

INVESTIGATING THE PROMISE OF MASS-CUSTOMIZED EDUCATION: A CONTENT ANALYSIS SELF-REPORTED DESCRIPTIONS OF WEB 2.0-LEARNING-TOOLS BASED ON MULTIPLE INTELLIGENCE THEORY

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ABSTRACT

Is the world "flat" or is the world "spiky"? Although leading authors and thinkers [Florida, 2005] struggle to find the perfect metaphor for describing our 21st century global ecosystem, there is agreement that the landscape is shifting. There is overwhelming agreement that our current education system was designed and continues to operate on an antiquated industrial model. To meet efficiencies, instruction is produced for batch delivery. This mass-delivery method inevitably will emphasize one learning style (i.e., visual, auditory) and be taught through the lenses of one intelligence (i.e., logical mathematical). This causes failure-to-strive syndrome in many students as the ecosystem fails to provide them the proper support that nurtures and rewards their individual learning needs. (Beilke & Peoples, 1997; Brown & Adler, 2008; Gardner, 2007; Pink, 2006; Robinson, 2001).

Emerging technologies (Web 2.0) have the potential to deliver learning that is highly customized to individual interests and intelligences (Christensen, Horn, & Johnson, 2008). This paper reports on a content analysis of website descriptions of the top 100 Web 2.0 learning tools as identified by the Center for Learning and Performance Technologies. Emergent themes are reported and deductive coding -- based on Howard Gardner's seven intelligences -- is used to refine thematic information.

Keywords: Multiple Intelligences, Web 2.0 - learning, Customized Learning.

INTRODUCTION

The purpose of this study was to analyze the websites of the top 100 web-based tools for learning, as identified by Hart (2008) at the Centre for Learning and Performance Technologies, in order to determine how these sites addressed multiple intelligences. There are many educators attempting to understand the significance of Web 2.0 tools for improving engagement and learning in the classroom. In addition, many learners are experimenting with these tools to increase their learning ability (Folkestad, 2008). The popularity of these tools indicates that many learners are seeking ways to improve their learning capabilities and capacities.

Research shows that learning information that aligns with an individual's dominant intelligence can increase

comprehension and retention (Gardner, 2007; Robinson, 2001). There is evidence that indicates that Web 2.0 tools can be used to create a new kind of participatory learning ecosystem that supports multiple modes of learning (Brown & Adler, 2008; Christensen, 2008). However, no prior empirical study has examined Web 2.0 learning websites to determine the nature of the content related to multiple intelligences. The results of this study can assist educators and learners in critically analyzing the relationship between self-reported content about Web 2.0 tools and the highly regarded multiple intelligence theory that is often directly related to education and learning. Educators and learners can gain insight into which intelligences are being supported by these tools. They can then reflect on this focus as they attempt to

customize their learning and teaching.

Literature Review

"We are living in extraordinary times. Significant forces in global communication, workflow, and education are converging to realign power, wealth, and work" (Folkestad & Banning, 2008). The recent volatility of the global economic system highlights the extraordinary interconnectedness of today's global knowledge-discovery enterprise. All nations are now a part of connected, competitive world in which each nation is attempting to empower its populace to increase their knowledge attainment, learning agility, and innovative prowess. As Kao (2007) stated, "Today, things are vastly different. Innovation has become the new currency of global competition as one country after another races toward a new high ground where the capacity for innovation is viewed as a hallmark of national success" (p. 1). Countries that thrive in the 21st Century will be those that foster innovation and subsequently attract globally-distributed research funding and venture capital from which economic growth will emerge (Friedman, 2005).

Fueled by this shift in work, the authors are witnessing the rise of a new global "creative class", a prosperous group that gains recognition and acceptance through creativity and innovation (Florida, 2003). Runco (2004) reinforces the importance of creativity stating, "because of its role in innovation and entrepreneurship, creativity has become one of the key concerns of organizations and businesses" (p. 659). The business sector has identified creativity as the engine of technological and economic development (Plucker, 2004). Employers want people who can think intuitively, who are imaginative and innovative, and who are flexible, adaptive, and self-sufficient (Robinson, 2001). Furthermore, Gardner (2006) stated that, "individuals without creating capacities will be replaced by computers and will drive away those who do have the creative spark" (p. 18).

Responding to this shift, governments officials from Australia, Canada, China, Singapore, and Sweden have created aggressive national innovation strategies that have been designed to capture and retain entire

technological sectors, such as Beijing's bid to become the world's leaders in nanotechnology (Kao, 2007). Talent development and recruitment is at the forefront of all of these governmental strategies. As more countries enter the innovation race, talent becomes scarce and enticing talent from other locations becomes more difficult. Governments and businesses recognize that education and training are key strategic elements for remaining economically competitive (Robinson 2001, p. 5).

As Robinson stated, "new forms of work rely increasingly on high levels of specialist knowledge and on creativity and innovation particularly in the uses of new technologies. These require wholly different capacities from those required by the industrial economy" (Robinson, 2001, p. 5).

All nations stand at a crossroads. To compete for global middle class individuals need to increase their ability to be creative and innovative. However, many nations and individuals are encumbered by industrial era organization and thinking. Over the past 150 years, modern complex democracies have depended on an industrial information economy where information has been scarce, created by an elite few, and controlled through an industrial-based educational system (Benkler, 2006). In order to supply the industrial enterprise workforce, education systems were designed in the mass-production image. Education was designed to be extremely efficient at producing and sorting the highest quality students. The problem is not the efficiency per se, but the pre-occupation with one particular intellectual ability, academic ability, over others (Robinson, 2001, p. 7). Although this system served the industrial-based economy, it is struggling to nourish the new creative economy; it is under developing some critically important abilities (creative and innovative thinking) that will drive 21st century innovation-based work.

Creative thinking and innovativeness are often enhanced when divergent thinkers or people with divergent intelligences and experiences work together to solve a problem. It is at the intersections of intelligences, ideas, and experiences that innovation is nourished. The problem is that our current industrial education system

neglects many intelligences and rewards individual performance over collaborative discovery, exploration, and problem solving (Pink, 2006; Robinson, 2001; Brown & Adler, 2008). As Christensen (2008) stated, "if we hope to stay competitive academically, economically, and technologically we need to rethink our understanding of intelligence, reevaluate our education system, and reinvigorate our commitment to learning. In other words, we need disruptive innovation" (inside cover).

To nourish an innovative workforce we need a learning process that is customized for each learner, fostering their intelligences (strengths) and one that rewards collaborative design and problem solving over individual achievement (Pink, 2006; Robinson, 2001; Christensen, 2008). As Florida (2003) stated, "the creative process is social, not just individual, and thus forms of organization that are necessary. But elements of organization can and frequently do stifle creativity" (p. 22). We need to retool the way we educate ourselves in order to enter the new global successful working class.

Computer-based technologies have the potential to move learning from their current mass-delivery, industrial mode to student-centric learning (Christensen, 2008; Pink, 2006). As Brown & Adler (2008) stated, "indeed, the Web 2.0 is creating a new kind of participatory medium that is ideal for supporting multiple modes of learning" (p. 18), "... student-centric technology will make it affordable, convenient, and simple for many more students to learn in ways that are customized for them" (Christiansen 2008, p. 92).

Research Questions

"The web offers innumerable opportunities for students to find and join niche communities where they can benefit from the opportunities for distributed cognitive apprenticeship. Finding and joining a community that ignites a student's passion can set the stage for the student to acquire both deep knowledge about a subject (learning about) and the ability to participate in the practice of a field through inquiry and peer-based learning (learning to be)" (Brown, 2008, p. 28). The participatory nature of web 2.0 learning tools and the

ability to customize learning using these tools has seen the growth of communities of learners.

Given the global importance of knowledge attainment and innovative thinking, interesting questions arise about Web 2.0 tools. Do these tools reflect the old industrial mass-consumption model of education, focusing on a limited number of intelligences, or are they inclusive providing learning customized for multiple intelligences? With this broad question in mind, the authors were interested in learning how developers of leading Web 2.0 learning tools describe their applications and how these descriptions are related to multiple intelligence theory. Analysis of this self-reported data will provide insights into how these applications are being conceived and if they are being designed to accommodate multiple types of learners. These insights may give developers information about underrepresented applications and provide direction for customization that could accommodate other intelligences, improving the breadth and depth of Web 2.0 applications. Furthermore, this analysis will provide educators and learners insights into how Web 2.0 may accommodate their learners / learning. To this end, the authors examined the degree and manner in which Web 2.0 tools address, on their self-reported websites, the following questions:

1. What are the salient themes that emerge from the self-reported descriptions on these websites?
2. To what degree are the seven intelligences (linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, inter-personal, intra-personal) addressed on Web 2.0 websites?

Methods

A content analysis was conducted on the top 100 Web 2.0 learning tool websites as identified by the Center for Learning & Performance Technologies. During 2008, two hundred and twenty three learning professionals from around the world were asked to send their listings of the top ten learning and performance support technologies / tools. Training consultants, educators, CEOs, CIOs, and instructional designers from over 21 countries contributed, and from these top ten lists a 2008 top 100 rank order list

was compiled (Hart, 2008).

In addition to the rank order list (see website for rank order listing) each tool was also placed into a specific category based on its function. The top 100 tools were categorized into 34 different functions, the most populated of which were, blogging tools, document / spreadsheet tools, media creation tools, personal productivity tools, research tools, screen capture tools, and web authoring tools. A complete listing of the tools and associated websites have been included as Appendix A.

Coding Procedure

The self-reported "about" or "information about" content from each of the websites (top 100 tool websites) was captured and analyzed. Both inductive and deductive analysis was conducted on this self-reported content. Inductive data analysis was conducted to establish emergent themes related to learning and deductive coding was used to analyze the content as it is related to multiple intelligence theory. Descriptions of each of these analyses are provided below.

Coding and inductive data analysis on learning content

In developing the inductive codes related to learning, Boyatzis's (1998) five-step process was followed. First, the self-reported data was analyzed by individual tool (self-reported website information) and summarized or paraphrased. Second, the tool / website information was then placed into subgroups based on the tool categories that were established by the Center for Performance and Learning Technologies. Comparisons were made between tools with the subgroups and similarities, and patterns were identified. Third, the themes were compared across subgroups or categories with the intention of reducing the information into a manageable number of emergent codes. Fourth, the themes were revisited and rewritten to establish a set of statements that maintained maximum differentiation. In the last step, trustworthiness and consistency of judgment was addressed (see below). Because our research questions were directed at understanding the emergent (inductive) and deductive themes from this self-reported data, the authors have provided rich description to connect and

ground their findings within the content of the data analyzed.

Coding and deductive analysis of six-dimensions of intelligence

A theory-driven thematic coding scheme was used to analyze the website content. A coding template was developed to examine the self-reported content on six dimensions. Gardner's (1983) seven intelligences were collapsed into six deductive dimensions that were then used as the template to conduct the analysis. Intra-personal and Inter-personal intelligences were collapsed into one coding dimension called personal. The six deductive codes included linguistic intelligence, musical intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, and personal intelligence. Definitions for each of the six dimensions are provided below.

Related to the first dimension, linguistic intelligence, was defined as having the ability to use language to learn and express oneself. For example, a successful writer toils over the nuances of words, appreciating subtleties and always striving to preserve intended meaning. Content that was coded as linguistic intelligence was identified as supporting linguistic processes, providing users with tools to improve their linguistic ability, and learning through the use of written, verbal, and semantic forms.

The second dimension, Musical intelligence was defined as having the ability to distinguish and compose pitch, melody, tone, and song. Musical intelligence has given us composers who can, compose music through their unique ability, stimulate human emotion, change mood, and calm an upset infant. For example, Tools that supported learning through music, auditory, and melodic abilities were coded within this dimension.

Logical-mathematical intelligence was defined as the ability to use scientific thought, consider propositions and hypotheses and perform complex mathematical operations. Mathematics and science are combined within this intelligence, the first attempting to explore abstract systems for their own sake and the second attempting to explain physical reality. Content that was

coded as logical-mathematical was identified as supporting learning using problem solving, experimentation, and scientific exploration.

Having a strong and unique ability to think in three-dimensional ways, and create works of art and form that engage the audience or viewer within that space, is defined as spatial intelligence. As example is the artist who can take a given studio space and transform it into an art installation that encourages the viewer to interact with the multi-dimensional experience. Website content that was identified as supporting artistic, visual, and tactile learning and understanding were coded within this dimension.

Bodily-kinesthetic intelligence was defined as having a keen mastery over the motions of one's body including the ability to manipulate objects and fine tune their physical skills. As an example the Olympic swimmer has the extraordinary ability to manipulate and fine tune the physical body to balance strength, flexibility, and fluidity in a coordinated effort toward acceleration and speed. Content was coded as bodily-kinesthetic if the descriptive passage described how the tool would help the user to strengthen their ability or learning using these bodily-kinesthetic skills.

Having the ability to understand oneself and others, and to use this understanding to interact effectively, are the foundations of personal intelligence. Inter-personal and intra-personal intelligences were combined into this dimension. Individuals that have the ability to bridge social divides and bring people together in action and understanding fit within this unique dimension. Tools that were identified as supporting learning and understanding through social, cultural, and emotional means were coded within the personal intelligence dimension.

Six deductive coding dimensions (keywords)

In an effort to increase interrater reliability, keywords were generated for each of the six coding dimensions. Gardner's book chapters on each of the intelligences were analyzed using the frequency word search tool Nvivo. A concerted effort was taken to increase the compatibility (compatibility of words, syntax, and format)

of the coding scheme to the raw data gathered from the websites under investigation. Toward this effort the keywords associated with each coding dimension were modified using three translations; these translations included modification or removal of the following types of keywords: structural words (e.g., and, the), out of context words that created confusion (e.g., own, understanding), and words that overlapped or appeared under several intelligences (e.g., skills, rules). A final keyword listing for each of the six deductive codes has been included in Table 1.

Content / paragraph selection and analysis

Using the associate keywords the coder used a word search query to identify all passages that were relevant to each of the six deductive codes. Next, in each of the relevant passages, a determination was made as to if the passage related directly to the thematic code being considered. For example, if a passage contained the keyword "scholar" (a keyword under the linguistic dimension) a determination was made as to if in fact the keyword was being used to describe a process (a process of using the tool) that was designed to support the linguistic learner. Coding the data using this template allowed us to tabulate the number of self-reported messages in each dimension for each website and across websites.

Strategies to enhance trustworthiness

Three standard methods for enhancing the trustworthiness of the findings were utilized. These three methods included: the researcher's perspective, peer review, and field notes.

Researcher's perspective: To understand the research results it is vital that they be viewed with an understanding of how the researcher envisioned the data and how that impacted the analysis (Boyatzis, 1998). The research was a 41-year-old male Associate Professor at Colorado State University within the School of Education. He earned his terminal degree (Ph.D.) from Texas A&M University in Educational Human Resource Development in 1996. His dissertation titled, *The Feasibility of Implementing a Model for a Wide Area Network Management Information*

Linguistic	Musical	Logical-mathematical	Spatial	Bodily-Kinesthetic	Personal
Linguistic	musical	mathematical	spatial	body	personal
language	music	mathematics	visual	dance	self
poet / poets	composer	logical	form / forms	bodily	individual(s)
word / words	tone / tones	mathematician (s)	imagery	motor	social
reading	composers	number	image	hand / hands	feeling / feelings
oral	song / songs	science	painting	tool / tools	life
speech	rhythmic	logic	game	movement	interpersonal
poetry	compose	operations	picture	dancer	culture(s)
poem	musicians	numerical	draw	physical	intrapersonal
scholars	pitch	scientific	drawing(s)	movement	society
semantic	rhythm	numbers	images	bodies	place
speak	sing	scientist	arts	create	community
syntactic	auditory	math	color	technique	being
verbal	piano	prove	imagine	dancing	cultural
writing	sound / sounds	scientists	artists	dancers	experiences
poetic	composing	solution	shape	imitate	animals
write	listening	solving	tactile	kinesthetic	existence
written	melodic	calculation	artist	produce	feel
writer	musician	functions	games		identity
	rhythms	arrays	pictures		societies
		calculate			family
		sets			personality
					reflect
					selves
					emotions
					motivations
					emotional

Table 1. Keywords identified for each intelligence coding dimension

System for Texas Education Agency Administered Programs of Adult Education, focused on the diffusion of technology throughout the adult education system. Over the last 10 years he has worked on several large-scale technology diffusion projects as the lead change agent. This training provided him with the background in education theory (multiple intelligences, learning styles) and expertise on the use of technology within educational settings.

He agrees with many scholars that technology has the power to create disruption in the educational system. This

disruption would create a mass customization of learning on a scale that was previously impossible (Christensen, 2008). Toward this goal, he continues to work with emerging technologies to understand their disruptive influences, and to educate others on how to use them to create personal learning communities.

Peer review: After codes were developed, the researcher invited peer review of the coding procedure to assess consistency of the coding.

Field notes: Field notes were maintained as an ongoing account of what happened during the research process.

These notes were then reviewed and summarized to best understand the methodology that emerged. The researcher recorded ongoing feelings, reactions, and changes in his impressions and preconceptions. This source of data provides insights that were added to the final analysis.

Results

The results are organized by the two research questions. First - the emergent salient themes are reported providing understanding and rich description on how the developers of the Web 2.0 tools describe their applications. Regarding the degree to which the established six dimensions of intelligence (linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, personal) are addressed by the Web 2.0 websites, reported the number of times each specific intelligence dimension was coded and rich description on the nature of statements that pertain to each of the six deductive coding dimensions.

Question 1: What are the salient themes about learning that are self-reported on these websites?

To address this research question, cross-case inductive analysis was conducted on the self-reported "about" or "information about" content to determine the salient themes. Several salient themes emerged from the analysis of all the website content. These themes that emerged included are:

- (a) tools support collaboration on documents, projects, and activities
- (b) tools allow easy multimedia production
- (c) tools that allow us to organize and find information and
- (d) tools that facilitate community-based learning.

In total, collaboration was referenced 178 times, multimedia production 134 times, organization 101 times, and learning from community was referenced 56 times. There is one coded item, that although did not truly emerge as themes, is worth noting. This item is customization of learning based on intelligence; it was referenced only four times across all of the top 100 websites. These direct references, to content related to the focus of this paper, and details on each of emergent

themes has been provided below.

Regarding the theme that *tools support collaboration on documents, projects, and activities*, Google Apps self-reported that "it's even easier to share important documents, spreadsheets and presentations within your company or group" (Google Apps). All Microsoft applications reported that their tools supported and enhanced collaboration. For example, the Office PowerPoint 2007 website reported that "the office fluent user interface in Office PowerPoint 2007 makes creating, presenting, and sharing presentations an easier and more intuitive experience" (PowerPoint 2007). Blogger, Bloglines, Edublogs, TypePad, and Wordpress all stated that their tools were designed as easy ways to collaborate, discuss, and share documents, ideas, and thoughts around the world. Developers state that "Flickr is almost certainly the best online photo management and sharing application in the world... Flickr is a way to get your photos to the people who matter to you" (Flickr). All of the online wiki sites reported the significance of collaboration, including Wikispaces that states, "A Wikispaces for a class is a great place to post their work so that teachers and classmates can correct, improve, and discuss their work" (Wikispaces). Many other statements also exemplified this theme, including, "Slideshare is the best way to share your presentations with the world" (Slideshare), "share a VoiceThread with friends, students, and colleagues for them to record comments too... VoiceThread inspires collaborative and expression with five innovative ways to comment" (VoiceThread), "The concept of Jing is the always-ready program that instantly captures and shares images and video from your computer to anywhere" (Jing), and "Diigo is two services in one it is a research and collaborative research tool on the one hand and a knowledge-sharing community and social content site on the other" (Diigo).

Regarding the theme that *tools allow easy multimedia production*, all of the blogging tools reported ease of use and provided simple steps for publishing pictures, video, and audio. For example, Blogger self-reported that, "to add video to your blog post, click the film strip icon in the post editor toolbar above where you compose your blog

text. A window appears prompting you to 'add a video to your blog post,' (Blogger). Furthermore, Audacity reported that its tool is a free, easy-to-use audio editor for recording and editing sounds. SnagIt reported that its tool "... helps you to create great-looking graphics while keeping things simple." "Camtasia Studio makes it easy for anyone even a multimedia novice to produce a slick, professional-looking screen video on a shoestring budget" (Camtasia). The Adobe Captivate 3 website provided one more text that exemplifies this theme stating that its "software enables anyone to rapidly create powerful and engaging simulations, scenario-based training, and robust quizzes without programming knowledge or multimedia skills." There were many similar statements that provided support for this emergent theme.

Regarding *tools that allow us to organize and find information*, LibraryThing self-reported that using their tool, "you can edit your information, search and sort it, 'tag' books with your own subjects, or use the Library of Congress and Dewey systems to organize your collection." Furl reports that its website solves the personal information management problem by allowing its users to bookmark websites and then organize those bookmarks based on searchable annotations, topics, and tags. "Zotero is a free, easy-to-use Firefox extension to help you to collect, manage, and cite your research sources." In addition, "Office OneNote 2007 is a digital notebook that provides people one place to gather their notes and information, powerful search to find what they are looking for quickly, and easy-to-use shared notebooks so that they can manage information overload and work together more effectively" (OneNote 2007). As noted above, this was a strongly supported theme with over 100 coded references.

Regarding the theme *tools that facilitate community-based learning*, all of the bookmarking tools (Delicious, Diigo, Stumbleupon, Furl) allow the user to see what other individuals are bookmarking and stress the advantage of learning through those that have similar interests. Many of the blogging tools (Blogger, Bloglines, Edublogs, TypePad, and Wordpress) describe communities of learners

engaged in sharing their ideas and reading other bloggers in an effort to learn. "We have a special page which notifies you of any follow-ups to your comment so you can easily follow your conversations... this helps educators to create effective online learning communities" (WordPress). Wikispaces suggests that we learn by sharing our passion and by keeping track of what you've learned on a wiki. This learning is enhanced when we invite others that share our interests to help us build our website and knowledge about a subject. "Diigo is two services in one it is a research and collaborative research tool on the one hand, and a knowledge-sharing community and social content site on the other... Diigo is quite different from typical social networks in that it is solely about social networking through knowledge-sharing". As mentioned above, there were 56 coded references, from multiple websites and tools, that supported the emergence of this theme.

Customization of learning based on intelligences is noted here because it is the focus of this paper and it is of interest that it did not emerge as a strong theme. Across all 100 of the top learning tools only two developers described how their tool helps customize learning for individual users. Regarding this developers of Adobe Connect Pro made the following statement, "get training where it's needed, when it's needed. Acrobat Connect Pro lets you quickly create and deliver interactive multimedia-rich training that addresses a variety of learning styles. Learners can access self-paced courses from anywhere with just a click and complete training at their own pace." Working with similar ideas regarding customized pacing, Camtasia Studio developers reported that users can, "record a live presentation or lecture to give learners a rewind button for class. Helping them learn at their own pace... or catch up from an absence".

Question 2: To what degree are the seven intelligences -- linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, personal (intra-personal, and inter-personal) addressed on Web 2.0 websites?

Across all 100 websites, the total number of coded passages for each intelligence dimension was determined. Findings were that linguistic intelligence

contained 69, musical contained 18, logical-mathematical contained 13, spatial intelligence contained 71, bodily-kinesthetic contained two, and personal intelligence contained 79. In summary, three intelligences - inter-personal, linguistic, and spatial appeared to be described more extensively than the remaining four.

The support for writing, editing, and reading (linguistic intelligence) was reflected in the self-reported descriptions of numerous Web 2.0 tools. For example, "I'm a student entering my freshman year of college at Whitman College and use [Google Docs] for nearly everything. I use it to post to my blog, do writing assignments, type notes for reading assignments and many other things" (Google Docs). "This guide can help you familiarize yourself with the main features of Blogger and get started writing your own blog" (Blogger). Furthermore, Wikipedia's developers reported that, "Wikipedia's 10 million articles have been written collaboratively by volunteers around the world, and almost all of its articles can be edited by anyone who can access the Wikipedia website". Zoho also supports this intelligence stating that, "Zoho helps people to collaborate on projects and share information with a simple mouse click. For example, in Zoho Writer, there are several ways to share documents in private, make them public or even perform collaborative editing in real time" (Zoho Notebook).

Many additional statements described tools that supported linguistic-based activities including "Writer shows you what your blog entry will look like before you post it, using your blog's templates and formatting" (Window Live Writer), "You can also save your own comments on the page. This is to remind yourself about the item, or to communicate to others your thoughts about it, or even as a forum to write your own commentary or response to it" (Diggo), and "Scribd created iPaper, the first document format built for the web. Like YouTube's player did for video formats, iPaper standardizes all document formats into one viewer that can be seamlessly integrated into webpages" (Scribd).

As mentioned above, keywords that related to musical

intelligence appeared less frequently and therefore received fewer deductive codes, being referenced 18 times. The GarageBand's developers stated that, "with GarageBand, you can create your own virtual onstage band and play along on your favorite instruments. You can record, edit, and mix a song exactly as you want it, in pristine CD quality". Audacity reported that its software is for recording and editing sounds allowing the producer to cut, copy, splice, or mix sounds together. Furthermore, Scribd indicated that its software allows individuals to self-publish documents including sheet music.

Logical-mathematical intelligence was referenced and coded only 13 times, as website developers used the related keywords sparingly. Examples that related to this intelligence were centered on online spreadsheet applications and online survey tools. One example is provided by Google Documents, "the equation builder helps you construct editable, in-line mathematical equations using real mathematical symbols, prebuilt equations, and automatic formatting." Developers of Survey Monkey state that, "using just your web browser, create your survey with our intuitive survey editor. Select from over a dozen types of questions (multiple choice, rating scales, drop-down menus, and more...). Powerful options allow you to require answers to any question, control the flow with custom skip logic, and even randomize answer choices to eliminate bias".

Keywords relating to spatial intelligence were found to appear frequently and 71 statements were coded within this dimension. Many of these statements related to the ability to design and customize documents, websites, and application interfaces using user/artistic preferences. Several statements exemplified this dimension including, "each theme allows you to customize your sidebar using widgets, and several themes let you upload your own photo or image for the header bar" (WordPress). Google Documents reported that, "you can easily do all the basics, including making bulleted lists, sorting by columns, adding tables, images, comments, formulas, changing fonts and more". The developers of PowerPoint 2007 noted that, "document themes help you to change the look and feel of your entire presentation with just one

click". Blogger provides another example statement for this dimension stating that, "once you've selected your image, you can then choose a layout to determine how your image will appear in your post". Ning's statement on branding exemplifies the ability to customize stating, "use your logo or any other image at the top of your network. Fully customize the look of your network by choosing a theme or creating your own design with CSS [cascading style sheets]."

In addition VoiceThread supports sketching stating that, "with doodling, you can draw on top of the media as you record your comment. VoiceThread's innovative Video Doodling feature allows you to control the playback of a video, while doodling and commenting on specific video segments". The developers of Adobe Flash state that you can, "create chain-like animation effects with a series of linked objects or quickly distort a single shape using the new Bones tool". And Google Earth, an application that literally deals with space, stated that, "Google Earth lets you fly anywhere on Earth to view satellite imagery, maps, terrain, 3D buildings, and even explore galaxies in the sky. You can explore rich geographical content, save your toured places, and share with others". It is apparent that Web 2.0 developers and their websites are being designed to support many spatial ways of producing and seeing the world.

In contrast, very few websites referenced the keywords associated with bodily-kinesthetic intelligence. GarageBand's developers came the closest to addressing the use of hand, body, and dance when discussing their applications' virtual environments stating, "welcome to your personal recording studio where it's easy to make a song whether you're a first-time musician or a seasoned pro. With GarageBand, you can create your own virtual onstage band and play along on your favorite instrument".

Keywords relating to personal intelligences (inter-personal and intra-personal) appeared frequently and this intelligence was coded 79 times. Most of the items coded as personal intelligence related to the creation and promotion of computer network-mediated social networks and computer-mediated communication. For

example, "Skype is jam-packed with great features to help you stay in touch with friends, family and co-workers, share your thoughts and views and find the information you need". Twitter's creators stated that, "Twitter is a service for friends, family, and co-workers to communicate and stay connected through the exchange of quick frequent answers to one simple question. What are you doing?" The developers of Flickr are focused on creating a community of photographers that share their images. "Flickr is an amazing photographic community, with sharing at its heart". And the developers of Ning stated that they "wanted to see what would happen if everyone had the freedom to create their own social network for anything".

Additional statements abound such as, "but this new navigation also reflects our belief that, over time, the web in general and iGoogle in particular will become more personalized but also more social more focused on connecting us with our friends through shared online activities" (iGoogle); "we're firm believers that wikis can be revolutionary tools for building communities" (Wikispaces); "Slideshare is the world's largest community for sharing presentations" (Slideshare); "Facebook helps you connect and share with the people in your life" (Facebook); and "Today, Netvibes is a global community of users who are taking control of their digital lives by personalizing their web experience" (Netvibes).

Discussion

The purpose of this study was to analyze the websites of the top 100 web-based tools for learning, as identified by Hart (2008) at the Centre for Learning and Performance Technologies, in order to determine how the developers of these websites addressed multiple intelligences. In examining the self-reported "about" and "information about" content from these websites, several themes emerged. The first emergent theme, *tools that support collaboration on documents*, is not surprising as collaboration and sharing of documents was one of the original purposes of internet communication technologies. The second theme, *tools that allow easy multimedia production*, is aligned with the emergence of browser based technology that supports graphical content. The third, *tools that allow us to organize and find*

information, represents a concerted effort to deal with information abundance and overload. And the fourth theme, *tools that facilitate community based learning*, is supported by the literature and is reflective of a desire for groups to connect and meet forming collaborative communities that prior to these technologies was difficult or impossible to facilitate.

These emergent themes provide insight into how these Web 2.0 tools were conceived and grown and therefore provide understanding into how they may support learning. Furthermore, findings based on coding of Gardner's intelligence dimensions appeared to align with the emergent themes and again reflects on how these Web 2.0 tools have emerged. First, personal (inter-personal and intra-personal) intelligences were referenced many times (79 references), reflecting the fourth emergent theme of facilitation of community based learning. Second, spatial intelligence also obtained noteworthy attention, being referenced 71 times. This appears to align with the emergent theme concerning tools that allow easy multimedia production. Web 2.0 applications have provided an outlet, that was previously unavailable or difficult to access, for producing and sharing imagery, art, and other visual forms. Linguistic intelligence was well supported by Web 2.0 applications. This is reflected across several of the emergent themes including, tools that support collaboration on documents (written and verbal) and tools that allow users to organize and find information. This is not surprising reflecting on the heavily textual nature of the Internet.

It is also important to reflect on the intelligence dimensions that were referenced less frequently. First musical intelligence was reference 18 times (the highest of the lower dimension), Music composition and sharing is reflected within the emergent theme of *tools that allow easy multimedia production*. It is interesting to note that, although the music industry has been disrupted by new distribution methods facilitated by the Internet (e.g., iTunes), these tools received few references within the top 100 listing analyzed in this study. This potentially reflects the learning perspective/bias of current educators, at

least those who contributed to the top 100 listing, and their comfort level of customizing learning toward those who are musically inclined. Given the disruption as witnessed by the music industry and the new nature of distribution of music based content, we would believe that more focus and reference would be given to this particular dimension of intelligence. We believe that tools that address this area have significant potential for learning and should be investigated further.

Second, logical-mathematical intelligence was referenced 13 times. Most references to this intelligence focused around the creation of spreadsheets for computation and analysis. The low level of content in this area is interesting and may be somewhat misleading. There are a significant number of online learning communities that focus on this intelligence; in fact, the open-source software movement has given outlet to many learners that are inclined to use logic and mathematics in computer programming. Although it is well documented that web-based environments have provided support for this type of learning (social networking tools, etc.), developers of Web 2.0 tools elected to use less technical jargon to describe their tools. The reasons for this are unknown, but may include their desire to attract a wider audience and deserve further investigation.

The last dimension, bodily-kinesthetic intelligence was only referenced two times. This reflects the less developed area of taking computer-based learning to the physical world. This includes the primitive nature of existing virtual worlds (e.g., SecondLife) that have the potential to make this connection allowing individuals to experience their learning using hands-on activities, motor movements, and body based experiences. This area of Web 2.0 is in its infancy and has significant potential. For example, handheld GPS devices and augmented reality are emerging as this paper is being written.

It is important to note that *customization of learning based on intelligences* did not emerge as a theme. Analysis of self-reported content found only two references for the customization of learning at the basic level. And it is interesting to note that only one developer referenced

learning styles directly. We believe that this reflects the emergent nature of these tools, and a significant opportunity for future development. Developers have an opportunity to explicitly state and provide examples of how their tools can facilitate customized learning based on intelligences and a variety of learning styles. It is through these descriptions that progress will be made toward mass-customization of education and learning.

Furthermore, additional research needs to be conducted on the content being generated using these tools. This study was limited to the self-reported "about" and "information about" website content. Although we believe that this study has provided insights into the nature of these tools, it is important to note that additional and useful insights can be realized by conducting further research into how these tools are being adopted and adapted by individual learners to further their understanding and by educators to create individualized learning based on students strengths and intelligences.

Conclusion

Developers of Web 2.0 tools are creating new collaborative websites at an amazing pace. New web-based applications emerge on daily bases that allow users to easily contribute content to the Internet and share it with others. In this collaborative model the potential for learning and creativity is large as people begin to engage each other and produce learning content that is customized based on individual learning style and intelligence. Although many of these websites can be used to create customized learning content, only two describe their applications as tools with this overt intent. This content analysis indicates that only a few of Gardner's intelligences are being overtly targeted by the developers of these Web 2.0 tools. Furthermore, several intelligences were rarely describe by the sites' developers suggesting a potential bias by the developers themselves (bias toward inter/intra personal intelligence and spatial intelligence) or a bias in the selection process of the *Top 100 Tools* (as is describe above, the top 100 tools were selected by educators). This study should open a discussion about how Web 2.0 websites may be expanded (expanded functionality) and/or repurposed

(refocused description) to accelerate customized learning in the 21st Century. In addition, it may open a discussion about the selection of Web 2.0 tools for education and learning. The selection of "top tools" for learning should be based on how well the tools support mass-customized learning based on individual learning strengths (intelligences). These "top tools" should therefore move learning from a process of mass-consumption to one that allows the learner to find instruction that is framed within their individual intelligence or learning strength.

Appendix A. Web 2.0 tools listed by category including website URLs

Tool category	Web 2.0 Tool	Website URL
Browsers, Extensions, Tool bars and Players	FireFox Opera and Opera Mini Internet Explorer Safari Adobe Reader	www.mozilla.com/firefox/ www.opera.com/ tinyurl.com/3242ra www.apple.com/safari/ www.adobe.com
Blogging	Word press Blogger Blog lines Type Pad Edublogs Windows Live Writer	wordpress.com/ www.blogger.com/ www.bloglines.com/ www.typepad.com/ edublogs.org/ get.live.com/Writer/overview
Content Management	Joomla Drupal	joomla.org/ www.drupal.org/
Course & Learning (content) management systems	Moodle	moodle.org /
Course authoring	exe Course Lab	exelearning.org/ www.courselab.com/
Documents, speardsheet and database	Google Documents Microsoft Word 2007 OpenOffice Excel 2007 Adobe Acrobat	www.google.com/docs office.microsoft.com/word www.openoffice.org office.microsoft.com/excel www.adobe.com/products/acrobatpro/
Email, SMS, Voice and Video Messaging	Gmail Outlook Thunderbird	mail.google.com/ office.microsoft.com/outlook www.mozilla.com/thunderbird/
File hosting and / or sharing tools (documents, photos, audio)	Flickr TeacherTube Scribd	www.flickr.com/ teachertube.com/ www.scribd.com/
Broadcasting	Ustream.tv	ustream.tv/
Interactivity	Smart Board software	tinyurl.com/3l4p29
Instant Messaging	Skype	www.skype.net/

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Mapping	Google maps Google earth	maps.google.com/ earth.google.com/	Screen Sharing and Web Conferencing	Eluminate Adobe Connect Pro	www.eluminate.com/ www.adobe.com/ products/connect/
Media Creation and Editing	GarageBand iMovie Flash GIMP MovieMaker Paint.net	www.apple.com/ilife/ garageband/ www.apple.com/ilife/ imovie/ www.adobe.com/ products/flash/ www.gimp.org/ tinyurl.com/3fpo4 www.getpaint.net/	Social bookmarking	Delicious Diigo Stumbleupon Furl	www.delicious.com/ www.diigo.com/ www.stumbleupon.com/ www.furl.net/
Microblogging / real time messaging	Twitter Tumblr Twhirl	www.twitter.com/ www.tumblr.com/ www.twhirl.org/	Social networks and networking	Facebook Linked in	facebook.com www.linkedin.com/
Mind mapping and brainstorming	Mind Manager Mindmeister Bubbl.us	www.mindjet.com/ www.mindmeister.com/ bubbl.us/	Start Page	Netvibes Pageflakes iGoogle	www.netvibes.com/ www.pageflakes.com/ www.google.com/ig
Note Taking / Sharing and Whiteboard	Microsoft OneNote	tinyurl.com/33hb86	Team, Group, Collaboration and Sharing	Basecamp	www.basecamp.com/
Personal Productivity	Zoho Notebook Remember the milk Google Apps Jott LibraryThing Zamzar Google Calendar	www.zoho.com/ www.rememberthemilk. com/ www.google.com/a/ www.jott.com/ www.librarything.com/ www.zamzar.com/ www.google.com/ calendar	Video tools, hosting and sharing sites	You Tube Slideshare iTunes	youtube.com/ www.slideshare.net/ www.apple.com/itunes/
Podcasting	Audacity iPod	audacity.sourceforge.net/ store.apple.com	Virtual World	SecondLife	www.secondlife.com/
Polling and survey	Survey Monkey PollDaddy	www.surveymonkey.com/ www.polldaddy.com/	Web authoring tools and HTML editors	Dreamweaver WetPaint Google sites Notepad Nvu	www.adobe.com/ products/dreamweaver/ www.wetpaint.com/ sites.google.com/ tinyurl.com/yycxnr net2.com/nvu/
Presentation	PowerPoint 2007 Keynote VoiceThread Adobe Presenter	office.microsoft.com/ powerpoint www.apple.com/iwork/ keynote/ www.voicethread.com/ www.adobe.com/ products/presenter/	Web Conferencing	Yugma	www.yugma.com/
Research	Google Scholar Google Search Wikipedia Zotero Articulate	scholar.google.com/ www.google.com/ www.wikipedia.org/ www.zotero.org/ www.articulate.com/	Wiki	Wiki spaces PbWiki Media Wiki Tiddly Wiki	www.wikispaces.com/ pbwiki.com/ www.mediawiki.org/ www.tiddlywiki.com/
RSS/ Feed readers and alerts	Google reader Google alerts	www.google.com/reader www.google.com/alerts			
Screen capture, Screencasting And software demo	Snagit Camtasia Studio Jing Adobe Captivate Wink	www.techsmith.com/ snagit.asp www.techsmith.com/ camtasia.asp www.jingproject.com/ www.adobe.com/ products/captivate/ www.debugmode.com/ wink/			

In short, societies will thrive by attracting innovation capital and a large part of that success will rely on leveraging their human potential. Gladwell (2008) examines the capitalization of human potential in his book *Outliers*. He examines how the United States is inefficient at growing talent and squanders human capacity. Human capitalization is the rate at which a given community capitalizes on the human potential of those within its society. As Gladwell states, "what percent of those who

are capable of achieving something, actually achieve it" (2008).

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