FROM PHYSICAL BENCHMARKS TO MENTAL BENCHMARKS: A Four Dimensions Dynamic Model to Assure the Quality of Instructional Activities in Electronic and Virtual Learning Environments

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ABSTRACT

The objective of this paper was to develop a four dimensions dynamic model for designing instructional activities appropriate to electronic and virtual learning environments. The suggested model is guided by learning principles of cognitivism, constructivism, and connectivism learning theories in order to help online learners to build and acquire meaningful knowledge and experiences. The proposed model consists of four dynamic dimensions:

- **Cognitive presence activities;**
- **Psychological presence activities;**
- **Social presence activities; and**
- **Mental presence activities.**

Cognitive presence activities refer to learner's ability to emerge a cognitive vision regarding the content of learning. The cognitive vision will be the starting point to construct meaningful understanding. Psychological presence activities refer to the learner's ability to construct self awareness and trustworthiness. It will work as psychological schema to decrease the load of learning at distance. Social presence activities refer to the learner's ability to share knowledge with others in a way to construct a community of practice and assure global understanding of learning. Finally, mental presence activities refer to learner's ability to construct mental models that represent knowledge creation. It will help learners to make learning outcomes and experiences transferable. Applying the proposed model will improve the process of developing e-based activities throughout a set of adaptive and dynamic frameworks and guidelines to meet online learner's cognitive, psychological, social and mental presence.

Keywords: e-Learning, Virtual learning, Instructional activities, Quality assurance, E-based activities

INTRODUCTION

Educational practices through the ages have been shaped by the dominant forms of communication, and the transitions from one age to the next age have caused great anxiety among educators of the time (Thornburg, 1996). While communication was an important skill in the industrial age, it has become the most important skill during the current age – the digital age.

Web-based learning began with a poor initial pedagogical model of e-learning, based on a behaviorist and page-turning approach to learning. The reality is that Web-based learning is becoming integrated into portals and work flows, even though it is not necessarily labeled as e-learning.

The lines are increasingly blurred between learning and working, and many aspects of learning that occur online are not being measured as such (Driscoll, 2008).Today's students live in a global-knowledge-based age. They deserve teachers whose practices embrace the best that technology can bring to learning (International Society for Technology in Education (ISTE), 2002).

The Internet and the Web are the driving force of the future of the educational delivery, in which the learners are allowed to choose and change not only the location and people, but also the time that learning takes place. The instructional environments became non-linear and concurrent than ever before.

Therefore, it is questionable whether new instructional activities will support the non-linear and concurrent features of Web-based instruction and learning to educate our students to be life-long learners and successful contributors to other students learning. Such holonomic view will make student not only responsible for his own learning but also other students' learning as well. With face-to-face teaching the educator receives continuous feedback from the students. Several non-explicit messages tell him if the speed of presentation is correct, and send other information which make possible to evaluate in real time the level of understanding, and tune properly the delivery (Corso, Forno, Morrone, & Signorile, 2006).

This is not possible for e-courses. They are prepared without an audience – or audience at delivery is different from the audience at preparation. Therefore, they must be designed very carefully and with specific methodology (Corso, Forno, Morrone, & Signorile, 2006).

The holonomic concept is shifting Web-based learning environment from ordinary one into an adaptive and effective learning environment. According to NRC, effective learning environments are consisted of four basic components:

- **knowledge-centered wherein the emphasis is on understanding rather than remembering;**
- **learner-centered, wherein individual learners' personal and cultural backgrounds and learning styles are valued;**
- **community-centered, wherein learning activities are collaborative and foster a community of practice that involves legitimate peripheral participation; and**
- **assessment-centered, wherein formative assessment is used to make students' thinking visible to them and evaluation is performance-oriented (Rhodes, 2011, p. 2).**

The author may add one more components to the previous ones. This component is that effective learning environment is activity-guided in which learning and instructional activities are the capital of any e-course delivery. In this regard, Heide & Henderson (2001) reported that there are a number of important reasons for adaptive models of instructional activities:

- **our students live in a world of technology,**
- **new technologies can enrich and expand learning, increase the productivity of teachers and students, and enhance their lives beyond the classroom,**
- **research continually provides us with new information on how we learn and how technology can be of assistance in the teaching/learning process,**
- **there is an ever-widening diversity of student needs in every classroom and these students have different learning preferences, and**
- **the workplace demands a new repertoire of skills and competencies.**

Many of current e-learning models could be characterized as e_3 –learning (e sub-three learning) (Merrill, 2008, p. 397):

- ***Enervative*, which, rather than promoting skill acquisition, actually interferes with the learning that should occur.**
- ***Endless*, which leads to boredom by being too passive, devoid of interaction, allowing learners to disengage, thereby failing to gain the desired skill acquisition.**
- ***Empty*, which fails to implement those instructional strategies that have been found to be necessary for learning to occur and may be, at its worst, information alone-transferred to the Internet without appropriate demonstration, practice, feedback, learner guidance, or coaching.**

Thus, this paper attempted to design a new model for designing e-based instructional activities based on the non-linear and interactive features of the digital learning and instruction through the Web and the Internet. The premise of this new model was based on the belief that adaptive learning environments are important medium in teaching and learning process and need to be integrated into Web-based instruction more than ever before (Abdelaziz, 2012).

Adaptive learning environments introduce another source of knowledge, skills and values. The introduction of an adaptive and interactive activities of learning means that instructors may spend less time presenting knowledge to groups of students and more time facilitating small groups work and guiding students to appropriate resources of curriculum. This shift will more likely involve a change in all instructional practices and delivery of Web-based education. This shift will also keep our learning with the Internet and the Web more molecularized and holonomic than ever before. Nowadays, students are learning in a technology-rich environment that is collaborative and knowledge building. Thus, technology-rich environment requires a special type of holonomic and adaptive instructional activities. The main features and components that can be used to visualize, direct, and manage the process of Web-based learning according to this new model are presented in thin paper.

THEORETICAL AND PEDAGOGICAL BACKGROUND OF THE PROPOSED MODEL

Assuring The Quality Of E-Based Activities

What shall we do when information is doubling every 73 days or less? One rational answer is to train students to learn how to learn and contribute to other students' learning in an ever-changing society.

In order to develop such training/learning activities, we need to adopt a student-centered curriculum and materials where students can become adept to new information in the light of their own needs based on their academic and culture background (Gillani, 2003, p.4.)

Many of educational literatures and studies pointed out several characteristics to assure the quality of Web-based instructional activities. One of these studies is Merrill's study (2008). Merrill pointed out three characteristic of e-learning activities.

E-learning activities according to Merrill's model should be: effective, efficient, and engaging (e^3 learning – e to the third power learning activities) (p. 398).

The National Research Council (NRC) has also reported that there are five ways that e-learning activities can be used to help meet the challenges of establishing effective learning environments (NRC, 2001, p. 243):

- **Bringing real-world problems into classroom through the use of videos, demonstrations, simulations, and Internet connections to concrete data and working scientists.**
- **Providing "scaffolding" support to augment what learners can do and explain about on their path to understanding. Scaffolding allows learners to participate in complex cognitive performances, such as scientific visualization and model-based learning, which is more difficult or impossible without technical support.**
- **Increasing opportunities for learners to receive feedback from software tutors, teachers, and peers; to engage in reflection on their own learning processes; and to receive guidance toward progressive revisions that improve their learning and reasoning.**
- **Building local and global communities of teachers, administrators, students, parents, and other interested learners or groups.**
- **Expanding opportunities for educators' learning.**

In this regard, Horton (2008) reported that Web-based learning activities are providing creative solutions to qualify and quantify learning through the following strategies (Horton, 2008):

- ***Increasing knowledge*** **by making it more accessible to people.**
- ***Capturing knowledge*** **by making it easier for people to record what they know.**
- ***Refining knowledge*** **so it is expressed in a way that's useful to others.**
- ***Sharing knowledge*****, which involves making knowledge accessible, keeping knowledge chunks small and easy to find and quick to use and reusing knowledge.**
- ***Applying knowledge*****-that is, acting on the messages in the content.**

The effective teaching of Web-based courses requires knowledge of both the activity structures/types that are appropriate for teaching specific content and the manners in which particular technologies can be utilized as part of the lesson, project, or unit design (Harris, Mishra, & Koehler, 2009, p. 406). Table: 1 matches the levels of e-learning activities with enabling communication technologies (Jonassen, Peck, & Wilson, 1999, p. 123).

Table: 1
Learning Activities Facilitated by Different Levels of Computer Networking Technologies

Communication level	Description	Enabling Technologies	Learning Activities
One-alone	Individual can access information resources stored on the World Wide Web. These resources can also be used by groups.	On-line databases and journals Software libraries Tutorials and job aids Other Web resources	Independent Inquiry Research and writing Browsing
One-to-one	Individuals can communicate to other individuals using e-mail, and can arrange for individual learning experiences such as internship or independent studies.	E-mail Chatting technologies using text, audio, and/or video	Apprenticeships and internships E-mail posts, private consultations One-on-one chats
One-to- many	Individuals can broadcast information to entire groups, information can also be published at Web sites to allow others access.	Distribution lists Web Pages as a source of text and multimedia displays Web pages as links to outside resources.	Lectures and symposiums Publishing results of research and inquiry activities Convenient access and dissemination of resources
Many-to-many	Groups of people can engage in open communication, through various discussion and activity forums, both real-time and asynchronously.	List services Chat and conferencing technologies MUD and MOO systems	Debates Discussion and support Groups Group exercises and projects MUD and MOO learning activities

As the World Wide Web (WWW), the Internet, and telecommunications have become the common tools of instruction in the digital age, the linear features of the traditional models no longer fit or meet the "learning focused" instructional activities. Perhaps the most important of all implications is that much of the designing should be done by the learners while they are learning, with help from a computer system and/or the teacher and other students generating options. In this regard, Harris (1998) has developed a list of activity structures suitable for the classroom, demonstrating the variety of activities that telecommunications enables:

Interpersonal Exchanges

These activities give students an opportunity to interact with others from a distance. By doing so, they come to appreciate how differently people see and make sense of their world. They also have opportunities to reinforce literacy skills through extended reading and writing activities. Harris (1998) cites several examples: Keypals, Global classrooms, Electronic appearances, Electronic mentoring, and Impersonations.

Information Collection

The focus of these activities is on collaborative, distributed collection, analysis, organization, and presentation of information. Students can participate in every step of this process. Information activities may help students internalize scientific methods.

They may also strengthen students' information literacy skills. Examples include: Information exchanges, Database creation, Electronic publishing, Electronic field trips, Pooled Data Analysis.

Problem-Solving Projects

These projects focus on individual, small group, or multi-group problems. They often require higher levels of collaboration and organization between sites. Students have opportunities to learn task-management skills in addition to content objectives.

Examples include: Information searches, Parallel problem solving, Electronic process writing, Serial creations, Simulations, Social action projects.

Learning styles are yet another quality factor that should be considered in designing e-based activities.

For better activity design, online educators need to pay attention to this factor if they hope to engage every member of the group, from a solid and successful learning community, and achieve the objectives of the e-course (Palloff & Pratt, 2003, p. 37).

Table 2 provides a matrix to match students' learning style and appropriate online instructional techniques and activities (Palloff & Pratt, 2003, p. 37-38).

Theoretical and Pedagogical Framework of E-Based Activities

Cognitivism, constructivism and connectivism perspectives were adopted as a theoretical framework for this dynamic model.

The underlying theme of cognitivism learning is that learning is a method to model the process of interpreting and constructing meaning from understanding.

As learners' performance becomes more expert-like and fluent so the component skills become automized (Mayes & Freitas, 2012).

Constructivism has a substantial impact on views pertaining to the conditions and instructional strategies and activities essential to build and organize learners' knowledge.

Increasingly, mainstream cognitive approaches to learning have emphasized the assumptions of constructivism that understanding is gained through an active process of creating hypotheses and building new forms of understanding through activities (Mayes & Freitas, 2012).

In the meanwhile, constructivism gives a considerable attention to the social culture of learning. This view of learning focuses on the way knowledge is distributed socially. When knowledge is seen as situated in the practices of communities then the outcomes of learning involve the abilities of individuals to participate in those practices successfully (Mayes & Freitas, 2012).

Table: 2
Online Instructional Techniques and Activities to Address Various Learning Styles

Learning Style or Preference	Instructional Techniques and Activities
Visual-verbal: **Prefers to read information.**	**Use visual aids, such as PowerPoint or whiteboard.** **Provide outlines or lecture materials in written form.** **Use written materials, such as textbooks and Internet resources.**
Visual-nonverbal or Visual-Spatial**: prefers working with graphics or diagrams to represent information.**	**Use visual aids, such as PowerPoint, video, amps, diagrams, and graphics.** **Use Internet resources, particularly those that contain graphics.** **Use videoconferencing.**
Auditory-verbal or verbal-linguistic**: prefers to hear material being presented.**	**Encourage participation in collaborative and group activities.** **Use streaming audio files.** **Use audio conferencing.**
Tactile-Kinesthetic or bodily-kinesthetic**: prefers physical, "hand-on" activity.**	**Use simulations.** **Use virtual labs.** **Require outside fieldwork.** **Require presentation and discussion of projects.**
Logical-mathematical: **prefers reasoning, logic, and numbers.**	**Use case studies.** **Use problem-based learning.** **Work with abstract concepts.** **Use virtual labs.** **Encourage skill-based learning.**
Interpersonal-relational: **prefers working with others.**	**Encourage participation collaborative and group activities.** **Use discussion board.** **Use case studies.** **Use simulations**
Intrapersonal-relational: **Prefers reflection and working with others.**	**Encourage participation in collaborative and group activities. Use discussion board.** **Use case studies.** **Make use of activities requiring self-and group assessment.**

Both cognitivism and constrcutivism are sharing some learning principles about effective instructional activities, which can be summarized in the following:

- **engage learners in activities authentic to the discipline in which they are learning,**
- **provide for collaboration and the opportunity to engage multiple perspectives on what is being learned,**
- **support learners in setting their goals and regulating their own learning, and**
- **encourage learners to reflect on what and how they are learning (Driscoll, 2002).**
- **Barab & Duffy (1999) pointed out, there are at least two 'flavors' to situated learning.**

One can be regarded as a socio-psychological view of situativily. This emphasizes the importance of context-dependent learning in informal settings. This activity-guided view of situated learning led to the design of what Barab & Duffy call '*practice fields*' this authentic to the social context in which the skills or knowledge are normally embedded in the situation (In: (Mayes & Freitas, 2012, p. 10).

Constructivism has also a substantial impact on views pertaining to the conditions and instructional approaches essential to build and organize learners' knowledge and authentic experience (Savery & Duffy, 1995). Constructivism has considerable pedagogical views regarding how to contribute and support other people learning through a process of collaboration and social inquiry. The collaborative social inquiry is important for learners in that it maintains good rapport with team and fostering open communication, collaboration, creativity, initiative, and appropriate risk taking (Corcoran et al. 1995; Loureiro, & Bettencourt, 2010).

From previous two paragraphs we can say that both congnitivism and constructivism gave a great attention to cognitive and social presence while designing e-learning activities. Those two presences are important to visualize and manage the knowledge making process among online learners.

In the meanwhile, connectivism has considerable views regarding how to contribute, delve and support other people learning. It emphasizes on neural network learning. This approach sees knowledge states as represented by patterns of activation in a network of elementary tasks. In a networked world, the very manner of information that we acquire is worth exploring. We derive our competence from forming connections (Siemens, 2004). This perspective addresses learning that occurs outside of people (i.e. learning that is stored and manipulated by technology). A network can simply be defined as connections between entities. Computer networks, power grids, and social networks all function on the simple principle that people, groups, systems, nodes, entities can be connected to create an integrated whole.

Principles of connectivism (Siemens, 2004):

- **Learning and knowledge rests in diversity of opinions.**
- **Learning is a process of connecting specialized nodes or information sources.**
- **Learning may reside in non-human appliances.**
- **Capacity to know more is more critical than what is currently known.**
- **Nurturing and maintaining connections is needed to facilitate continual learning.**
- **Ability to see connections between fields, ideas, and concepts is a core skill.**
- **Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.**
- **Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.**

It could be noticed from connectivism principles of learning that both psychological presence and social presence are main components of networked learning.

Thus, e-based activities should give an emphasis on those two kinds of presence. In summary, the quality of e-based activities can be measured by the following indicators:

- **Understanding how our students learn (*theoretical indicator*).**
- **Awareness of the issues that affect students' lives and learning and how they bring them into the Web-based class (*students' needs indicator*).**
- **Understanding what virtual students need to support them in their learning (*technological and human presence indicator*).**
- **Understanding how to assist virtual students in their development as reflective practitioners (*sociological indicator*).**
- **Finding a means to involve virtual students in e-course design and assessment (*pedagogical indicator*).**
- **Respecting students' rights as learners and their role in the learning process (*Mental and cognitive indicator*).**
- **Understanding how to develop e-courses and programs with an eye on continuous quality improvement so that students stay in the learning process and move smoothly in the direction of their goals, objectives, and values (*motivational indicator*).**

In this regard, Salmon (2004) presented a five stages model for e-Tivities: access and motivation, online socialization, information exchange, knowledge construction, and development.

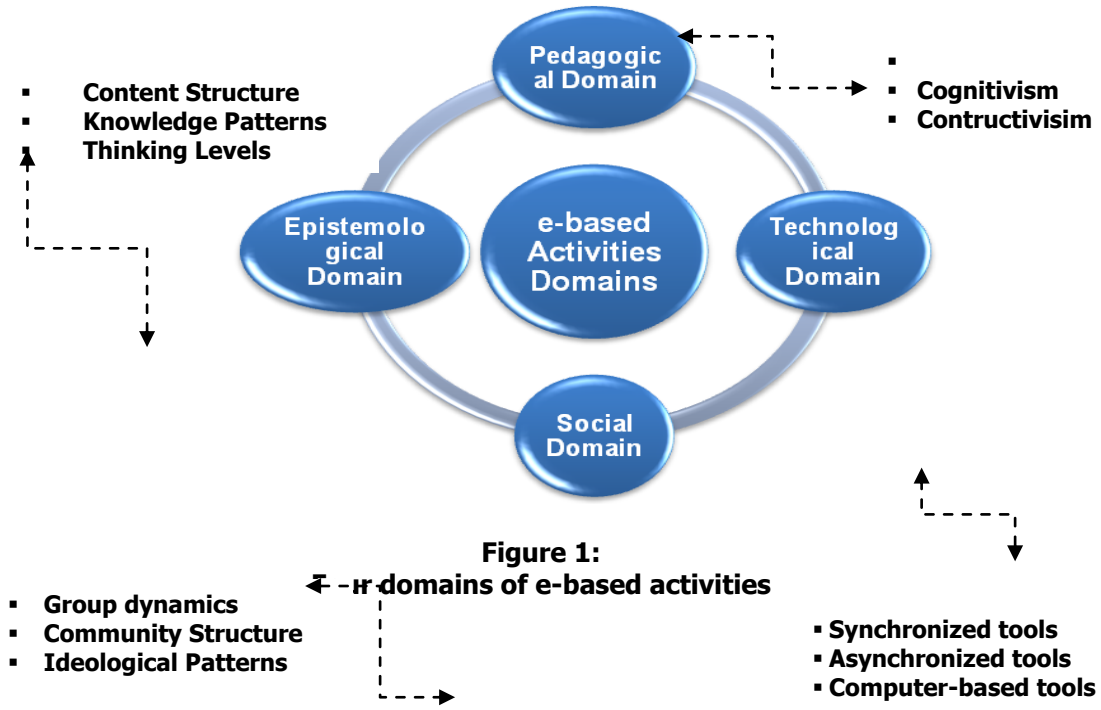

Figure 1:
The domains of e-based activities

We can notice that both Harris's model (1998) and Salmon's model (2002) gave a great attention to information exchange and knowledge construction activities. But the proposed model of e-based activities is giving more attention to the pedagogical, epistemological, social, and mental e-based activities.

In this paper, the author introduces a dynamic-based learning activities model based on learning principles of educational perspectives and quality factors above mentioned. This model goes beyond technocentric strategies and emphasizes the importance of helping both educators and online learners develop and apply integrated and interdependent understanding of Web-based activities that fit with technology, pedagogy, learning styles, content, and context of e-learning. The proposed model of designing e-based activities is consisted of four main domains that guide the design process of e-learning activities (*Figure 1*). In the following section, the author presents these presences in details Based on the quality factors and theoretical perspectives previously mentioned.

Cognitive Presence

In cognitive presence, students are presented theoretical statements via the "opinionator," a free virtual world tool that animates a Likert-like questionnaire scale. This provides an opportunity for students to position themselves and then ask questions about the theoretical point and engage in an exchange of ideas as they explain their decisions to each other. Students display their positions by virtually placing themselves on the opinionator. During the activity, some students may change their position, due to the arguments of fellow students. Some students favorably compare the engagement and presence of this experience as opposed to having a similar discussion in a conventional, text-based LMS (McKerlich, Riis, Anderson & Eastman, 2012).

Social Presence

In social presence, a student is presenting his position on virtual worlds as *role model* for other students. As part of his presentation, the student wants to show his fellow students how additional activity can be used to achieve interpersonal skills needed in learning situations. Dacko, (2006) concluded that giving strong interpersonal skills is essential to strong everyday comradeship, thus, there is a clear need for strengthening interpersonal skills among learners' practitioners to speed the generating and transferring of knowledge within and across organizational boundaries.

Psychological Presence

In psychological presence, learners are virtually emulating an observable behavior for a person (coach) who is dealing with others in a learning situation. The central them of psychological presence is that learner can transfer the knowledge-based content into real and authentic actions. Authentic actions are very important to assure skills building and acquisition. One of the main characteristics of psychological presence is that it gives the student a read on how the learners are responding. Thus, psychological presence focuses on body languages and its impact on convincing learners who are having different opinions.

Mental Presence

Mental presence refers to learners' ability to construct meaningful knowledge and skills. It can be defined as "meaning building or making" in which learners are having new lines of knowledge applications. In mental presence process, learner is coaching her/himself to emerge knowledge and skills.

Jonassen, Peck, & Wilson (1999) used mental presence as synonym to *"mindtools"* in which learner are constructing knowledge bases that represent personally relevant and meaningful knowledge while learning with virtual world.

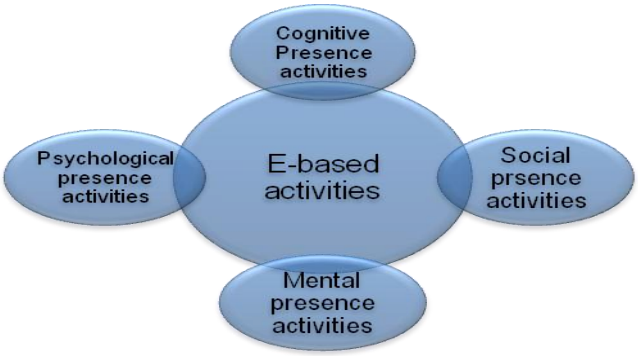

Figure: 2
Four types of e-based activities

The main product of mental presence is new and creative and adaptive techniques to deal with future requirements of learning situations. These new techniques can be distributed and shared with other learners through a line of community of inquiry and practice. These four components are presenting in figure: 2.

CONCLUSION

The previously mentioned four characteristics of effective learning activities might be used as grounded elements of any instructional approach or model for designing virtual/or e-based learning activities. In virtual world, learners and teachers can actively create, use and re-use learning objects through a process of interaction and coaching, where their presence is created and enhanced. It is through this lens that the researcher focuses on virtual and electronic activities in this paper as an emerging model that has the potential to create rich sense of e-based activities to develop online learners' abilities and values. Table 3 presents a matrix of the domain of e-based activity types matched with compatible e-learning technologies.

Recommendations

The following recommendations are important to validate the proposed e-based activities model presented in this paper:

- **There exists a real need for examining the effect of using the proposed model of e-based activities on learning subject matters in several contexts.**
- **There exists need for investigating the impact of using e-based activities model on developing thinking skills among secondary schools' students.**
- **A qualitative study is needed to explore the best practices of using e-based activities model in developing creative thinking skills among secondary schools' students.**
- **Further research should address the effect of e-based activities model on developing computer and Internet skills among undergraduate students.**
- **Further research is needed to examine the proposed model in developing e-courses/curricula based on the e-based activities structure mentioned in this paper.**
- **Finally, more studies should examine the impact of e-based activities model on developing teaching and classroom management skills among in-service and pre-service educators.**

Table: 3
The Domains of e-based Activities Types and Compatible e-learning Technologies

e-based Domains/ Types	Examples	Compatible Technologies*
Cognitive Presence activities	1. Read online text 2. View presentation 3. View Images 4. Research 5. Artifact-based inquiry 6. Data-based inquiry 7. Answer questions 8. Complete charts/table 9. Take a test	1. E-books, Web browsers, CD-ROM, document view. 2. Presentation software, e-note taking tools, audio/video, whiteboards, concept mapping software. 3. Image/animation/video editing and display software. 4. Traditional and online books, encyclopedia, Wikipedia. 5. Artifact kits, online books and journals, Wikipedia. 6. Web sites, online databases, WebQuests. 7. Discussion boards, wikis, whiteboard, e-quiz and polling software. 8. Excel or other data processing software, concept mapping. 9. Quiz software, survey software.
Social presence activities	1. Group discussion 2. Debate 3. Simulation 4. Answer questions 5. Create a game 6. Do a presentation 7. Engage in role play 8. Create a diary	1. Discussion forum, blogs, wikis, chartrooms. 2. Discussion forums, e-mail. Chat. 3. Virtual reality Web sites, simulation software, animations. 4. Discussion boards, wikis, whiteboard, e-quiz and pollir software. 5. Word Processors, imaging tools, Web authoring software, specialized game-making software. 6. Presentation software, multimedia 7. capture/editing software. 8. Presentation software, multimedia 9. capture/editing software. 10. Word Processing, concept mapping, e- document Wikipedia.
Psychological presence activities	1. Listen to audio 2. Group discussion 3. Field trip 4. Debate 5. Design an exhibit 6. Engage in role play 7. Do a performance 8. Engage in team action	1. Web sites, MP3 Players, podcasts, radio, tape players, players. 2. Discussion forum, blogs, wikis, chartrooms. 3. Video, virtual reality systems, online museums, galleri and exhibitions. 4. Discussion forums, e-mail. Chat. 5. Presentation software, word processing, Web authorin tools, graphic tools. 6. Presentation software, multimedia capture/editing software 7. Word processing, storyboarding software, video/audio editing tools. 8. Word Processing, Web site design, blogs, wikis, email.
Mental presence activities	View images Simulation Artifact-based inquiry Data-based inquiry Answer questions Create a map Complete a review activity Create a diary Develop a metaphor). Build a model	1. Artifact kits, online books and journals, Wikipedia. 2. Virtual reality Web sites, simulation software, animations. 3. Artifact kits, online books and journals, Wikipedia. 4. Web sites, online databases, WebQuests. 5. Discussion boards, wikis, whiteboard, e-quiz and polling software. 6. Cartographic software, Google Maps, Drawing software. 7. Courseware, quiz polling software, wikis. 8. Word Processing, concept mapping, e- documents, Wikipedia. 9. Image banks, graphics editors, multimedia authoring tools. 10. Modeling, simulation construction, graphic software, multimedia production tools.

* Note: Most of these Compatible Technologies were adopted from Harris, Mishra, & Koehler (2009).

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