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Introducing the R2D2 Model: Online learning for the diverse learners of this world

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The R2D2 method—read, reflect, display, and do—is a new model for designing and delivering distance education, and in particular, online learning. Such a model is especially important to address the diverse preferences of online learners of varied generations and varied Internet familiarity. Four quadrants can be utilized separately or as part of a problem-solving process: the first component primarily relates to methods to help learners acquire knowledge through online readings, virtual explorations, and listening to online lectures and podcasts. As such, it addresses verbal and auditory learners. The second component of the model focuses on reflective activities such as online blogs, reflective writing tasks, self-check examinations, and electronic portfolios. In the third quadrant, visual representations of the content are highlighted with techniques such as virtual tours, timelines, animations, and concept maps. Fourth, the model emphasizes what learners can do with the content in hands-on activities including simulations, scenarios, and real-time cases. In effect, the R2D2 model is one means to organize and make sense of the diverse array of instructional possibilities currently available in distance education. It provides new ways of learning for diverse online students, and demonstrates easy-to-apply learning activities for instructors to integrate various technologies in online learning. When thoughtfully designed, content delivered from this perspective should be more enriching for learners. The R2D2 model provides a framework for more engaging, dynamic, and responsive teaching and learning in online environments.

Introducing the R2D2 Model

Online Learning for the Diverse Learners of this World

Online learning has been increasingly popular in training and education. In 2004, about 2.7 million students in the USA took at least one course online, and 91% of

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the public learning institutions in the USA had online class offerings (Allen & Seaman, 2004). However, with a high drop out rate (Carr, 2000; Diaz, 2002; Frankola, 2001), instructors face serious challenges to attract and retain diverse learners in online courses. Learners in online environments, especially those born after the mid-1970s, want learning that is responsive to their preferred styles of learning. Thus, it is important to recognize the rich body of literature on learning styles within face-to-face instruction (e.g., Felder & Brent, 2005; Kolb, 1984; Lawrence, 1993), and to provide an extended theoretical framework as well as practical guidance to enable online teaching to address varied learning styles, cultural backgrounds, generational differences, and preferences. This article proposes an easy-to-apply, practical model—the R2D2 model—that is designed to help online instructors integrate various learning activities with appropriate technologies for effective online learning. In this way, R2D2 provides a framework for the changes required in learning and teaching that will arise as online distance education becomes more and more widespread.

Learning Styles

According to Kolb (1984), effective learning involves four phases: (a) getting involved in concrete experiences; (b) reflective listening and observations; (c) creating an idea with an abstract conceptualization; and (d) making decisions through active experimentations. Extending Kolb's experiential learning approach, Bernice McCarthy (1987) developed the 4MAT system, identifying four types of learners: innovative, analytic, common sense, and dynamic. According to McCarthy, innovate learners are primarily interested in personal meanings, whereas analytic learners are focused on acquiring facts to understand concepts and processes. In contrast, common-sense learners want to know how things work, while the fourth type of learner in her model—dynamic learners—are primarily interested in self-directed discovery.

Similarly, Fleming and Mills (1992a, 1992b) identified four types of learners and learning styles: (a) visual; (b) auditory; (c) reading/writing; and (d) kinesthetic, tactile, or exploratory, known as the VARK learning styles. According to the Fleming and Mills model, visual learners prefer diagrams, flowcharts, and graphics, yet educational technologies such as videos, films, Webcasts, or PowerPoint presentations are noticeably absent from their descriptions. In addition, auditory learners prefer hearing directions, lectures, or verbal information. Learners who prefer reading and writing learn best from text passages, words, and written explanations. Finally, tactile or kinesthetic learners learn best by connecting to reality through hands-on examples, role plays, debates, practice exercises, and simulations.

All types of learning situations and events have their benefits and opportunities. The options available in online environments can make the learning formats more explicit. At the same time, the wealth of options might overwhelm online instructors and course designers. To provide an organizing aid for the various options, we designed a model for addressing online learning styles and an associated mnemonic to enhance the memorability and use of it.

Recent research by Bonk, Kim, and Zeng (2006) indicates that there is a shift looming on the horizon to more active learning, problem-solving, authentic learning, and virtual teaming or collaboration online. Bonk et al.'s research within both higher education and corporate training environments indicates that online courses will move away from being text-centered and lecture-based while increasingly incorporating hands-on activities (Kim, Bonk, & Zeng, 2005). While hands-on learning was deemed the least addressed area today, it was predicted to be the most salient aspect of e-learning courses in the next couple of years (Bonk et al., 2006). Of course, more complex and realistic simulations, scenarios, and interactive news stories are already signaling part of this trend.

This shift may reflect not only technological advances, but also may mesh with the learning styles of younger generations that are surfacing in college classrooms and corporate training settings (Oblinger, 2003). With young, tech-savvy learners entering college classrooms, there is increasing attention on generational lifestyles; some of it focusing on how different generations of students learn, or not learn, with various emerging as well as more common technologies (Dede, 2005). With increasing numbers of Generations X and Y as well as younger learners in online courses, educators must consider how to design their courses for greater interactivity, visualization, collaboration, captivation, and technology sophistication to motivate learners and promote effective learning.

R2D2 Model

As a further extension of the above theoretical framework, we propose the R2D2 model for online learning. It is distinct from instructional design models with the same name (e.g., Jost, Mumma, & Willis, 1999) or similar names such as R2D5 (i.e., Dream, Define, Design, Develop, Deliver, Review, and Revise—Pederson, 2005). Our model does not specifically address the instructional design and development process; instead, it fosters reflection on the type of tasks, resources, and activities that one may want to embed in an online course or module so as to address different human learning strengths and preferences or skill target areas. Like 4MAT and VARK, the R2D2 model proposes an integration of four types of learning activities: (a) Reading/Listening; (b) Reflecting/Writing; (c) Displaying; and (d) Doing. While highly similar to the VARK method, the R2D2 method places more emphasis on reflective activities, while auditory activities are generally grouped with the reading and writing quadrant. As noted in Table 1, the R2D2 model suggests a variety of learning activities for active and effective online learning with various e-learning technologies for each type of learner.

Applications of the R2D2 Model

As indicated, there are four components to the R2D2 model—Reading, Reflecting, Displaying, and Doing. Below we detail each of these components as well as instructional activities that link to each area and type of learner. However, almost every

Table 1.   Learning activities and technology applications for online course using the R2D2 model

R2D2	Learning activities	Technology/resource/example
Reading, listening, and knowledge acquisition	Reading materials (online or offline) and finding information (online or offline)	Announcements, Q&A, FAQs
	Synchronous online presentation	Elluminate™, Live!™: http://www.elluminate.com/ Breeze™: http://www.macromedia.com/software/breeze/
For auditory and verbal, who prefer words, spoken or written explanations	Online discussions, group discussions, and presentations	Chat, Instant Messenger, bulletin boards/forums, Yahoo groups, listservs
	Guest expert chats with text, audio, whiteboard, application share, video, etc.	Chat, Instant Messenger, bulletin boards, Yahoo groups, listservs
	Online tutorials Webinars	pubMed tutorial: http://www.nlm.nih.gov/bsd/pubmed_tutorial/m1001.html Webinar: http://www.nten.org/webinars
	Listen to and/or watch lectures posted on the Web	Audio, streamed video, podcasts Podcast directory: http://www.podcast.net/ NPR podcast directory (Beta): http://www.npr.org/rss/podcast/podcast_directory.php Webcasts: United Nations Webcasts: http://www.un.org/webcast/index.asp UC Berkeley Webcasts: http://webcast.berkeley.edu/
	Listen to and/or watch expert explanations	Audio, streamed video, podcasts
	Online meetings in chat rooms or forums Online brainstorming or discussion with peers	Chat, Instant Messenger, bulletin board, Yahoo groups, listserv
	Online testing	Hot potato: http://web.uvic.ca/hrd/halfbaked/ Captivate: http://www.macromedia.com/software/robodemo/
	Webquest	Webquest portal: http://webquest.org/
	Online scavenger hunt	Online scavenger hunt: http://www.spa3.k12.sc.us/Scavenger.html

Table 1. (*Continued*)

R2D2	Learning activities	Technology/resource/example
Reflection	Posted interviews about occupations, internships, and field placement observations	Blogs, bulletin board, streamed video
For reflective and observational learners, who prefer to reflect, observe, view, and watch learning; they make careful judgments and view things from different perspectives	Online role play	Threaded discussion forums, interactive video conferencing via Elluminate™, Breeze™, or the like
	Online debates, pros and cons, mock trials	Bulletin board, threaded discussion forums, online chats, video conferencing
	Collaborative group paper writing	Sharepoint, Groove, Word, etc.
	Annotate electronic texts	Blogs, Word documents with footnotes, comments, annotations
	Read, react to, and reflect upon documents in another language	Blogs, online newsletters
	Write reflection papers: team reflection papers, trends in field, chat with expert reflections, group or class blogging, summary papers, etc.	Online discussion forums, blogs, bulletin boards
	Provide feedback on papers	MS Word "track changes" and "comment"
	Conferences with live video feeds	Internet Time Group: http://www.internettime.com/visual/gallery6.htm
	Watch or observe expert performances online (music, Cyber fashion show, etc.)	Streamed video, video conferencing
	Online modeling with archived exemplary performance data	Streamed video Learning management systems (e.g., Moodle, WebCT, Blackboard, Desire2Learn, ANGEL, etc.)
	Electronic portfolios with reflections	E-portfolios, blogs, personal homepage or Web site, CD, DVD
Displaying	Search video library of concepts, cases, or experts	Video files, CD, DVD

Table 1.   (*Continued*)

R2D2	Learning activities	Technology/resource/example
For visual learners, who prefer diagrams, flowcharts, timelines, pictures, films, and demonstrations	Learners generating graphic representation of knowledge structure	Concept mapping (e.g., Inspiration, Kidspiration) and other visualization software Visual Understanding Environment (VUE): http://vue.tccs.tufts.edu/ IHMC concept mapping tool: http://cmap.ihmc.us/
	Learners create task timelines	Timeline tool: http://www.readwritethink.org/materials/timeline/ http://www.learningtools.arts.ubc.ca/timeline.htm http://www.teach-nology.com/web_tools/materials/timelines/
	Interactive visual with online chat	http://www.learningbydoing.net/
	Peer evaluation and critics on learner-generated graphic representations	Bulletin board, blogs
	Use draw tools in asynchronous chats	Instant Messenger with whiteboard
	Flash visuals and animations	Statistics, cash flow, visualization software to track weather patterns, etc.
	Taking virtual tours, and post team project in a gallery or virtual tour	Virtual tours http://astro.uchicago.edu/cara/vtour/ http://www.michielb.nl/sun/ http://www.md.huji.ac.il/vjt/
	Adventure blogging	ExplorersWeb: http://www.explorersweb.com/ The Poles: http://www.thepoles.com/
	Online demonstrations	Video-streamed lectures
Doing For tactile/kinesthetic learners, who prefer learning by active doing, experiencing, hands-on, and often also group work	Interactive, project-based learning with dynamic online databases	The Global Grocery Project: http://www.landmark-project.com/ggl/ The Globe Program: http://www.globe.gov/globe_flash.html
	Case simulations and manipulations	Business, special education, medical science, chemistry, etc.

Table 1.   (*Continued*)

R2D2	Learning activities	Technology/resource/example
	Case-based learning	MedCases CME Portal: http://www.medcases.com/Physician/cme_portal.asp SimTeacher: http://www.simteacher.com/
	Online simulations and lab resources	Simulated businesses, hospitals, schools, farms, planets, etc.
	Posting oral histories	Blogs, bulletin boards
	PBL	Final products in online gallery or Web site
	Online survey research	http://www.surveyshare.com and http://info.zoomerang.com
	Use iPod to create radio station	iPod, podcast
	Digital movie-making based on reflective writings	Digital video-recording hardware and software
	Create an online gallery to demonstrate current, past, and future students' learning outcomes and achievements	http://www.indiana.edu/~tickit/projectgallery/gallery.htm
	Online personal performances	Theater, music, and surgery Webcasts, podcasts, etc.

activity discussed below will address more than one component. Our classifications are meant to indicate which aspect is primarily being addressed. If instructional designers involved in distance learning initiatives as well as online instructors take these four types of learning and learning activities into account when designing and delivering online and other forms of distance learning courses, they should experience higher success rates with diverse students.

Reading, Listening, and Knowledge Acquisition for Verbal or Auditory Learners

Reading, exploring resources, and listening to online lectures is the first part of the R2D2 model. Given that one must typically acquire knowledge prior to knowledge use, this first quadrant of the model essentially focuses on knowledge acquisition.

In distance learning, there are various ways that knowledge can be acquired—through video-streamed lectures and podcasts, synchronous presentations, online discussions, guest expert chats, and online and paper-based readings and explorations. Learners in this quadrant might also prefer online tutorials, audiotapes or audio files, group discussions, speaking or presenting, and generally talking things through and negotiating meaning. With synchronous presentations and video-streamed presentations from the instructor or guest expert, the learner has multiple ways to internalize the information including both visual and verbal representations.

Podcasting, which typically involves only an audio-channel, is rapidly growing in use in both higher education and corporate training. Online knowledge acquisition may also happen in virtual classrooms or Web conferences, with application sharing, Web touring, surveys and polls, online presentations, and chats. As the formats of online presentation tools proliferate, it is vital to conduct research in this area. Podcasting, for instance, has many open research questions related to learner satisfaction, use, access, and overall learning.

In terms of reading, an online scavenger hunt and Webquest are common types of such activities. A learner might be assigned online reading materials or required to find articles that relate to the activities for a particular week. Content explorations might be guided where students read from a selection of articles prescreened by the instructor. Such guided discovery activities also might be more open-ended, where students select articles based on their interests related to the course. The latter approach is perhaps more suited to self-directed or self-motivated learners and online learning veterans; often these are older and more mature adults. In contrast, pre-assigned readings might be employed when students need more guidance or who are new to e-learning. Verbal learners will also appreciate frequently asked questions (FAQs), course announcements, and the archiving or posting of email internally within the system.

Such learners may also prefer online chats, especially with voice channels open. Chat tools can also be used for online quizzing of select students to test their understanding of course content, using dynamic assessment that changes with their answers. Finally, foreign language courses might have students read online newsletters, newspapers, magazines, and other foreign correspondence and then test them or have them use it in a particular way.

There are a variety of ways to help online learners read, listen, explore, and otherwise acquire knowledge. Instructor guidelines on how to use these tools and where to focus one's efforts are central to the smooth running of the course and student retention within it. In effect, the first quadrant of the R2D2 model lays out a range of learning activities to help with active knowledge acquisition and collaborative knowledge construction with widely available learning technologies.

Opportunities for Reflective or Observational Learners

The second part of the R2D2 model has students reflect on what they have learned; essentially, it addresses reflective or observational learners who prefer observing, viewing, watching, and reflecting upon learning situations and activities. Such a learning style relates to those who listen to others and learn from models or examples of what is expected. Naturally, as a key part of this reflection, this quadrant also emphasizes writing tasks and activities.

Distance learning may offer these types of learners engaging opportunities not available in face-to-face classes. With asynchronous discussion forums, for instance, they can think carefully and thoughtfully before responding to others or posting a new message. Such delayed response opportunities are especially important for

in-depth discussions and to critically synthesize thoughts across topics. Instructors may also ask students to create online resource libraries (ORLs) of additional articles that they have read.

While reading electronic articles and exploring associated resources is vital to learning, collaborative and reflective writing online has become an increasing part of the curriculum. For instance, in addition to everyday email responding, bulletin board commentaries on current news and posted articles, threaded online discussions in college courses, and engaging in multiple online chats with colleagues and friends around the world, millions of learners are now reflecting on their learning in their personal or course-related blogs. There are many instructional uses of blogs, such as individual blogs for reflections, team blogs for joint assignments, instructor blogs for a class, and class blogs for cross-cultural exchanges (Martindale & Wiley, 2005). In our own classes, we typically assign students a "critical friend" in the class who gives them weekly feedback and hopefully some encouragement on their blog-related postings. Also, at the end of the semester, we require a reflection paper on their overall blogging experiences and associated learning.

In addition, students might engage in mock trials, pro-and-con debates, and role plays within online discussion forums or conferences.[1] These controversies will foster critical reflections as well as collaborative knowledge sharing and construction. And, of course, reflection papers, summary writing, and collaborative group papers are also ideal for reflective learners. Once completed, learners will further benefit from written comments and annotations from peers, team-mates, and experts. As we have found, the "track changes" and "insert comment" features in Microsoft Word™ are handy.

There are a variety of other highly reflective activities which can be fostered on the Internet. For instance, in an internship or field placement in professional schools, such as accounting, law, education, or nursing, students may interview practitioners about their jobs so that they can reflect on the demands of a particular occupation. They may also reflect on how certain concepts, principles, or ideas from their book(s) or online lectures are referred to, encountered, or handled in the real world (Bonk, Hara, Dennen, Malikowski, & Supplee, 2000). During such live placements, reflective learners might notice particular nuances related to how a concept is implemented as well as alternatives and competing ideas to that which they have learned in class. As a result, they might discern where book knowledge is not directly applied in the real world as well as how their knowledge must continually be modified and updated to fit the actual circumstance or situation. If an internship is not possible, online instructors might embed videos of real-world situations and scenarios for learners to reflect on. Of course, while such a technique is useful for visual learners, it also has extensive applications for reflective learners depending on the task selected and overall pedagogical use.

Another way of placing reflective learners into professional situations, again with links to visual learning as well, is to have them attend video-streamed conferences, seminars, or live performances, such as online music recitals, theater performances, heart surgeries, and fashion shows (e.g., Carlson, 2004; Olsen, 2003; Young, 2003).

As Albert Bandura's (1986, 1997) social cognitive model of learning highlights, observation and reflection are highly powerful components of human learning. Fortunately, with the emergence of personal learning tools such as blogs, personal homepages, student profiles, and electronic portfolios, opportunities for students' reflections on their performances continue to mount. Using such tools as e-portfolios, learner reflections can be accumulated and shared (Young, 2002). Of course, when online learners transition from observational learning to conducting their own online performances, they tend to operate in the fourth quadrant of the R2D2 model, as described below.

Similarly, online learners might reflect on a podcast or Webinar offered via a virtual classroom using tools like Breeze™, WebEx™, Placeware™, or Elluminate™ (Erlanger, 2005). Instructors might, for instance, conduct a demonstration of a physics or chemistry experiment online that can be reused and synchronized with student notes. These activities apprentice students into their chosen profession by allowing them to lurk on the outside or periphery of a discipline, in effect, as legitimate peripheral participants (Lave & Wenger, 1991). If current trends continue, such synchronous e-learning tools and applications will offer increasingly interactive activities for apprenticing online learners and fostering learner engagement (Bonk et al., 2006; Shi & Morrow, 2006).

With trends toward more active and self-directed learning, there has been a parallel emphasis on student reflection so that they internalize and expand upon their learning pursuits. For instance, online instructors might utilize self-tests, self-reflections, "Did you know?" prompts, and other self-assessment activities to get learners to pause and reflect on the content that they are learning. Such tasks are especially common in courses with extensive learner–content interactions or minimal feedback from instructors, peers, and outside experts. Along these same lines, sample answers or archived student work examples give reflective learners something to observe as a standard or model of exemplary performance. Online modeling might be especially useful in physical education and outdoor recreation courses as well as in counseling, teacher training, and any form of emergency preparedness training.

As e-learning tools are designed for self-testing, reviewing one's performance, and observing the performance of others, there are increasing opportunities for those who prefer activities in the second quadrant of the R2D2 model. As clearly indicated by the R2D2 model, emerging and existing technologies provide new opportunities to address the varied learning styles and preferences in online courses, and, at the same time, these differences require more responsive online pedagogies. What seems needed now is research in this area to explore the impacts of reflection on student learning and course satisfaction.

Displaying Learning for Visual Learners

The third part of the R2D2 model forces students to represent what they have learned or are in the process of learning through visual representations, depictions, or overviews. Learning in this quadrant of distance education focuses on providing pictures, diagrams, charts, graphs, videos, animations, and written overviews or

summaries, and, therefore, relates most closely with visual learners. It can also involve the manipulation of mathematical and scientific symbols as in algebra, chemistry, and physics. There is notable overlap here with the reflection category, since activities in both quadrants can entail showing learners a macro representation of a concept, principle, or idea and then having them reflect on its use.

Once again, there are myriad strategies that can be called upon in distance learning environments to address visual learners or others who have moved to this stage of the R2D2 learning process. For instance, an online instructor might use an interactive whiteboard in synchronous communications with students using arrows and different colors, notations, and highlights. The instructor might also have students explore or search through an online library of video clips which display concepts, procedures, and skills as in the real world. In particular, video cases are often used in professional schools such as business, medicine, law, and education to display key concepts in action.

Another way to address this form of learning is through a series of visuals for exploration or navigation. For instance, the Internet is becoming increasingly used for virtual tours. An archeology professor might take students on a virtual tour of a Mayan ruin, an economics professor might design a virtual tour of oil wells and the underlying supply potential around the world, and a tourism instructor might show students how to highlight different points of interest in a country, community, or geographic region. Such virtual tours might provide quick overviews that anchor students' learning in a visual that can be discussed or replayed later to pull out key concepts (Cognition and Technology Group at Vanderbilt, 1990).

There are still more techniques to enhance student visual learning, such as adventure blogs and animations. Adventure blogs may provide current and interactive news stories, blogs of explorers in their travels, and videos of explorer treks or scientific experiments. Such tools take students directly to the content instead of reading about it in books or online articles. In effect, students can see it in action. While less current, online animations are also increasingly used to bring learners more directly into a discipline. An animation can be played to illustrate a concept more clearly, paused to give the learner time to reflect on it, and replayed when the learner has specific questions. As with the use of video cases and virtual tours, both adventure blogs and animations situate student learning in a real context (Brown, Collins, & Duguid, 1989; Collins, 1990; Collins, Brown, & Newman, 1990) and engage such students in authentic learning environments (Herrington & Oliver, 1997; Herrington, Oliver, & Reeves, 2003; Reeves, Herrington, & Oliver, 2002).

The visual displays that are now available online can draw students into the learning environment and help them connect concepts that they have read about (Quadrant 1 of R2D2) and reflected upon (Quadrant 2 of R2D2), and begin to internalize them through visual conceptualizations. Even more important is having students form their own visual depictions and representations of the content, since students are more likely to remember information when they actively construct their own knowledge (Cognition and Technology Group at Vanderbilt, 1991). For instance, students might create a concept map summarizing key points of a paper,

chapter, module, or lesson. Students might also represent their learning in a comparison and contrast matrix, Venn diagram, flowchart, or virtual tour. There are also a number of timeline tools available to help students represent their learning. With all these visual formats, one of the key goals is to foster student critical thinking and evaluation of their learning.

The Internet is a highly visual tool which provides learners and instructors with access to current events in ways that previously were not possible. While there are many such visualization technologies available and new ones are constantly emerging, additional tools and toolkits for visual representation are needed to guide learners to become more self-directed in their online learning pursuits. At the same time, more empirical research is needed to investigate emerging pedagogies in online learning using visualization technologies, as the R2D2 model suggests.

Hands-on Learning for Kinesthetic Learners

The fourth quadrant of the R2D2 model involves having learners applying what they have learned, reflected on, and visualized in practice exercises or in the real world. Such learning links well with kinesthetic learners, who need to try out, experience, imitate, and practice concepts and ideas in order to learn them more deeply. Fortunately, the Internet is increasingly offering hands-on experiences or activities for online learners, especially in the science areas.

One obvious way to apply learning is through the use of cases, scenarios, and simulations. These learning methods situate learners in rich contexts or authentic problems where they can test their knowledge or solutions against that of their instructor, their peers, or an expert. Cases now exist on the Web in almost any field of study from anthropology to zoology. In the medical field, for example, cases allow one to obtain case information, order lab tests, make diagnoses, and compare one's solution to an expert's (see http://www.medcases.com/Physician/cme_portal.asp). Similarly, in teacher education, pre-service teachers might interview for jobs in a simulated school, talk to school counselors, teachers, librarians, and principals about particular students or situations, and make decisions about problem cases (see http://www.simteacher.com/). In these online experiences, the goal is to engage learners in the content by allowing them to physically manipulate contents or variables and observe the results of those manipulations.

There are varying degrees of authenticity in online cases. For instance, in the real-time case approach (Theroux, Carpenter, & Kilbane, 2004), a full-time case writer is located in an existing company thereby enabling students to experience and discuss real events as they unfold. Online learners might not simply manipulate existing data, they might also collect and analyze it. Students and instructors may use any available technology including online chats, teleconferencing, threaded discussion forums, and video conferencing.

Another idea for placing students in the real world is to have them conduct market research and interesting educational research using online polls and surveys. Real-world research enables learners to not only explore concepts in real-world settings, but

also potentially discover and share new knowledge. Authentic activities in fully online and blended environments also offer opportunities for sustained inquiry, the examination of a task from multiple perspectives, interdisciplinary learning, and the creation of more polished and meaningful final products (Oliver, Herrington, & Reeves, 2006).

Of course, there are many other ways for learners to collect real-world information with educational technologies. For example, students might interview famous people or those who lived through different historical events (e.g., World War II, the Vietnam War, etc.) and post those oral histories in an online podcast or digital movie. In expanding on the idea of oral histories, tools such as the VideoPaper Builder™ (see http://vpb.concord.org/?version=print) enable students to juxtapose a digital movie against a paper they have written. Using such a tool, a student might back up key points in a paper with video snippets of key events. Or, in teacher training, pre-service teachers might reflect on how their performances (as seen in Webcasts and other video tools) compare to state or national standards. Another interesting tool to enable students to take charge of their own learning is the use of an iPod for podcasting their own radio stations and shows. And with the emergence of video-capable iPods, there are numerous other applications where students become designers of knowledge.

At the end of an online course, students might also produce final class products which are made available for an audience beyond the instructor. For example, student final projects might be posted to the Web in an online gallery for expert, teacher, or peer evaluation and feedback (Oliver & McLoughlin, 1999; Oliver, Omari, & Herrington, 1998). The first author of this article used this method in training rural teachers how to integrate technology into their curriculum (see http://www.indiana.edu/~tickit/projectgallery/gallery.htm).

In effect, the fourth quadrant of the model expects students to apply their new knowledge and further extend learning by doing something such as making case decisions, conducting scientific experiments, and collecting and analyzing real-world data. For example, Ou and Zhang (in press) introduced various ways of integrating databases in teaching, including using live, dynamic, real-world databases from the Internet for students to experience firsthand scientific discoveries in different subject areas, or through interdisciplinary inquiries. Similar learning activities can be conducted in online environments as well. In courses where instructors might give up more control over the curriculum, learners might also take ideas from a course or module and create unique products or ideas. In either case—using existing resources or creating new ones—the learner is trying out ideas and concepts, instead of simply listening about them, reflecting on them, or seeing visual depictions of them as in the first three quadrants of the R2D2 model.

Discussion

Tools, resources, and activities for distance education are proliferating at a time of increasing demand for online education (Bonk, 2004). There are extensive opportunities to address learners with different styles of learning or learning preferences, including those who prefer words or text, reflective activities, visual

representations, or hands-on activities. The R2D2 model enables instructors to consider learners and learning activities in each quadrant, potentially providing a more engaging and enriching environment for online learning. In addition, this model offers a learning and problem-solving process that moves from the acquisition of content to the reflection and visualization of it, and finally, to its actual use. As an instructional design model, it provides both a macro lens on processes that an instructor or instructional designer should consider in designing an online class, as well as a window into specific ideas that might work in successfully delivering it. In effect, it is an organizing aid for the distance educator. And, perhaps more importantly, the Read, Reflect, Display, and Do (i.e., R2D2) model is easy to remember and versatile to apply! With the increasing availability of learning technologies and virtually limitless pedagogical potential of such technologies, the R2D2 model lays out exciting opportunities to better address the needs for more versatile teaching and learning in online environments.

Naturally, there are many open issues and questions that still need to be sorted out with this model as well as various limitations. Among the most pressing issues and questions is whether self-reported assessments of learning styles at the start of a class will help instructors better deliver their online courses. In addition, are there more extensive learning gains and greater knowledge transfer in courses that use the R2D2 method over those that do not? In terms of limitations, it is obvious that many ideas cut across multiple quadrants of the model. At the same time, that also adds to the power of this model since some learning activities address more than one type of learner; and the model offers a means to make sense of the complexities and opportunities within online teaching and learning. The applications of the R2D2 model in designing and delivering online courses may take technology integration to a new level in distance education, and, more importantly, they may lead to positive changes in online pedagogical practices, learner experiences and overall sense of satisfaction, and course and program success ratios. May the force be with all of those who attempt to take the R2D2 model on such research and development journeys in the coming years as well as those who embed this model in their own online teaching and learning practices!

Note

1. We realize that these activities could easily be positioned in the fourth quadrant of the R2D2 model but place them here since they involve writing while most of the other tasks in the fourth quadrant do not.

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