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Dear Melissa Koch,
Please find attached the CILT Seed Grant Final Report for the project entitled “Building Blocks for Virtual Worlds: Design Principles for a Starter Kit for Educational Virtual Worlds.”

Sincerely,
Katy Börner, Margaret Corbit, and Bonnie DeVarco

Bloomington, March 28th, 2003

CILT Seed Grant Final Report

PROJECT TITLE:

Building Blocks for Virtual Worlds: Design Principles for a Starter Kit for Educational Virtual Worlds.

PARTICIPANTS:

Project Leaders
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Margaret Corbit, Cornell University
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Students
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Chad Rooney, Research Intern

WEBSITE
http://vw.indiana.edu/building-blocks/

PROJECT SUMMARY
This project aims to develop design principles for a starter kit for educational virtual worlds. It will synthesize lessons learned by the VLearn3D.org educational 3D multi-user virtual worlds community into a set of design principles, which can be shared within our community and with the broader community of educational technology developers via CILT. Specifically, the project will inform the design of a "basic starter kit" for using the Activeworlds technology.

Phase 1: August 2002 – December 2002
Interested in serving the needs of the users (teachers, students, etc.) and in exploiting the rich experience of the AWEDU and VLearn3D communities as well as related research groups, the first months of the project were devoted to designing and conducting question and discussion sessions to compile a list of critical features for the success of 3D multi-user virtual worlds for education.

In particular, we acquired data via an **Online Questionnaire** (see Appendix A) comprised of demographic questions, as well as questions related to (1) User experience with AW Technology, (2) Experience with 3D Worlds for Educational Purposes, (3) Community Building, (4) A Toolkit to be Developed to Ease AW Usage. The Online Questionnaire is available at http://ella.slis.indiana.edu/~ellwrigh/building-blocks-questionnaire.html. Preliminary examination of dataself-reported by AW users indicates that the respondents are socially diverse, that they are focused on the use of different parts of the technology for the same ends, and that the instructors in the group are largely responsible for the construction of their worlds with little help.

Ten educational 3D technology experts participated in **In-World Interviews** conducted to collect the 'lessons learned' by the user community in terms of world design, use of this technology for educational purposes, and evaluation of the results.

In addition, we organized a **Fall Roundtable Series**:

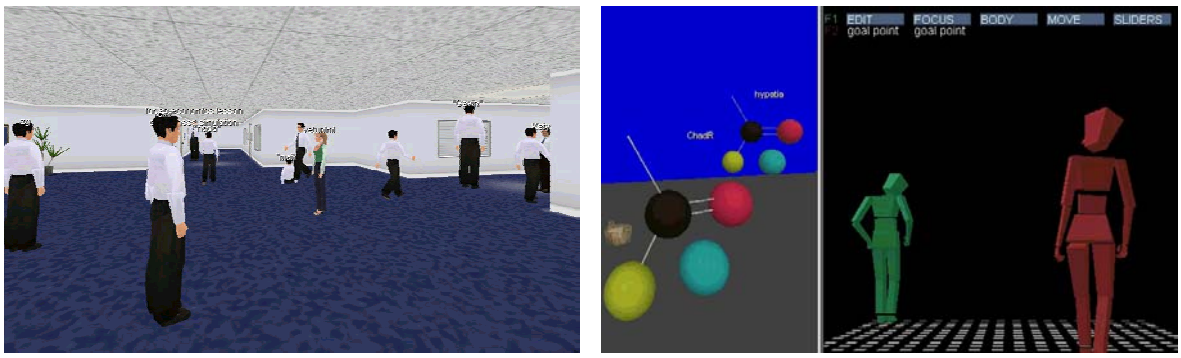
Oct. 30: Roundtable 5 on "New Avatars & New AW 3DWeb Page"
Oct 16th: Roundtable 4 on "Forming Effective Virtual World Communities"
Oct 9th: Roundtable 3 on "Funding & Multi-Institutional Projects - Challenges & Opportunities "
Sept 25th: Roundtable 2 on "World Design and the Educational Experience"
Sept 18th: Roundtable 1 on "Technology Issues in Virtual Worlds"

The focus of this series was to draw attention to the design principles study by facilitating regular discussions with members of AWedu and other invited guests. Chat logs and still images are available online at http://vw.indiana.edu/building-blocks/roundtables/.
The results of the interviews were combined with input from the roundtables to inform the extraction of design principles for the CILT database and to suggest a framework for the starter kit for educational world developers.

VLearn3D Conference
First results of this project were presented at the annual online Vlearn3D Conference on Dec 7th, 2002 and will be posted to www.vlearn3d.org for discussion and input. During the conference, CILT member Yael Kali presented an overview of the CILT Design Principles Database for our AWedu participants and previewed the new online database. This enabled more of our community to have a stake in its growth and a desire to become potential users of and contributors to the database.

Stills of the Fall Roundtable Series

VLearn 3D Conference Stills: Panels and Brainstorming Session



VLearn 3D Conference Stills: Parallel Tours of Different Worlds

Phase 2: January 2003 - March 2003

The second part of the project was devoted to data analysis and the specification of design principles as well as a "basic starter kit" which can be shared within our community and with the broader community of educational technology developers via CILT.

Data Analysis Results

The data analysis was performed with the intent to generate a document informing the production of a "Starter Kit" for the use of ActiveWorlds technology in particular and 3D Multi-user worlds in general. Data comprised in-world interviews, chat logs recorded during the Fall roundtable series and the VLearn 3D Conference as well as data submitted via the online questionnaire.

From a survey of 143 education-based users of the AWedu universe during the past four years, a smaller list of 10 educators was selected for personal one-on-one interviews held in AWedu. The interviews were conducted with a core group that is geographically diverse, coming from different disciplines and educational settings, all of whom serve varied age groups, from K-12 to university level. Each interviewee has used AWedu for a period of two years or more. Data acquired via the online questionnaire is summarized in Appendix B.

Approximately 12 to 20 participants from around the world attended each of the five Building Blocks Roundtable sessions between September and November of 2002.

The VLearn3D 2002 conference concentrated on the CILT Building Blocks study as well. This five-hour conference was held on Saturday, December 7, 2002[1]. Up to 60 attendees from around the world were present at each session, and the "Building Blocks for Virtual Worlds" provided an overall theme to the entire day of sessions, which included a session on the CILT Design Principles Database presented by Yael Kali. Appendix D contains a description of the VLearn Conference as well as a visualization of user movement data generated using tools developed in this project.

All interviews and roundtables were carried out via text chat and recorded in chat logs (the roundtables are publicly available via the WWW and the one-on-one interviews are private).

[1] http://www.vlearn3d.org/conference2002/index.html

The inworld interviews, community roundtable sessions, and Vlearn3D 2002 Conference invited educators using AWedu Environment to:

1) openly discuss the advantages of the medium for education

2) explore and articulate the most common problems educators encounter using it

3) present lessons learned from applying the medium in different age groups, different disciplines and with varied pedagogical approaches

4) identify shared needs based on what works well and what does not

5) create a "wish list" for the desired components of a "Starter Kit" for using 3D Multi-user worlds in education.

The subsequent list of (i) Advantages of the Medium, (ii) Uses of the Medium, (iii) Challenges, and (iv) Needs generated from our initial discussions is by no means complete. However, it can be seen as a starting point to inform the next generation of education-based users of 3D multi-user worlds. From this information, various design principles can be identified and utilized by users of the CILT Design Principles Database the AWedu community and users of 3D MUVEs in general.

(i) ADVANTAGES OF THE MEDIUM

Inexpensive, thin, PC-based medium
- Cost less than virtual reality
- Does not require broadband access

- Students can participate in the planning/building process
- Since it is modular, students can build with pre-designed modules
- Building with modules happens in realtime so co-curation of galleries and shared "barn raising" is possible with distributed student groups
- Inworld mentoring between student and student, teacher and student and designer and student is possible
- World design can "evolve" as students use the world and various users provide input on what is needed

Supports Collaboration across distance
- One-to-one, many-to-many and one-to-many communication
- People around the world can meet and work with one another (cross-cultural contact)
- Geographically distributed students can work together
- Saves travel time and long distance cost
- Chat-based – logs record all sessions automatically
- Enables private communication telegramming, file-sharing, whisper

Environment Supports Interactivity
- Animation and slide shows are possible inworld
- Bots enable automation in 3D environment
- Avatars can interact in a social environment

Works well in conjunction with other technologies
- RESOURCES: Uses any web-based material in conjunction with the world (in web-section of the multitasking browser)
- COMMUNICATION: Can be used in conjunction with voice chat, web-based asynchronous communication environments and web-based whiteboards
- MULTIMEDIA: Ambient sound, narration and music via .wav and midi files can be used inworld. Audio, Video and webcams can be integrated into virtual worlds

Design of the Environment is Versatile
- Supports creative expression – worlds can be very imaginative
- Enables verisimilitude – worlds can be built to reflect environments in the real world

(ii) USES OF THE MEDIUM

- Tutoring
- Multi-generational programs (matching university and high school students)
- Test Preparation
- Intercultural Communication Projects
- Informal learning – science museum exhibits for distributed students (field trips)
- Giving underrepresented students access to resources, college prep and a college-bound student network
- Using the environment as a location for educational events that include distributed groups of educators and students
- Using environment as a location for students to work with specialists (arts, design, etc.
- Questionnaires are used to inform the design evolution to the next iteration

Pedagogical Methods used:
- Bloom's Taxonomy
  http://www.dlrn.org/library/dl/guide4.html
- Gardner's Theory of Multiple Intelligences
  ex: http://web.tiscali.it/no-redirect-tiscali/3dfantasia/1issue/multiple_en.htm
- Problem-Based Learning
  http://score.rims.k12.ca.us/problearn.html
- Constructivism
  http://www.ilt.columbia.edu/ilt/papers/construct.html
- Collaborative, Peer-to-peer and Team-based Learning

Interactivity in Science, Art, Humanities, Language
- Virtual Labs, virtual science centers
- Games, Science experiments
- Student commons, counseling

Following types of projects were identified
- Libraries of resources on linked to worlds
- Orientation centers, intercultural projects (where language is not the only way to communicate)
- Art galleries, science labs using flash,

Design of Virtual Environment
- Worlds are built based on dream experiences or reflect imaginary environments, environments are built to reflect cultural ideas
- Worlds are built to reflect historical or real locations, cultural artifacts or science concepts

(iii) CHALLENGES

Technology & Access
- Takes time to learn
- Separate Browser – sometimes difficult to install
- Firewalls often limit access
- Teachers lack time to integrate it into the classroom in a given semester
- Teachers are still learning to integrate the 2D WWW with classroom activities so 3D is even more of a challenge

Dependency on the Browser
- No one standard for multi-user 3D. A number of proprietary platforms that are not interoperable.
- Competing with highly sophisticated game technologies

Cross-Platform Compatibility
- AW and most 3D multi-user worlds are not Mac-based, except those running virtual PC (and the performance is not optimal)

Compatibility with other Tools
- Separate browser is cumbersome
- Collaboration and communication tools are hard to use unless integrated with world (separate download, installation)

Navigation

- It is hard to navigate in virtual worlds. Spatial, Semantic and social information is needed to make navigation more intuitive.
- Mapping worlds is necessary to see a "map to the territory" or get a bird's eye view.
- Metadata about world is not currently provided at a world or universe level

Development
- Users don't refer to "help files" that often
- Users respond to mentoring from expert users but volunteer mentoring is too spurious and needs an infrastructure
- Even though the medium is thought by some to be as easy as a web authoring tool, the learning curve is still high

Sustainability
- Most institutions don't plan for the human infrastructure that supports the sustainability of a collaborative virtual environment.

Community Support/Social Engineering
- Not enough support for user base
- No regularly inhabited universe "commons" with someone to contact while inworld

(vi) NEEDS

Technology
- Regular tech support is needed – from the educational community as well as the tool provider
- Cache CD for quick downloading of objects

Need for more seamless integration of:
- asynchronous communication tools
- Evaluation and Navigation tools for spatial, semantic and social information voiceover IP
- whiteboard
- Bots for automation
- Evaluation, navigation and visualization tools

Navigation Tools and Support
- Integrated Evaluation and Navigation tools are needed for spatial, semantic and social information. http://vw.indiana.edu/uservis/
- Ability to generate visualizations of use on the fly
  Integrated tools for mapping a world
- Need to have standard procedure for generating and acquiring metadata regarding world use

Development Support
- Need for a visual "help guide" rather than text-dense "help files"
- Need for an infrastructure for consistent mentoring and support
- customized templates are needed to make building easier. A simpler SDK (software development kit) and central resource library is needed.
- need standard procedure to guide design evolution
  need a library of compatible "open source" learning objects shared by community

Sustainability
- Need for multi-institutional funding

Community Support/Social Engineering
- Need for a "Community Director"
- Need for more than just volunteer or company-based support
- Need for a common "Netiquette" for virtual worlds

In addition, the analysis of the in-world interviews resulted in an overview of the history of and the participants using AWedu (see Appendix C).

Design Principles Data Base - Implications for 3D Multi-User Environments

Since the CILT Design Principles Database (http://wise.berkeley.edu/design/) is still in its infancy, the most important contribution of the Building Blocks project would be to encourage the 3D Multi-user virtual world community to add their expertise to this database rather than to set up a large list of database entries ourselves. Educators using 3D Multi-user environments represent a unique community in that they are often not designing software, but are instead customizing and designing within pre-existing software platforms such as ActiveWorlds, Blaxxun and Adobe Atmosphere. They are developing what could be considered educational applications, based on existing more generalized tools. In addition, they are already sharing ideas and approaches through and within the medium. This initial study focused specifically on community members who used the ActiveWorlds environment and resulted in two general database entries (see:Appendix E) and a brief invitation and guideline for this community to begin to gain familiarity with the database and contribute discrete, granular entries to it as it evolves.

Upon reviewing the database, it became clear that users of 3D MUVEs can initially contribute "features" (the "conceptual design of an element, an applet, an application, or even a whole environment) rather than principles (a principle general enough to connect between several software features of diverse contexts). Currently there are a number of distributed projects by users of AWedu that could contribute pragmatic grain-size feature entries on the design and development of the medium for humanities, arts and sciences. These entries might include:

- Design for interactivity
- Design for effective communication across cultures and age-groups
- Design using multiple visualizations from different sources
- Use evaluation tools to evaluate and optimize learning spaces built by both students and teachers
- Apply constructivism/constructionism, problem-based learning and multiple intelligences theory to the design process in multi-user 3D

Many of the principles in the current version of the Design Principles DataBase are drawn from Marcia Linn and Sherry Hsi's book, *Computers, Teachers, Peers: Science Learning Partners* (© 2000). Although we are submitting one principle for a 3D Multi-user environment, we believe that entries for the "principles" will become easier to synthesize and establish as a larger project is carried out to develop a "Building Blocks Toolkit" and a broader review of the existing literature on 3D MUVEs is undertaken. There are 76 distinct principles listed in the Design Principles database at: http://wise.berkeley.edu/design/viewPrincipleSummary.php. Since 3D MUVES provide a location for both real-time communications, collaborative interactivity and visualization, the following set of principles lend themselves best as links to this community's "feature" contributions.

Existing principles most relevant to Collaborative Multi-User Environments:

- Support multidisciplinary inquiry
- Use multiple, visual representations from varied media
- Promote productive interactions
- On-line discussions should include about 15 diverse participants
- Make student learning the centerpiece of design activities
- Focus discussions
- Enable teacher peer discussion
- Design for peer critique
- Design collaborations among heterogeneous groups

The "Building Blocks for Virtual Worlds" report presented online, as well as an invitation to various communities using 3D Multi-user environments will enable many users to begin the process of submission to the CILT Data Base.

Building Blocks Starter Kit

Through the wealth of information contributed by current participants of the Active Worlds Educational Universe and by experts in design and development of virtual worlds for educational purposes who were kind enough to join in open, inworld discussions, the Building Blocks team has been able to identify some of the key principles that educators will want to use in creating their own learning worlds. The community of contributors represented a broad cross section of educators, designers, researchers, and technology professionals. Review of the text and visual resources amassed in this project suggest the following overall structure for a "Starter Kit" for persons interested in setting up a world that others can use for educational purposes. This definition is kept intentionally broad because the community of current developers/users represents K-12 classroom teachers, after school and outreach educators, distance learning providers ranging from K-12 to professional development outside of the education profession, and college level educators and researchers in fields as varied as fine arts, language learning, and information sciences. Moreover, many of these educators are interested in enabling learners to implement and manage their own instances of worlds.

A "Starter Kit" can be considered as a form of User Manual with tools. It would likely be designed to integrate a combination of media, from online or CDROM movies to examples of virtual spaces and their associated print-based worksheets. In many cases, we have found that adults especially are reassured by the presence of print materials.

The following outlines some of the essential components for such a document. It is clear from this preliminary work that there is a need for such a resource and a wealth of information available. One consideration will always be the avoidance of creating materials of short-lived value. With this in mind, any such project will focus on leveraging the documentation and other resources provided through Active Worlds and other commercial providers. The Starter Kit should be considered a wrapper that provides the scaffolding necessary to master this medium from an educational perspective.

STARTER KIT COMPONENTS

Planning Your World

Purpose: An overview of the objectives of existing and proposed worlds with images and where possible links to examples. It may be possible to provide example space(s) that serves as a gallery. For example, over the past year we have heard from people building worlds that serve as virtual counterparts to real locations that are inaccessible or exist only in someone's or a shared imagination; worlds that serve as information access spaces that can be reconfigured base on their usage; more traditional classroom spaces for synchronous activities; user-built knowledge spaces for science and cross cultural education; spaces used for data visualization and for artistic expression.

Styles: An overview of the uses of space, graphics, sound, light, etc. to support the purpose and affect user mood /behavior. This would include technical features of and new community-developed tools for Active Worlds and again examples.

Design: We have seen that the design process varies dependent upon the purpose of the world and that in the case of team-based development by students this process can be a very important part of the learning experience—in some cases the primary component. It would cover/suggest design principles at the landscape, architectural, and avatar scales, with special emphasis on the creative use of movement through space and organization of information. This section can also offer tips for planning such as the use of gridded maps, drawings, logged discussions, focus groups, etc. to build consensus and plan the construction process when appropriate.

Community: It is important to plan for supporting a variety of users in a world, from developers to end users, including independent evaluators. The space and related networked content can be organized in advance to accommodate each subgroup. This section will review and reference the kinds of roles individuals might play within the community and models for structuring supporting subgroups.

Getting Started

Introduction to the environment with references to the online documentation. Options for starting out by taking advantage of AW's modular classroom generator and related tools. Basic components of learning world: the nature of the space (Cartesian coordinates, gravity versus no gravity,

chat space delineation, etc.); integrated Web content and other network and multimedia technologies; navigation including mapping options. Management: user identity and rights, etc.; monitoring tools, privacy issues, etc.; recording systems from logs to propdumps. Assessment tools:Note that these range from research methods to experimental software tools at this point. There is no standard.

Preparation for Group Use

This section might begin with a technical description of the steps taken to instantiate a world and user ids, etc. identifying suggested roles and skill sets for the individuals responsible for managing the technology. It would include pointers to common problems, FAQs, etc. online. It is also important to consider the relationship between the virtual world project and network security, etc. within the larger organization.

Initiation

There are a range of procedures that can be used to register new users, from email notification to ritual induction. It should be possible to offer reasonable predictions for the time allocation required for simply initiating new users to the system in advance of constructive activities and to provide pointers for minimizing this, such as limiting the number of avatars available.

Interactions and Ongoing Community Support

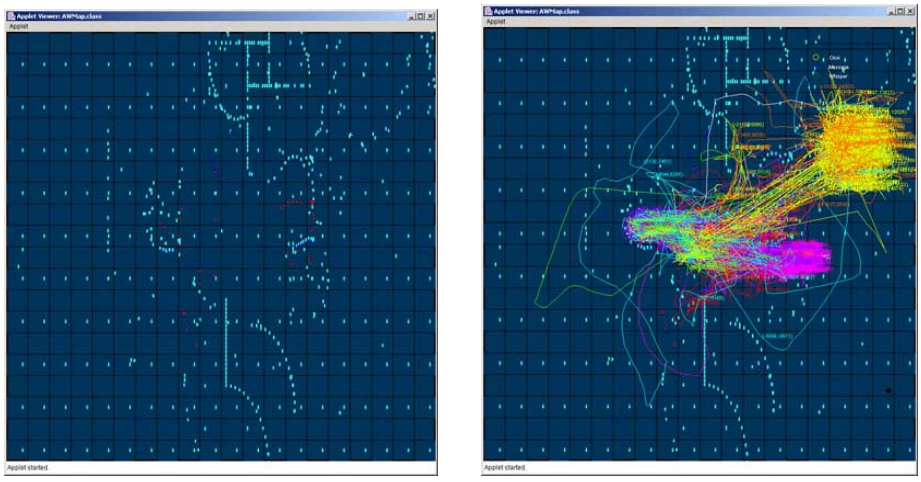
An overview of the kinds of interactions that educational users have found worthwhile and tips for implementation/support, emphasizing the importance of participating in this community and contributing to the knowledge base. Guidelines for social interaction and references to useful features for managing appropriate behavior. Models of collaborative activities with differing levels of dependence on/integration with other technologies.

Assessment

Overview of the range of assessment goals represented by the community. Examples of ways educators have chosen to evaluate their programs. Gateway to suggested methods. Information on current tools/methods within the community. Suggestions for the creative use of existing features. Emphasis on the importance of establishing collaborations among educators and researcher to advance these methods and document successful projects. Suggestions for needed additional tools and research.

Visualization of User Interaction Data

User interaction data such as locations, chat and web access activity can be visualized to evaluate the design of the world (can all resources effectively accessed?), to support social navigation (new users ‘see’ the footprints of previous users), or to study activity levels of a particular users, world or universe.



Map of VLearn World (left), User Trails in VLearn World

With the support of this project, a diverse number of user visualization tools have been partially reimplemented, documented, and made available online[2] as very first part of a **Starter Kit**. The tools comprise a *Worldmapper* that produces cartographic maps of virtual worlds. The maps provide information on interaction facilities such as linked web pages or teleports and are clickable. That is, a click into a certain area of this map teleports a user into the corresponding area of the 3D world. The *User Trail Visualization* overlays user interaction data onto these maps. The *Chat Log Visualization* provides a means to visualize the chat activity of in-world users.

These tools have been used to visualize user interaction data recorded during the VLearn3D Conference (see Appendix E). The results will be submitted to the IEEE Information Visualization Conference 2003.

RESULTS AND IMPLICATIONS

Final recommendations for the **starter kit** will be contributed to the CILT database and posted at VLearn3D.org. This information will serve as the basis for seeking support to develop a starter kit for AWEDU that will incorporate means for managing and evaluating user activities inworld in addition to a simple and flexible virtual architecture for user spaces.

LESSONS LEARNED: COLLABORATION

We used AW technology to communicate almost exclusively. Major project steps were discussed inworld as a group. Chat logs were shared after each planning and discussion session. Having synchronous chat and the possibility to visit venues turned out to be sufficient to discuss and agree upon major decisions. E-mail was used to exchange information such as drafts of questionnaires, inworld interview plans, and results.

AW provided us an easy interface for simultaneous discussion and review of world and Web content during our inworld meetings. The 3D space was used as an organizing tool for structuring interaction, for example during the October 9 Roundtable discussion when introductions proceeded around the table at which our avatars were standing. We had serendipitous opportunities to promote our effort when users noticed our presence inworld and joined us out of curiosity.

In addition, AW technology includes text chat, instant logging and telegramming for communication and we documented our collaborative sessions onto the building blocks web pages for public and via email for private planning purposes. AW served as an excellent communication tool, thus Yahoo and Egroups were not needed. The face to face meeting of Bonnie DeVarco and Katy Borner in CA in January 2003 made the collaboration even more effective.

NEXT STEPS

This project determined the scope and extent of a follow-on project that aims to implement a basic starter kit for the AWedu community and users of 3D MUVEs in general.

The Roundtable on Oct 9th focused on "Funding & Multi-Institutional Projects - Challenges & Opportunities". Participants shared their approaches to funding development of virtual worlds and the thrusts of their projects. Shared interests emerged in terms of the need for specific kinds of information from the software system. A diverse number of opportunities were discussed. Edward Fox, Virginia Tech and PI for one of the NSDL collection projects, CITIDEL (www.citidel.org) joined this roundtable and gave an overview of NSDL (http://nsdl.org/). Rick Noll, CEO of Active Worlds of also joined and expressed his interest to partner in a project that aims to improve Active Worlds technology for educational purposes. Noll described AWs plan to stage the world makers' experience by encouraging new users to start with 3D Homepages, Active Worlds new starter kit, and he expressed interest in collaborating on appropriate proposals to develop a similar product for educators.

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[2] http://vw.indiana.edu/uservis/

RELATED RESOURCES

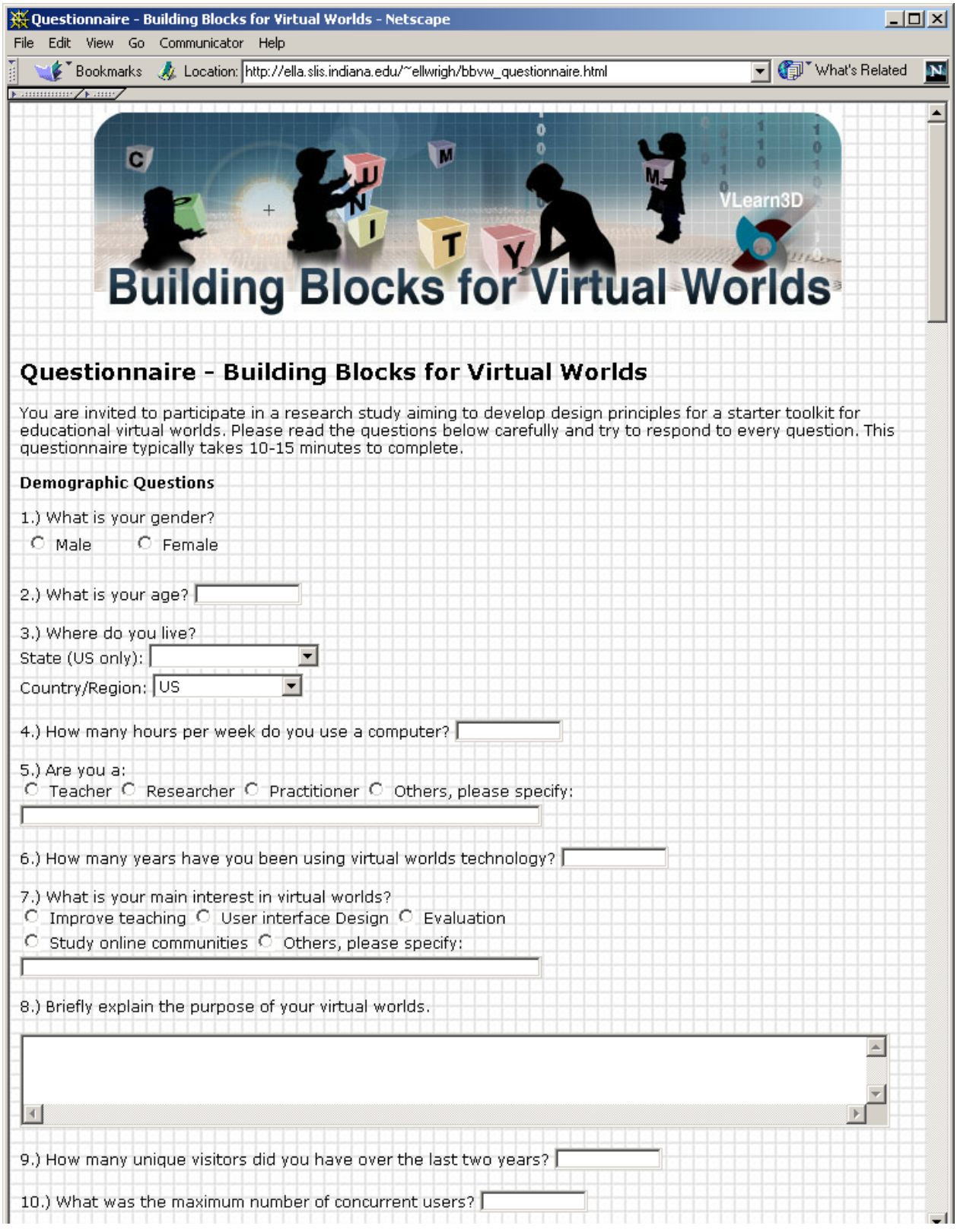
Building Blocks Project
http://vw.indiana.edu/building-blocks/

VLearn3D.org
http://www.vlearn3d.org/

Building Blocks Project - Fall Roundtable Series
http://vw.indiana.edu/building-blocks/roundtables/

VLearn3D Conference 2002
http://www.vlearn3d.org/conference2002/

Appendix A: Online Questionnaire



Questions Related to your Experience with Active Worlds (AW) Technology

1.) Please list the multi-user 3D browsers you are familiar with:

2.) What was your previous experience with computer/internet technologies prior to using AW?
☐ Basic word processing ☐ Programming languages ☐ 3D design
☐ MUDs and MOOs ☐ Other (please specify)

3.) How many years have you been using Active Worlds technology?

4.) What media are you using in the 3D space (check all that apply)
☐ Chat ☐ Text ☐ Images ☐ Audio
☐ Animation ☐ Video ☐ Others, please specify:

on the 2D web pages (check all that apply)
☐ Chat ☐ Text ☐ Images ☐ Audio
☐ Animation ☐ Video ☐ Others, please specify:

5.) What communication tools do you use in addition to chat? (check all that apply)
☐ Asynchronous forums ☐ Voice over Internet Protocol (VoIP)
☐ Others, please specify:

6) What part of your team set up the world/object set and files?
○ Teacher ○ Student ○ Professional ○ Others, please specify:

7.) What AW features are most valuable for you?

8.) What problems did you encounter using AW?

9.) What was the source of technical support for your team during the early phase of your project/s?
○ AW Help Files ○ AW Tech Support ○ Mentors (from the AW community)
○ "Building" World in AWedu ○ Others, please specify:

10.) Do you serve your world/s on your local server?
○ Yes ○ No

11.) Have you used virtual worlds in conjunction with bots or other programs?
○ Yes ○ No

Questions Related to your Experience with 3D Worlds for Educational Purposes

1.) What are your educational objectives – what kinds of learning are hoped to occur using the medium?

2.) Why do you think 3D is beneficial for learning?

3.) What were your initial expectations? How were they met or not met?

4.) In what format or environment do you use your 3D world?
○ Part of classroom activities ○ As a special class project ○ As a research project
○ As a virtual environment for distributed groups of students
○ Other, please specify:

5.) How do you promote the use of your world to your students and/or teachers?

6.) Do you create new 3D models?
○ Yes ○ No

If yes, who creates the models used in your environment? (check all that apply)
☐ Teacher ☐ Student ☐ Design professional
☐ Others, please specify:

If yes, what modeling program or language do you use?

7.) Have you shared resources/and or objects for or with others in the AWedu Universe?
○ Yes ○ No

If yes, which?

8.) Do you have a map of your world?
○ Yes ○ No

If yes, how did you create it?

9.) Have you undertaken research or written articles/papers about what you have learned using 3D in education?
○ Yes ○ No

(We will appreciate it if you send a link to those publications via email to Bonnie DeVarco <devarco@cruzio.com>).

10.) How do you evaluate the success of your world?

Questions Related to Community Building *(adopted from Amy Jo Kim http://www.naima.com/CS377B/template.html)*

1.) What is the PURPOSE of your community?

2.) What are the most commonly used GATHERING PLACES in your world?

3.) Do you have MEMBER PROFILES that evolve over time?
○ Yes ○ No

4.) How do you promote effective LEADERSHIP?

5.) Do you have a CODE OF CONDUCT?
○ Yes ○ No

6.) What CYCLIC EVENTS do you support in your world?

7.) What RANGE OF ROLES (e.g., visitor, student, teacher) does your world support?

8.) What member-created SUB-GROUPS do exist in your world?

9.) How do you Integrate the online environment with the REAL WORLD?

Questions Related to a Toolkit to be Developed to Ease AW Usage

1.) Do you regularly use or access resources online that support your work in multi-user 3D?
○ Yes ○ No

If yes, what resources do you access?

2.) Have you created resources for the larger educational community using 3D worlds?
○ Yes ○ No

If yes, are they available online (please provide location if public)?
○ Yes ○ No

Location:

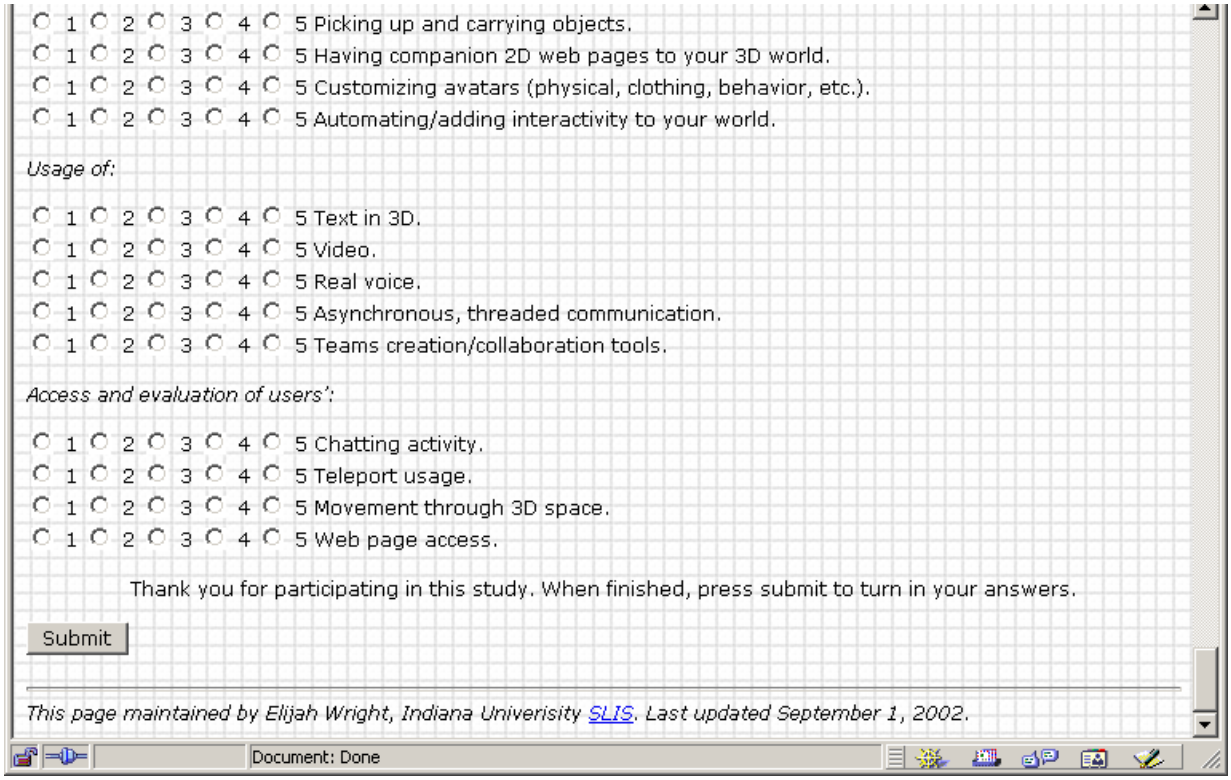
3.) Have you or any of your team participated in events, annual conferences or roundtables organized by other members of the AWedu community?
○ Yes ○ No

If yes, what activities/events?

4.) On a scale of (1="not important" to 5="very important") rate

The ability to modify your world by:

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Adding standard objects to the world.
○ 1 ○ 2 ○ 3 ○ 4 ○ 5 Designing new objects.


1 2 3 4 5 Picking up and carrying objects.
1 2 3 4 5 Having companion 2D web pages to your 3D world.
1 2 3 4 5 Customizing avatars (physical, clothing, behavior, etc.).
1 2 3 4 5 Automating/adding interactivity to your world.

Usage of:

1 2 3 4 5 Text in 3D.
1 2 3 4 5 Video.
1 2 3 4 5 Real voice.
1 2 3 4 5 Asynchronous, threaded communication.
1 2 3 4 5 Teams creation/collaboration tools.

Access and evaluation of users':

1 2 3 4 5 Chatting activity.
1 2 3 4 5 Teleport usage.
1 2 3 4 5 Movement through 3D space.
1 2 3 4 5 Web page access.

Thank you for participating in this study. When finished, press submit to turn in your answers.

Submit

This page maintained by Elijah Wright, Indiana Univerisity SLIS. Last updated September 1, 2002.

Document: Done

Appendix B: Analysis of Online Questionnaire Data

Demographic Questions

Of the 12 respondents who provided sufficient data for analysis, 2 were female and 10 male. The average age was 43, with a low of 20 and a high of 57 (2 subjects report this age). 7 were from the US, 3 from Europe, 1 from Asia and 1 from Australia.

Participants self-reported an average of 43 hours of computer use per week (minimum of 20, max of 100+). Of the twelve, 6 categorized themselves as teachers, 3 as researchers, 1 as a practitioner, 1 as an undergrad student, and 1 as an administrator. This population of users reported an average of 3.9 years of experience using virtual world technology.

Purpose reported by subjects is highly variable, but most report using 3D world technology as a learning tool or as a tool for accelerating discussion / virtual meetings.

When asked for the number of unique visitors to their world, 10 subjects responded while 2 did not. Of the 10, there were an average of 605.5 unique visitors to the world, with a low of 20 and a high of 4000 visitors. Most worlds were small, with well under 150 reported unique users. Subjects reported an average of maximum 55.5 concurrent users, with a low of 1 and a high of 500.

Questions Related to Experience with Active Worlds (AW) Technology

All 12 users reported some previous familiarity with some form of virtual world technology. Of the 12, 11 had previous experience with ActiveWorlds, 2 with Adobe Atmosphere, 2 with Blaxxun, 2 with Traveler, 1 with Rose, 1 with Oz Virtual, 1 with Linden Labs, 1 with Muse, 1 with Meet3D, and 1 with Cosmos. 6 of the 12 reported that they had previous experience with basic word processing, and 5 of the users reported facility with more complex tasks (Macromedia Director, information visualization applications, Toolbook, databases).

When specifically queried about their previous experience with ActiveWorlds technology, subjects responded that they had been using the software for an average of 3.2 years, as compared to the 3.9 years they had previously reported for “virtual world technology”.

11 subjects reported using chat in 3D.
11 subjects reported using text in 3D.
10 subjects reported using images in 3D.
8 subjects reported using audio in 3D.
5 subjects reported using animations in 3D.
3 subjects reported using video in 3D.
2 subjects reported using other media in 3D: 1 stated that his world was as yet undeveloped, while the other responded that he runs simulations via the SDK.

9 subjects reported using text in 2D.
8 subjects reported using images in 2D.
7 subjects reported that they use asynchronous forums.
5 subjects reported using animations in 2D.
4 subjects reported using chat in 2D.
1 subject reported using other media in 2D (and specified that he used Flash).

Setup-teams: 4 reported that a teacher was primarily responsible for world setup, 4 reported that students were responsible, 1 reported use of a professional, 1 reported that they had done it themselves, 1 reported use of volunteers, and 1 reported that a combination of all of these was used.

Questions Related to Experience with 3D Worlds for Educational Purposes

Valuable Features

Respondents to the questionnaire provided the following features (in free-form text) that they found valuable about the 3D virtual world space:

- The possibility of moving into spaces, interacting, building representations of historical buildings
- Having a shared virtual presence so that users are aware of each other
- Ability to build, customize, visualize the actions that other users are taking
- Support for bots, synchronous chat, links to web content and teleports
- Graphics, spatial investigation, real-time building of new content
- Ease of building and ease of use by end-users

Encountered Problems

Respondents raised the following problems that they had encountered with the medium, among others:

- Lack of accessible documentation for new users and administrators
- Difficult learning curve for users, object creators, and bot administrators
- Problems with in-world object alignment and visual interface
- User difficulty with learning to move comfortably or naturally – often attributed to interface design problems on the part of the software.
- Lack of flexibility in the connections between the in-world chat and the sense of in-world presence
- Performance problems with complicated objects, difficulties with world authoring and advanced scripting.

Early phase technical support

7 users reported that the AW help files were their primary source of information during the initial setup process. 2 responded that they had had assistance from ActiveWorlds tech support, and two reported that they had been assisted by 'mentors' from the AW community.

5 participants their world is served locally. 8 participants report that their world uses bots.

Educational Objectives

Respondents reported many educational objectives that they thought were being met by their use of the 3DVW interface:

- Use of a variety of approaches, addressed to multiple ways of learning
- Learning tied to interaction and sharing rather than specifically to the VW space
- Improving communication strategies of learners
- Learning by explaining
- Improvement in English language skills and 3D design skills
- Developing a sense of student community, visualizing complex processes
- Demonstrating difficult concepts, building awareness, empowerment, constructivist learning opportunities

Why is 3D beneficial?

Respondents submitted a variety of reasons for considering the usage of 3D technology in the classroom beneficial:

- Representing abstract concepts spatially
- Giving a sense of location and 'depth'

- Giving an opportunity for synchronous communication
- Holding the attention of adolescents better than two-dimensional computer programs or games.
- Supporting virtual teaching agents
- Developing digital media knowledge and 3D spatial awareness
- Encourages student engagement and interest
- Helps create a social sphere and can help in visualization of complexity.
- Ability for the world to respond to the manipulations and experimentation of students.

Initial expectations

Several respondents to the survey mentioned differences between their initial expectations and what actually happens in their worlds:

- Creating useful virtual worlds is harder than it appears – building is only the first step. Content packaging and insertion in the world, in suitable and educationally useful ways, is a considerable challenge.
- Expected the program to be able to handle Japanese better.
- Few initial expectations – learned where the medium is appropriate and where it doesn't work well, and went with that.
- No initial expectations – was evaluating AW as a communication tool versus other virtual worlds.
- Looking for scientific visualization online with low bandwidth costs – getting there.

Usage

1 subject reported using the VW as a part of normal classroom activities; 1 reported that it became a special class project. 4 subjects reported the use of the VW as a research project, while 4 others reported using it as a virtual environment for distributed groups of students. 1 subject reported using it both as a part of normal classroom activities and as a virtual environment for distributed groups; another reported that it was used for research, distributed groups of students, and also for outreach.

Tool Use / Content Production

6 subjects (50%) reported that they had created 3D models. 2 others reported that they had acquired 3D models from other sources, or that someone had created them for them.

Modeler Usage

Truespace: 4
3DSMax: 3
rwx: 1
Maya: 1
Text editor: 1
Poser: 1
Avatarlab: 1

1 of the 12 users reported that he had created shared resources – animation and bot configurations.

4 users reported that they had a map of their world. 7 said that they did not. 1 user did not answer.

Publications

7 of the 12 subjects say that they have written articles about their experience with AW or VW technology. 3 say that they have not, and 2 did not answer.

Success

Respondents provided the following data about how successful they thought their virtual worlds had been, and how they evaluated success:

- Success will be determined by having classes that are as good as the classes we do now but with much higher interaction among students who would not regularly have an opportunity to interact.
- The world is a wonderful idea, but we have had a really tough time getting all the schools to participate because of district policies against chatting or firewalls. With the schools that are able to use our world, the kids seem to like it a lot. A problem with the monitoring is that our monitors are unable to hear whispers or chat that is taking place too far away from them.
- It was not engaging enough to sustain an active and interested community.
- Student entrance/exit interviews, test scores in related classes, number electing to choose the elective.
- Quantitative (pre- and posttests) and qualitative assessments (interviews, chat analysis).

Questions Related to Community Building

Various purposes for AW implementations were given, including those which respondents chose to state "were not communities":

- At the moment there is not a real community.
- To deliver coursework and to allow participants who would not normally have opportunities to interact to do so.
- To give the schools and the children a place they can go to meet kids from other schools and build in a 3D environment. We have our own community so that we can keep track of membership and keep out unauthorized visitors.
- To learn Japanese.
- To teach adult IT professionals in government about information and information technology management.
- Rebuild the towns and the river that we study in our project.
- Expressive purposes – a kind of living art installation.
- Research into VW as communications tools
- To bring together disparate elements of the student population, particularly to provide mentoring for freshman programming students.

Gathering Places

Respondents reported that they had developed spaces that allowed for social navigation and the finding of other users – classroom spaces, virtual meeting halls, buildings that students had created, a virtual university campus, central teleportation points, lobbys, game rooms, "study halls", locations indicated by signage, bookmarks and teleport destinations.

Member Profiles

2 of the subjects say that their world has member profiles. 8 say no, and 2 did not answer.

Leadership promotion

Respondents report in-world leadership promotion in several ways:

- Students are expected to take an active role in the development of their learning activities – the 3D world is "passive" in this regard so far.
- Kids learn to work with one another to build the world.
- Trusted team members / volunteers are promoted into positions of authority.
- Leaders are given special "powers" and "status" when they successfully mentor younger members of the virtual community.

Code of conduct

7 of the subjects say that their world has no code of conduct. 3 say yes, and 2 did not answer.

Cyclic events

Respondents reported that they had implemented a number of cyclic events:

- Monitored chat for 2 hours/day, 4 days/week. The world is closed at all other times.
- Meetings with partners.
- Annual cyberconference, regular special events.
- Weekly roundup, best-of-quarter gallery exhibit, student poll.

Range of roles

Respondents reported that they had implemented a number of combinations of roles within their virtual worlds:

- Teachers, students and alumni.
- Students, teachers, and professionals
- Student and Teacher
- Newbies (first-time users), experienced users, pro builders, formal in-world support staff
- Freshmen, upperclassmen, professor, admin

Subgroups

Respondents reported observing subgroups that could be best described as student teams and student social circles. One respondent also classified "students" and "virtual agents" as social subgroups.

Real-world integration

Respondents submitted a variety of ways in which they saw their use of virtual worlds interacting with the "real world":

- Our students are teachers in K-12 schools and community colleges. Their activity in classes brings their real-world experiences into the online community as a point of focus.
- The kids are meeting other kids from around the state and from our main office at Michigan State University.
- Use chat logs in grammar/oral classes.
- The on-line environment is used as the forum for discussing real-world issues and challenges. It is also used as a repository for information to support real world activities.
- Web pages.
- Hard to say; in future we will equip NASA devices to communicate with rovers modeled in virtual space, otherwise the worlds tie into email and the Web.
- Meeting people face-to-face to discuss the world as a communication tool.
- We open it up and talk about it in class, weekly meetings in Computer Science House (real world group / club / dorm).

Online Resource Use

2 subjects say that they have used online resources. 9 say no, and 1 did not answer. The two subjects who responded in the affirmative say that they have accessed AWEDU resources (building/reference info), listserv information, and bot programming resources.

Only 1 of the 12 subjects says that resources they have created are available online.

4 subjects say that they have participated in online events related to AW / VW tech. 7 say no, and 1 did not answer.

Appendix C: Overview of AWedu

The AWedu Universe was opened in Fall, 1999 due to increased interest in ActiveWorlds technology by educators and an appeal for free access to a "safe environment" for students of all ages. During the course of the past four years, more than 100 formal and informal education institutions from all over the world have used the AWedu universe as a location in cyberspace for their projects.

The AWedu universe is open to all visitors at no charge – the free downloadable browser enables anybody to visit the universe. Coordinators of virtual worlds in AWedu can choose to keep their world private or make it public for anybody to enter. In order to develop one's own world in using ActiveWorlds technology, a yearly licensing fee is charged. This fee is based on the size of the world and the number of simultaneous users. During the first three years of AWedu, educational institutions acquired free worlds (in a package with 20 citizenships) through an application process. In January 2002 a new price structure was implemented for the AWedu universe and educational institutions are required to pay a regular licensing fee for worlds and citizenships. More than 100 worlds remain in use after the implementation of fees.

The following participant overview is based on a review of the educational institutions that have used AWedu between September 1999 to September 2002. This review covers institutions using the medium, instead of the number of worlds in the universe (some institutions host two or more worlds and projects). The data is approximate as it is based on participant lists compiled from the AW participant pages from this four year period and more current participant information may never have made it into these pages.

Participants
Out of 143 institutions participating in AWedu (this number does not include educational institutions using the public AW universe), 32 institutions were no longer active after the first two years and 56 institutions have joined the universe in the past two years. The following is a description and breakdown of the types and number of institutions and their locations.

Colleges, Universities & Technical Schools
Project Coordinators in from College/University include professors, librarians, university administrators, project specialists, faculty researchers and graduate students.

K-12
Project Coordinators in the K12 come from public schools, charter schools, and boards of education in the elementary, middle school and high school levels. They consist of administrators, teachers and research or project specialists.

Informal Education Institutions or Organizations
Project Coordinators from informal education include museums, nonprofit educational organizations, medical centers, government institutions, for-profit education companies and independent researcher-led projects.

Participating Countries

Country	# Institutions
United States	66
Netherlands	13
Australia	12
Italy	10
United Kingdom	10

Country	# Institutions
Hong Kong	02
Japan	02
Switzerland	01
Columbia	01
Czech Republic	01

Canada	05
Brazil	03
Norway	03
Denmark	02
Croatia	02
Germany	02

France	01
Greece	01
Malaysia	01
New Zealand	01
Poland	01
Spain	01

Appendix D: Overview of VLearn3D 2002 Conference

The VLearn3D 2002 was a five-hour conference held on Saturday, December 7, 2002. It marked the fifth annual educational conference held by vlearn3d.org. Up to 60 attendees from around the world were present at each session; topics ranged from presenting the work of the CILT database, to roundtable discussions on developing trends in educational work in the virtual worlds medium. With the goal of gathering together a community of innovative peers, in order to develop an interest in more collaborative projects - "Building Blocks for Virtual Worlds" provided a consistent theme throughout the entire day of sessions. The conference was able to examine the design, community and educational strengths of this medium, while also presenting the challenges, issues and technological considerations experienced in the pioneering years of using multi-user 3D for education. Organizer Bonnie DeVarco noted, "I hope that this is the dawn of new relationships and resources that will help reshape the educational landscapes we see on the horizon."

After general introductions were made among this virtual assembly of educators, technologists and innovators, a roll call revealed the crowd was gathered from literally all over the world, including many states in America, countries in Europe, Singapore, Australia and Israel.

Keynote speaker Yael Kali, presented her work and vision for the Center for Innovative Learning Technologies (CILT) "Design Principles Database." Joining the conference from Israel, she described CILT's goal – "to create an infrastructure for the broad community of educational designers to publish, connect and discuss design principles with peer designers, as well as use the cumulative set of principles and features, to improve new designs." During her discussion, Yael elaborated the main idea that design principles should be articulated collaboratively by designers, rather than defined individually. In the following Q & A, there was a considerable discussion on intellectual copyrights of contributions made to the database. There seemed to be a general interest among many in attendance, to make contributions from their own studies.

Following the keynote, Katy Borner from Indiana University lead a discussion describing the Building Blocks Project. After fielding several questions regarding the general funding of the project, Katy described the team's first step was to synthesize lessons learned by the VLearn3D.org educational 3D multi-user virtual worlds community and to compile a list of critical features and new user issues through surveys of the AWEDU and VLearn3D communities as well as related research groups. With brief introductions from all the contributing team members, each described their own contributions and progress being made in collecting statistics and documentation of work among the v-learn community, to help develop a custom tool kit for educators hoping to incorporate virtual worlds into their curriculum.

Next up was a demo in on new interactive avatars by Cinzia Gandini from the Clinica dei Piccoli Animali in Italy.Dr. Gandini described how through the use of new interactive avatars, simple and effective animations can be easily created on the fly – for use by both by students for a better understanding as a self learning tool or by professors during demonstrations. Several examples of this technique were presented, during which chemical reactions animations were created in real time for the audience.

Following this demonstration, Carol Kerney of the BorderLink Project, introduced her recent developments with virtual world tools in distance education. Carol described LinkWorld as a virtual world created to help bridge the great geographic distances spanned by San Diego and Imperial County School Districts. It is her hope to provide student services that might not otherwise be available to underrepresented students in these isolated areas, through the virtual world's format.

Carol demonstrated recent developments of a CollegeQuest game model. This game, Carol explained, is based on utilizing student interest in video games to challenge the students to explore a series of virtual mazes and virtual environments for clues, as well as searching through websites on a quest to plan for and strategize the college planning process. Project developers, Bonnie DeVarco and Chad Rooney described the student's role as, "Let their journey take them through resources and guidance by collecting and reviewing specific online resources and tasks for college preparation."

After a brief run through the various gaming environments in LinkWorld, the conference reconvened in VLearn World, where Katy Borner conducted a roundtable discussion on how collaborative 3D worlds can help to make online spaces more sociable, to facilitate social navigation, and community building. She also posed the question, what kind of tool kit can support virtual world design and community building? What followed was a lively and diverse free form conversation on the benefits of virtual spaces for collaborative meeting spaces. Several highlights included: the economics of virtual conferences, global access, supporting a diverse community that could not otherwise for all practical purposes ever meet face to face in the real world, and the characteristic environment in which people are noticed for what they say rather than who they are. These conversations, deliberated throughout the session, explained just how unique this virtual medium really is - exemplified of course, by the day's unique gathering of minds. In the following Q & A, a lively discussion surrounded the debate of the children's interest in video gaming and just how educators might tap into that fascination. Several participants suggested that educational multimedia currently lack the entertainment and reward incentives of their gaming counterparts.

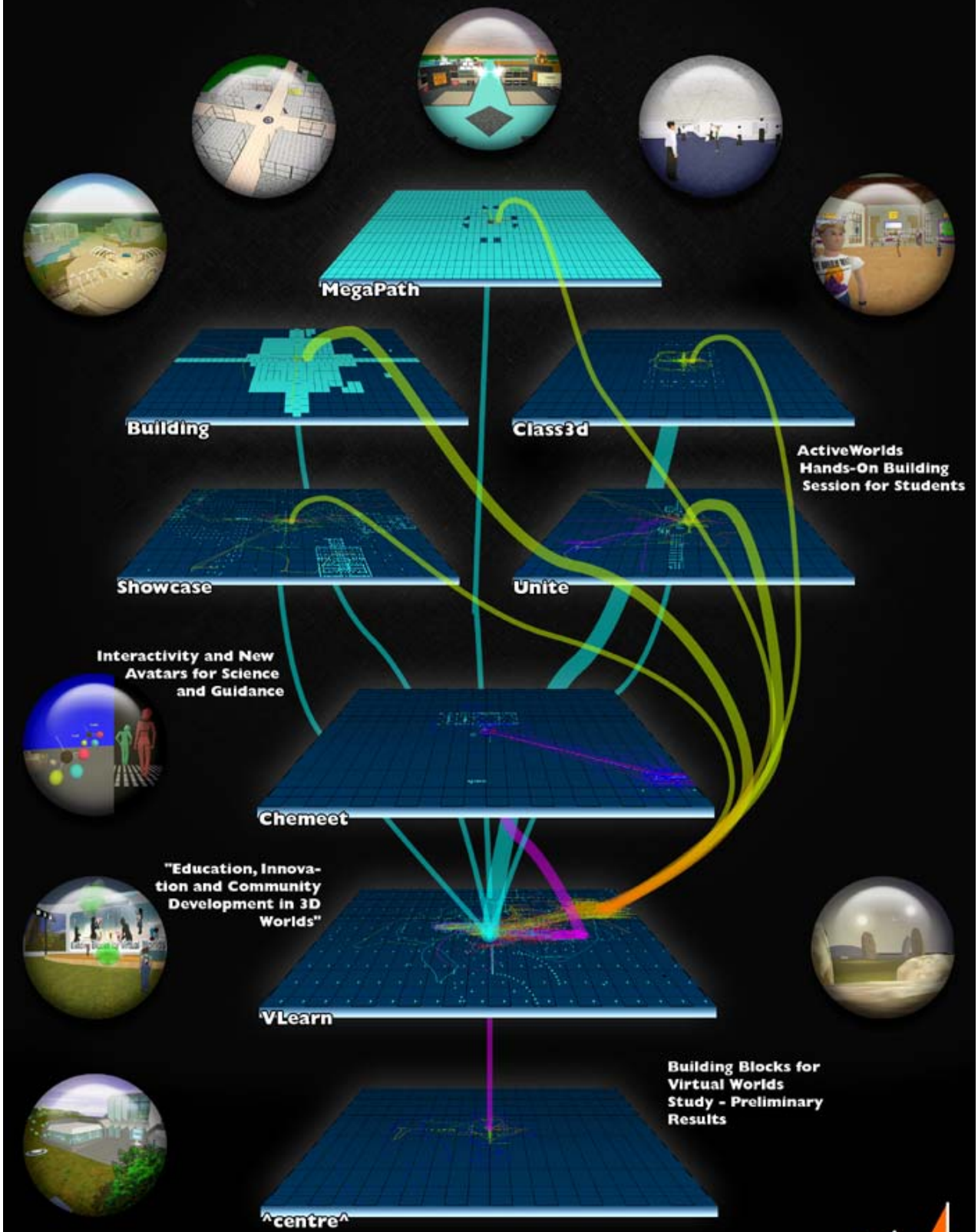
Following the roundtable, five breakout interactive sessions featured building demonstrations, a showcase of the latest bot technologies, a discussion on the collaboration of K12 using virtual worlds, and a demo of the new classroom generator in AWedu. Finally gathering together again in VLearn, all of the conference participants descended in a virtual meadow filled with megalithic stones. In what might be best described as "a unique blend of micromacro, astronano, ancient future as we take you into the stars and planets and back to the earliest civilizations...the megalithic complex," – the closing ceremony for the day concluded with an epic, effects filled, experimental event. With all of the participants swirling and jumping through virtual space, colliding and mingling their molecular avatars and minds on screen. Participants seemed especially thrilled -excitement was obvious throughout the final conversations. A memorable event for all, described as an explosion of the senses - this closing event truly accomplished the goals of the VLearn3D 2002 Conference by bringing the group together, in one space, merging of minds, with virtual bodies.

While perhaps hard to conceptualize all these proceedings and different events happening simultaneously, the following spatial/temporal information visualization recorded and designed by Katy Borner's team at Indiana University does an excellent job at visual depicting the simultaneous user interactions and paths of travel that took place throughout the conference. Imagine if you will, each separate glowing line, a crowded group of conference-goers rushing from world to world between the different speaker sessions. And then, of course, traveling back again to resume conversations with their peers present in another space. The thickness of lines represents the number of participants. Color coding was used to denote the chronological paths of the conference sessions throughout the day and ultimately reveal the final convergence of participants, together again for the closing ceremony.

VLearn 3D Conference

AWedu Education Universe 2002.12.07, Noon to 5:30pm EST

http://www.vlearn3d.org/conference2002/



Katy Börner, Richard Hazlewood, Ryan Jones, Gyeongja Jun Lee, Shashikant Penumarthy

http://vw.indiana.edu/uservis

Appendix E: CILT DB Entries

PRINCIPLE

Design for cross-cultural collaboration between globally distributed students and teachers
Author: Borner, Corbit & DeVarco 2003
Reference URL: http://vw.indiana.edu/building-blocks/report.pdf

Features Connected by Author:
Global Education Networking and Collaboration

Detailed Description:
Design synchronous collaborations between different cultural groups and different age groups using 3D Multi-user environments (desktop 3D). A global learning environment increases the appreciation of difference and expands the learning experience for both teachers and students through cross-cultural collaboration and exchange. Teachers can regularly discuss inquiry practices, design strategies, pedagogical approaches, share resources and build on each other's successes. Peer critique between students of other cultures and differing age groups increase student motivation and pride in the work they produce. Students can design their own criteria together for this as they collaborate between cultural sensibilities and language barriers. They can also help each other improve refine the work they present in virtual environments. Using persistent 3D environments created by students or teachers enable them to observe and discuss their inquiry practices with peers inside their own virtual learning environments to encourage creative adaptation of innovations.

Goals, Objective, Requirements:
Evidence: Heterogeneous groups, as long as each group is of roughly equal size, can generate more ideas than homogeneous groups. When teachers regularly discuss their inquiry practices, focusing on student reactions, they can support each other (Slotta, Chapter 9). Many successful global programs increase students' awareness of their own and their peers local environments and cultural perspectives and engender self reflection.

Limitations, Tradeoffs, Pitfalls:
Language barriers still exist in cyberspace. Time differences around the globe make synchronous sessions difficult to organize and carry out.

References:

FEATURE

Global Education Networking and Collaboration
Author: Borner, Corbit and DeVarco - 2003
Category: NA;
Subject: NA;
Kind: Element;
Grade: k12 to University
Software URL: http://www.activeworlds.com/edu/
Created by: Activeworlds.com
Reference URL: http://www.vlearn3d.org/buildingblocks, http://vw.indiana.edu/building-blocks/

All Connected Principles - 5

Connections made by author:
Principles
Design collaborations among heterogeneous groups
On-line discussions should include about 15 diverse participants
Design for peer critique
Enable teacher peer discussion
Design for cross-cultural collaboration between globally distributed students and teachers *

Features:
Academic seminar format to foster peer critique

Rationale:
3D Multi-user environments (desktop 3D) allow for collaborations to build between globally distributed groups of teachers, learners and developers. Because these environments are founded on realtime communication, networking these participants together through regular community events and collaborations between groups in the same virtual environment can speed up the development process by allowing participants to build on each other's successes, share resources and present their work to each other. Community-building approaches are needed to maintain and build this educational network.

Detailed Description:
The community of educators using AWedu has grown and shared resources Since 1999, the ActiveWorlds Education Universe (AWedu) represents a globally distributed community aggregated around an existing toolset to refine and customize it for specific educational uses. Since the platform exists as a "universe" that links numerous "worlds" together for shared access to each other's projects, educational users of many cultures and age groups have found it worthwhile to combine their efforts and projects and share the lessons they have learned. Projects such as Euroland that are carried out between countries or between age-groups such as SciCentr and SciFair have been successful in bridging students from different cultures together, peers with teachers and younger students with older students. It is also important to unify efforts throughout a whole universe to contribute to the core resources and tools these educators create and use. To do this a structure must be fostered to maintain consistent community support for shared events, mentoring activities and resource sharing through a common library and support network. Virtual Community Building guidelines and approaches such as Amy Jo Kim's "Basic Principles of Community" can be used to effectively guide this process.

Context of Use:
AWedu
VLearn3D.org

Evidence of Success: Euroland Project (see reference: Talamo, et.al) SciCentr, SciFair (see reference:Corbit, et.al), VLearn3D (see reference: Börner, et.al).

References:
Katy Börner, Margaret Corbit & Bonnie DeVarco: Building Blocks for Virtual Worlds, Final Project Report, March 2003. (http://vw.indiana.edu/building-blocks/report.pdf)

Corbit, Margaret; Building Virtual Worlds for Informal Science Learning (SciCentr and SciFair) in the Active Worlds Educational Universe (AWEDU), Presence: Teleoperators and Virtual Environments, Vol. 11, Issue 1, February 2000, MIT Press.Kim, Amy Jo "9 Timeless Design Principles for Community-Building" http://www.naima.com/CS377B/template.html

Talamo, Alessandra; Beatrice Ligorio Identity in the Cyberspace: The Social Construction of Identity Through On-line Virtual Interactions http://pluk.wau.nl/Euroland/SharedFolder/IDENTITY_handout.doc

Image: