simply juxtaposing content from different sources (e.g. feeds, widgets, media) into a single interface (mashup by aggregation), to a more complex remixing of different APIs into an integrated application, in order to create entirely different views or uses of the original data (mashup by integration).

A conceptual view of PLEF mashup engine is shown in Figure 2. PLEF mashup engine supports both types of mashups i.e. mashups by aggregation and mashup by integration. A key requirement for mashups by aggregation is that content should be available in standardized formats that can be reused easily in other contexts, such as Web feeds, widgets, and image/video formats. PLEF enables learners to use copy-and-paste and drag-and-drop actions to easily juxtapose different learning resources and services (e.g. feeds, widgets, and different media) from multiple learning platforms and service providers within a personalized space.

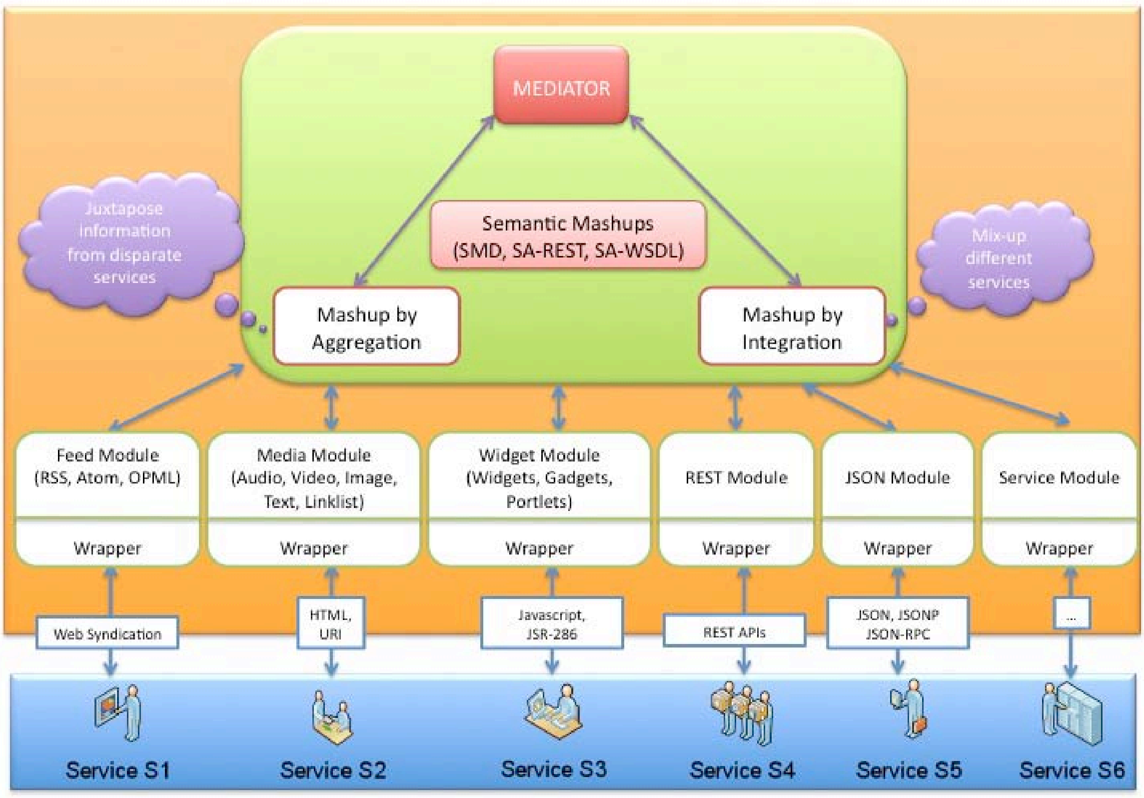

Figure 2: PLEF Mashup Engine

Unlike mashups by aggregation, creating mashups by integration is a time consuming task and impossible for a typical learner with no programming knowledge. Moreover, in order to create mashups by integration, it is difficult to address issues related to data interoperability, integration, and mediation. The concept of semantic mashups (SMashups) (Sheth et al., 2007) addresses these limitations by proposing the semantic annotation of Web services as a solution. SMashups enable to automatically mix-up services, with different input and output formats, based on a semantic description of the same.

Driven by the SMashup concept, PLEF supports learners in selecting, managing, and remixing different semantically annotated learning services with minimum effort. Thereby, different Web service annotation standards such as Service Mapping Description (SMD), SA-REST, and SA-WSDL can be used for the semantic description of the services.

Driven by the popularity of lightweight RESTful Web services, AJAX, and JSON that build core technologies in the Web 2.0 movement, PLEF focuses more on RESTful Web services with JSON as output format. The Service Mapping Description (SMD) is used to add semantic annotations to arbitrary RESTful Web services. SMD is a novel and simple JSON representation describing a wide array of Web services including REST services and JSON-RPC services (Zyp, 2009). PLEF leverages the SMD annotations of RESTful Web services to facilitate the automatic mediation and creation of learning mashups.

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Mobile Long Life Learner Pervasive Assistance System

Learning is the most sacred task for human beings. An important number of persons fail to pursue their studies because of various reasons and keep their ambitions for graduation or post graduation into their hearts. Mobile professionals, a subset of this kind of people, can find themselves in desperate situations when they have ambitions and will to improve their skills but they cannot match their work schedule with their class one. In fact, they are handicapped by their mobility and the inflexibility of Long Life Learning Centers (3LC).

A Mobile Learner (ML), usually moves from place to place connected by a road network, to take care of his/her permanent and occasionally customers dispersed geographically. The ML activities may vary in time and can allow him/her to have a free time at any moment. The ML has to react quickly in front of happening events to catch an eventual course or exam. To perform this objective, he/she has to find a 3LC, a class and a place in an acceptable time, while moving in one of the roads (e.g. in his/her car or on his/her feet). This can be performed using mobile devices well equipped to query distant databases and get efficient answers while moving. Answers can be ensured through a mediator, implemented thanks to wireless and mobile network architectures (Lin and Chlamtac, 2001), able to provide efficient responses for location dependent queries triggered by MLs.

The goal of this paper is to propose an approach based on pervasive assistance system for MLs able to localize, to match MLs free time with scheduled courses, and to make reservation of learning resources while being in motion. It supposes the following assumptions: 3LCs are distributed in various locations and grouped and managed in one centralized structure, and MLs can follow their courses in any 3LC.

Any ML, obviously, ask the following questions: Which are the nearest 3LCs close to my current position? Is there some classes corresponding to my planned courses and to my level? Do those classes' schedules match with my free time? Is there available place in these classes?

Our approach is performed to ensure providing answers to above questions through a location based services application interface implemented on the ML mobile device and based on the following agents:

- **3LCs Localor:** Following ML query, 3LC Locater agent determines the Continuous k Nearest Neighbors (CkNNs) 3LCs thanks to Delaunay Triangulation based On road (DT_r) (Khayati and Akaichi, 2008). DT_r provides a valid response for continuous research of the k-Nearest Neighbors. (for example: seek for me the 3 closest 3LCs from my current position).

- **Classes and Level Matcher:** More than determining the point of interests, the learner desires are to distinguish if these points enclose some classes corresponding to his/her planned courses and to his/her level. This is achieved through the Classes and Level Matcher agent able to match planned courses stored in ML mobile device database with located 3LCs databases. It takes into account ML level and course level provided by 3LCs.

- **Free Time Matcher:** This matcher looks for whether the computed courses schedule corresponds to ML projected free time. This is achieved through a matching performed according to free time preferences stored in ML mobile device database with the 3LCs courses schedules.

- **Availability Matcher:** The agent determines whether there is an available place for ML in the selected 3LC. If it is a positive answer ML decides on its subscription into a class.

Moreover, mobile Graphical User Interfaces (GUIs), aiming to help MLs to perform other tasks related to the use of some virtual learning resources, are designed. MLs have only to provide minimal but sufficient information, to acquire responses to their requests. The main GUIs are the following:

- Interface for CkNNs 3LCs Visualization: Permits to visualize localized 3LCs on the road network map. Those are displayed using a personalized color and labeled by their names, address and real distances.

- Interface for CkNNs Browsing: Permits to zoom any point of interest selected by ML. It is composed by the road network and the points which can be distinguished by specific colour. ML has only to click on any point of interest to browse learning resources in order to choose one of them for a learning purpose. Zooming allows visualization of the list of learning resources enclosed in any localized point of interest. This is performed using a table of two columns. The first one displays learning resources names, the second shows their descriptions. A button labeled "Reservation", in front of each, permits to the ML to make the needed reservation. We note that this GUI is also equipped by a button labelled "Compare". When ML clicks on it, a comparison is triggered between the identified points of interest, and the number of the table columns is multiplied by the number of points of interest.

- Interface for learning resources reservation: When the ML click on the button, labeled "Reservation", a time table is displayed showing the availability in time of the selected learning resource. This allows ML to decide whether to reserve or cancel the whole process and to go back for other points of interest.

Most of the services presented above are interactive. Obviously, this interactivity has to be decreased due to the professionals' mobility related to their work nature. This can be ensured by defining alerts according to ML preferences such as those specifying free times, programmed locations at programmed times, etc. The mediator may extract preferences information to compute matching performed by the above agents in automatic way, and alert MLs in an adequate time. Those have only to visualize such messages and to decide, whether or not, they are tolerable to their needs.

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Distance Learning the Wave of the Future: A Case Study of Bringing World Class Education to the Isolated Rural Poor of Pakistan at SUIT

Abstract: Technology is around everything we do. Integrating technology into various aspects of university instruction has rapidly become an essential component of effective teaching and learning. E-learning can be obliging in using it as an appropriate way to leverage quality of education as it breaks the obstacles in terms of geography, time, quality and competent teachers. The deployment of such an infrastructure in a developing region such as N.W.F.P will also enable a better understanding of the digital divide both within Pakistan, between Pakistan and other developing regions and between Pakistan and developed regions.

Keywords: *Information Communication Technologies (ICT), E-Learning*

Introduction

The influence of the Internet over the past two decades is unquestionable in the ability to provide profound opportunities for both the education and business communities around the globe. As technology evolves, we have been observing segregation in the growth of performance between 1st world and 3rd world countries. The e-learning portal constitutes a significant example of the use of Information and Communication Technology (ICT) to deliver higher education in both developed and developing countries. The Sarhad University of Science and Information Technology (SUIT) has been playing its part by maturing a collaborative research initiative with USA, under the umbrella of a research project – objective of this is to expand the scope of providing quality education through the use of the technology. Utilization of the E-learning tools involves the local communities in the academic process and would help to minimize the radicalism in the local communities of the NWFP.

Theoretical Framework

Over the past decade many universities have invested heavily in information technology in the belief that their investment would pay off and would enhance learning and enrich the student experience. Both the education community and the broader public community have long held great expectations for the role of technology in teaching, learning, and instruction (Morrison, 1999). But where are we vis-à-vis instructor using technology to enhance teaching? Research has revealed that increased use of appropriate technology in instruction results in increased student learning (e.g., Grabe and Grabe, 1998; Dwyer, Ringstad, & Sandholtz, 1991). Technology supports collaboration and communication and the development of attitudes and skills. It provides authoring support and allows instructors to monitor student activity.

Negroponte, Resnick, and Cassell (1997) argue that digital technologies can enable students to become more active and independent learners. The Internet will allow new ‘‘knowledge-building communities’’ in which children and adults from around the globe can collaborate and learn from each other. In the student-centered classrooms of today, with the aid of the technology, students are able to collaborate, to use critical thinking, and to find alternatives to solutions of problems (Jaber, 1997). Technology is nothing but applied science. Utilizing scientific ways for learning about science and technology is not a new concept in western world. As Mayer (2003) stated “*it’s the method of instruction that promotes learning not the medium of instruction*”.

Technology as a tool for interaction

Distance education has a long history in contexts where dispersed populations present challenges to traditional classroom-based educational systems. To address this issue, modern information communication technologies (ICT)-based forms of distance education are replacing correspondence course and broadcast radio models that have been used in the past (Davis and Niederhauser, 2005). E-learning can be obliging in using it as an appropriate way to leverage quality of education as it breaks the obstacles in terms of geography, time, quality and competent teachers. The employment of such an infrastructure in a developing region such as N.W.F.P will also facilitate a better understanding of the digital divide both within Pakistan, between Pakistan and other developing regions such as Latin America, Africa, and Russia and between Pakistan and developed regions. It will also leverage the wealth of talent available in Pakistan to contribute towards world-class students for different walks of life.

To implement e-learning methodology in full and positive way simply mean to significantly change the method of teaching and learning, that is "concealed" major target of the project and way to improve quality of education. That is why implementation of e-learning is multifaceted and multilayered project that consists of selection of political, social, organizational and technical measures that have to synergize and effect in new, improved university education process.

Conclusion

We expect that educating the local communities through E-Learning tools would bring prosperity in the life of NWFP residents and put them on the path of sustainable progress. It will provide an opportunity to contribute to the development of new technologies and would contribute positively to the Pakistani society and economy. And most importantly it will add value in the NWFP communities – educating the local communities to make them better global citizens.

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National Learning Object Repositories An Architectural Rethink

Abstract. User requirements have caused the Irish National Digital Learning Repository to fundamentally rethink its approach to service provision for the Irish Higher Educational community. This article presents an outline of the new architecture and its approach to meeting the demands of users.

Keywords. Repository, Learning Object, SWORD, SRU, SRW, Sitemap

Introduction

The Irish National Digital Learning Object Repository (NDLR) (www.ndlr.ie) is a collaborative project which involves all six Irish Universities and all 13 Institutes of Technology in Ireland. It has been running as a pilot for three years and has recently been awarded Irish Government funding to continue its work as a full-service.

The focus of the NLDR has been to base its operations on academic Communities of Practice (CoPs) and to use these communities of practice as a mechanism for the dissemination of best-practice in technology enhanced learning using reusable learning objects. The consequence of this is that the demands made of the repository technology have been driven by the demands of the academic communities of practice. This user-driven approach has resulted in a new architecture for the repository which is described in this paper.

The unique feature of the NDLR is that because Ireland is a small country, the NDLR is actually representative of the entire Higher Educational spectrum and likewise its Communities of Practice reflect the spectrum. This is a unique feature of the NDLR whose decision-making processes are consensual and driven by user needs.

As part of the ongoing commitment to quality in the NDLR, a comprehensive review of user-needs and perceptions was undertaken in 2008/9 and as a consequence of this a new prototype repository architecture was designed which makes use of the latest technologies to provide a radically different user-experience. The rationale behind this, the design goals, the key technologies used and the conclusions from the preliminary testing of the architecture are presented in the following sections of this article. A diagrammatic representation of the architecture is shown in figure 1.

Rationale

The decision to design a new architecture came from a series of user-focus groups which identified new trends in the manner in which users wanted to interact with the repository. The most important of these being that their activities would be better supported through a social networking platform or learning management system (or both) with a built-in repository.

This impetus fundamentally changed the previous concept of the NDLR architecture which had a set of social networks and a repository technology that was parallel to these networks, not embedded within them. This work was started about 12 months ago and has now been successfully prototyped, what is of interest is the fact that other national organisations in the UK are now taking a very close interest in the approach and starting to consider moving in this direction.

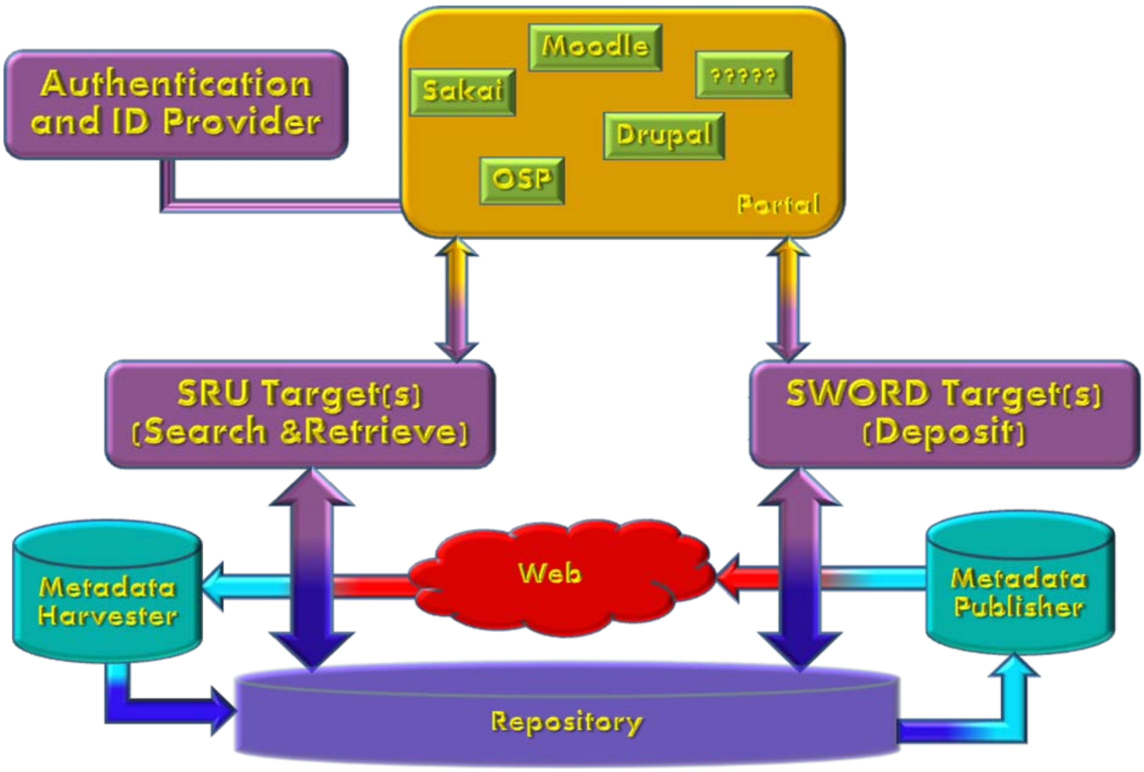

Figure 1: New NDLR Architecture

Design Goals

The design goals for the new repository were as follows:

- Agnostic to the database technolog(ies) used
- Embeddable in a wide range of social networking and learning management platforms
- Capable of indexing metadata in other repositories
- Capable of publishing its own metadata to crawlers such as Google
- Federated Authentication, Creative Commons Licensing
- Low cost of ownership

Enabling Technologies

The three key enabling technologies that combine to deliver the new architecture are briefly described in the following sections. The mechanism that allows deposit in the repository is based upon SWORD and the mechanism that allows search and retrieve of objects in the repository is based around SRU/W.

Deposit: SWORD

Simple Web-Service Offering Repository Deposit [1] is an application profile of the Atom publishing protocol which has been developed under the auspices of JISC in the UK. This is an ultra-lightweight protocol which allows developers to very simply create a deposit client for a repository to run on any web platform. The protocol is supported by a growing number of repository platforms in both the open and closed-source communities.

SWORD is designed to 'lower the barriers to depositing material in repositories' [2] and is highly appropriate for an application of this type as most of the NDLR depositors are depositing materials for altruistic reasons and cannot be expected to expend a great deal of effort in the deposit process.

Search and Retrieve: SRU/SRW

Search and Retrieve by URL [3] is a standard search and retrieve protocol which was derived from the widely adopted but outdated Z39.50 protocol for library search and retrieval. The SRU protocol can be implemented as a web-service, using either SOAP or REST techniques (though REST is increasingly the preferred approach) and in this instance it is referred to as SRW. SRU is an XML-based protocol which has Contextual Query Language, CQL built into it to support a powerful and database-agnostic search query interface.

Metadata Publishing: Sitemaps

In order to allow the content of the repository to be searchable via Google and other search engines, it is necessary to provide a mechanism that allows these engines to 'crawl' the repository and extract information from them. This is a critical task in contemporary repository architecture as most users searching for an object will go to Google in advance of anything else. Google have published a mechanism called "Sitemaps" [4] to allow this to take place. The repository needs only to generate a sitemap and put it in a place where Google can see it for its metadata content to be indexed.

Conclusions

The prototype system has met its design goals and a decision to proceed with the deployment of a full-scale service based on this architecture has been taken. It is believed that this approach will offer significant cost-savings and an enhanced service to NDLR users, contributors and administrators.

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List of International Conferences on Learning Technologies

DIGITEL 2010 The 3rd IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning, Kaohsiung, Taiwan, 12-16 April 2010

WMUTE 2010 The 6th IEEE International Conference on Wireless, Mobile & Ubiquitous Technologies in Education, Kaohsiung, Taiwan, 12-16 April 2010

SITE 2010 Society for Information Technology & Teacher Education, San Diego, CA, USA, 29 March - 2 April 2010

ITHET 2009 9th International Conference on Information Technology based Higher Education and Training, Daejeon, Korea, 16-18 December 2009

ICODL 2009 5th International Conference on Open and Distance Learning , Athens, Greece, 27-29 November 2009

CATE 2009 12th IASTED International Conference on Computers and Advanced Technology in Education, St. Thomas, US Virgin Islands, 22-24 November 2009

CELDA 2009 IADIS International Conference Cognition and Exploratory Learning in Digital Age, Rome, Italy, 20-22 November 2009

mLearn 2009 8th World Conference on Mobile and Contextual Learning, Orlando, FL, USA, 26-28 October 2009

E-Learn 2009 World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education, Vancouver, Canada, 26-30 October 2009

MTDL 2009 ACM International Workshop on Multimedia Technologies for Distance Learning , Beijing, China, 23 October 2009

FIE 2009 39th Annual Frontiers in Education Conference, San Antonio, TX, USA, 18-21 October 2009

TELearn 2009 Technology Enhanced Learning Conference 2009, Nankang, Taipei, Taiwan, 6-8 October 2009