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Use of Online Collaborative Community and Technologies for Research Infrastructure in Minority Institutions

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***Abstract*: This paper presents a case on how online collaborative communities and various technologies, including Information and Communication Technologies and health-related technologies, can be utilized to strengthen research infrastructure in a minority institution of higher education; California State University, San Bernardino. The online community presented here is part of a larger project, supported by a "Research Infrastructure in Minority Institutions" grant, a five-year $4.7 million program funded by the *National Institutes of Health* in the United States. The primary purpose of the grant was to establish sustainable professional activities to reduce health disparities among racially and ethnically diverse and disadvantaged persons. Technologies used by the grant participants include, but are not limited to, course management systems (Blackboard and Moodle), Podcast, Wikis, Skype, Google Docs, Listserv, Doodle, various online forms, existing databases in different organizations, Geographic Information System, Global Positioning System, and technologies in three facilities: Teleconference Room, Bio-Behavioral Laboratory, and Human Performance Lab.**

Keywords: Online collaborative community, technology, learning community, health disparity, health equity, health**.**

I. Introduction

California State University San Bernardino (CSUSB) has been awarded a 4.7 million dollar grant (2007-2012) from the National Institutes of Health (NIH) "Research Infrastructure in Minority Institutions" (RIMI) program to promote minority health and eliminate health disparities. The RIMI program provides a means for CSUSB to (1) strengthen its basic research infrastructure and capacity to support CSUSB's science programs, (2) institute a comprehensive research faculty development training program, (3) establish an academic research enrichment training program for students interested in a science career, and (4) support, as part of the supervised training process, individual faculty initiated research projects that may lead to development of independent researchers in minority health and health disparities fields.

An experienced researcher and faculty in the Psychology Department directs the CSUSB RIMI program. Her vision is to have a joint effort of faculty from various colleges form learning communities that augment productivity, and to use technology for enhancing communication and collaboration. Her vision has been drawing interests of faculty from four out of the university's five colleges (College of Social and Behavioral Sciences, College of Natural Sciences, College of Education, and College of Arts and Letters) and has led to successful delivery of several cores, for example, Faculty Core and Student Core. This paper discusses only one of the cores, the Shared Resources Core, and primarily focuses on the online collaborative community and various technologies utilized in the RIMI project, including a Teleconference Room, Bio-Behavioral Laboratory, and Human Performance Lab.

The paper first presents work about online collaborative communities and research studies conducted using the technologies or equipment similar to the ones in the Bio-Behavioral Laboratory and Human Performance Lab at CSUSB. The paper further describes the CSUSB RIMI online community incorporating Web 2.0 technologies and Information and Communication Technologies (ICT) that support communication and collaboration of the project participants. This is followed by descriptions of the Teleconference Room, Bio-Behavioral Laboratory, and Human Performance Laboratory. Recommendations are provided to professionals who are interested in forming online collaborative communities and utilizing technologies similar to those used in the CSUSB RIMI program.

II. Related Work

This section provides background about learning and online communities that serve as foundation of the CSUSB RIMI online collaborative communities. It also presents research conducted using the technologies similar to the ones in the Bio-Behavioral Laboratory and Human Performance Lab at CSUSB; CSUSB faculty's research related to the lab is highlighted.

A. Online learning community

The concept of learning community is not new. Senge defined learning organizations as "places where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" [1, p. 3]. Although the ideas of learning organizations were first embraced in corporate boardrooms, they quickly spread to classrooms. As Senge's paradigm shift was explored by educators and shared in educational journals, the label changed to "learning communities" [2]. It describes an environment in which learners become integrated into a group, recognizing that the new community is a valuable source for learning potential.

Communities of learners can be conceptualized as widely distributed memory with each of its members storing one part of the group's total memory. Distributed memory, what the group knows as a whole, is clearly more capacious than individual memories, and the sharing of that knowledge makes the community more dynamic [3]. Similar to Jonassen et al., Bielaczyc and Collins define "learning community" as a culture of learning in which everyone is collectively involved [4]. If a community member encounters a problem, the entire learning community brings its collective knowledge for successful resolution. It is not necessary for a member of the community to understand everything that the community knows, as long as the member is able to identify who within the community has the expertise to solve the problem.

Advanced technology has created opportunities for tremendous growth of such learning communities. Among the most promising is the emergence of the Internet and the World Wide Web, which, in its brief life, has hosted electronic interactions between a myriad of learners across the planet, facilitating the learning process for all participants. Jonassen et al. described the Internet as the ultimate distributed network, linking users and institutions together, allowing interactions of all kinds to occur [3]. They noted, "The education future portended by the Internet, therefore, is not isolated and targeted to individuals. Rather, it is a community-centered future that accommodates each person through the workings of the larger community of learners" [3, p. 73].

Tapped-In [5] is one such successful "online community" going online in 1997 with funding from the United States government's National Science Foundation. This online learning community is described as providing a response to educators' needs for support, community and idea sharing within a virtual space that is both efficient and intuitive [6]. Participants are provided with powerful, dependable communication tools, meant for interaction with as small or as large a community of participants as they wish to involve.

The advancement of Web 2.0 technologies and today's social media technologies further enrich and strengthen such online communities. Manlow, Friedman, and Friedman noted, "Social media, with its reliance on interconnected and collaborative communication, can direct the transformation of an organization into a true learning organization where participation and social interaction empower all members" [7, p. 61]. They advocated that "Social Media provides the tools and resources to stimulate new ways of thinking and to move effectively across new frontiers which open the door to communication, collaboration, community, creativity, and convergence—those features which can truly build a modern, global and inclusive learning organization" [7, p. 62]. With such media, professionals developed a variety of systems to increase efficiency. For example, Yang, Wu, Lin, and Yang constructed TiddlyWiki that allowed users to collect information and accumulate knowledge [8]. They also developed MediaWiki for building a research-group knowledge base. Lin, Lam, Wong, Cen, Sun, Miao, and McNaught developed electronic cases (eCases) for Traditional Chinese Medicine students at The Chinese University of Hong Kong [9].

In addition to developing learning environments and communities using advanced technologies, researchers have been examining the impact of the use of the technologies on communities. Anzai used Podcasting and Wikis in her foreign language classes [10]. In her research, she found that Japanese students were familiar with digital technologies and were in favor of ubiquitous learning. Huang, Lin, and Chiang conducted research in a blended-learning environment, in which American students studied Chinese [11]. The findings of that research suggested that Web 2.0 is a promising tool in promoting effective learning of Chinese. In their large, introductory biology course, Walker, Cotner, and Beermann used vodcasts (combining custom animation and video segments with music and faculty voiceover) and captures (combining the output of the classroom's digital projector with a recording of the instructor's voice) [12]. They found that students preferred vodcasts to captures, but no significant difference was found in student achievement in the course. Cady and Rearden provided online professional development to Mathematics educators [13]. The results indicated that the professional development opportunities increased teachers' pedagogical content knowledge although their mathematics content knowledge did not change significantly. Their findings also suggested that the professional development supported by advanced technologies fostered communities of practice among the educators. As Bonk noted, emerging technologies, especially social media, have opened up the world of learning for learners at anytime and anywhere [14]. Such technological transformation has been influencing a variety of learning communities.

B. Heath-related technologies

To strengthen CSUSB infrastructure for health-related research, the CSUSB RIMI program augmented two laboratories: the Bio-Behavioral Laboratory and Human Performance Lab. The former is used for studies that examine behavior and/or the physiology taking place during an experimental condition, and the latter allows researchers to collect and analyze a variety of data, for example, energy expenditure, body composition, and other fitness related measurements. The Bio-Behavioral Laboratory makes use of Mindware [15] and E-Prime [16] technology, which have been commonly used in health-related fields. Mindware is designed to record the electrical activity of the heart (Electrocardiograph, EKG) and monitor the cardiac cycle (Impedance Cardiography) during exposure to a stimulus. This technology is used to recognize the components of an EKG waveform (e.g. the R-spike used to determine heart rate) for identifying the parasympathetic influence on the heart (high frequency heart rate variability). Demaree et al. used Biopac hardware to collect skin conductance (EDR) data (similar to that of Mindware's hardware for data collection) and used Mindware software to analyze the data [17]. They compared and contrasted two modulation techniques and measured discrete indicators (i.e. respiratory sinus arrhythmia and pre-ejection period). They asked participants to suppress or exaggerate their facial responses to a negative emotional stimulus. The results showed an increase in EDR while watching a disgusting video clip; however, facial modulation did not elicit EDR reactivity beyond watching the film without suppression or exaggeration.

A Viasys portable metabolic cart [18] and dual energy x-ray absorptiometry (DXA) [19] in the Human Performance Lab are two pieces of equipment that are utilized for health related research. Using the facility, CSUSB faculty Haddock, Siegel, and Wilkin conducted research to determine if riding a stationary bike that controlled a video game would lead to significantly greater energy expenditure than riding the same bike without the video game connected [20]. Twenty children, 7-14 years old, with a BMI classification of "at risk for overweight" or "overweight" participated in the study. Results revealed that oxygen consumption and energy expenditure were significantly elevated above baseline in both conditions. Energy expenditure was significantly higher while riding the bike as it controlled the video game (4.4 ± 1.2 Kcal·min-1) than when riding the bike by itself (3.7 ± 1.1 Kcal·min-1) ($p<0.05$). Perceived exertion was not significantly different between the two sessions ($p>0.05$). They conducted another study to examine the energy expenditure of middle school aged children who were playing the Nintendo Wii Sports Game [21]. They specifically analyzed the length of time that the children played the games and the differences in energy expenditure between the games. The results showed that energy expenditure increased over resting conditions while playing the Wii for each game except golf. The average energy expenditure during play was 2.8 ± 0.9 kcal/min while 1.4 ± 0.4 kcal/min was seen at rest prior to testing. Overall, playing Wii Sports moderately increased the energy expenditure in children. Wilkin, Jackson, Sims, and Haddock conducted research using the DXA [22]. They specifically looked at racial and ethnic differences in bone mineral density among young adults to examine if there was a correlation with variables that would influence density. The results showed that bone mineral density was suggestively higher in African Americans than European Americans or Latina/o Americans.

In addition to faculty at CSUSB, faculty at other institutions conducted research utilizing equipment similar to the ones in the Human Performance Lab, such as the Vitalograph flow meter that measures lung volume, Biodex, and a Medgraphics Ultima series metabolic cart. Takara, Ruas, Pessoa, Jamami, Di Lorenzo, and Jamami used the Vitalograph, Assess, Air Zone, Galemed and Personal Best flow meter [23]. Sixty-eight healthy and insufficiently active subjects aged 19 to 40 years were tested. The researchers compared all five flow meters and found that the Galemed flow meter underestimated actual values while the Air Zone flow meter overestimated actual values. Median and interquartile ranges for spirometric values were 428 (263-688 L/min). The median and interquartile ranges for each flow meter were as follows: Galemed-380 (300-735 L/min), Air Zone-450 (350-800 L/min), Assess-420 (310-720 L/min), Personal Best-400 (310-685 L/min) and Vitalograph-415 (335-610 L/min). They found no agreement between spirometric values and those of the five flow meters.

Using the Biodex, Manal, Roberts, and Buchanan investigated whether pennation angles could be predicted from EMGS for primary ankle plantar and dorsiflexors during isometric contractions [24]. The researchers first used the Biodex system to set the ankle angle and to monitor joint movement. They then examined muscle activity of the human tibialis anterior, gastrocnemis, medial gastrocnemis and soleus. Data was collected from eight male and eight female participants at increments of approximately 25% maximum voluntary contraction (MVC) ranging from rest up to MVC. Manal et al. found that the coefficient of determination ranged from 0.76 for the human tibialis anterior and 0.87 for the soleus [24]. They concluded that there was a significant linear relationship between normalized EMG and pennation angle for all muscles when subject specific pennation angles were at rest and MVC were included in their analysis.

Employing a Medgraphics Ultima series metabolic cart [25], DiFrancisco-Donoghue, Elokda, Lamberg, Bono, and Werner investigated how medication for Parkinson's disease affected the autonomic responses of an individual during an exercise stress test using the Medgraphics Ultima series to collect metabolic data of patients [26]. The stress test was performed on subjects once they were off their medication and then one week later when they were back on the medication. Heart rate, blood pressure, metabolic data and norepinephrine levels were taken at rest and at peak exercise. It was found that heart rate, blood pressure, and norepiniphrine values were significantly lower than those subjects without Parkinson's disease whether or not the subject was on or off their medication. The abnormalities in the autonomic responses during exercise appear to be exhibited by the disease and not impacted by the medications used to treat Parkinson's disease. This study illustrates how technology can be used to research diseases, including their effects on the human body, and how technology can help develop interventions to treat diseases.

III. CSUSB RIMI Online Learning Communities and Technologies

The CSUSB RIMI learning communities are connected and enriched via the use of Web 2.0 technologies, ICT, various content-related technologies, and three facilities: a Teleconference Room, Bio-Behavioral Laboratory, and Human Performance lab.

A. RIMI website

Jonassen et al. noted that the Internet is the ultimate distributed network, linking users and institutions together [3]. Shortly after the NIH announcement of grant recipients, the RIMI Executive Council (EC) began their website construction. The website has been used as a centralized location linking users together for information dissemination, communication and collaboration of the grant participants. As a "one-stop shopping" spot, the website provides all parties (faculty, students, and community members) with necessary information relevant to health disparities and health equity. With assistance of the university technology support, the RIMI website is one of the five top sites appearing on the university webpage when users include search terms related to health disparity and health equity. This design allows users and visitors to easily access the RIMI website. The website contains several areas and may be viewed at [27]. The sections below outline the content from selected areas of "News and Events," "Faculty Research," "Student Scholars," and "Resources."

In the "News and Events" section, participants may find information about upcoming workshops, conferences, and seminars concerning health disparity/equity issues. They may easily disseminate the information to other professionals by simply providing a link. Participants may also contribute to the construction of the webpage by sending information to designated staff via email or by submitting information via online forms.

The "Faculty Research" webpage has links to information for faculty members, including (1) all CSUSB research-funding opportunities, with funding offices, calls for proposals, contact information, and deadlines, (2) external funding opportunities, (3) research projects completed by CSUSB faculty and supported by RIMI, and (4) work-in-progress research projects on campus. Faculty who conducted research with RIMI funds were interviewed, and the interview videos have been archived. To better understand faculty's research supported by the RIMI program, one may review their abstracts online and request a link to the archived videos.

Similarly, the page of "Student Scholars" has links to (1) professional development opportunities such as fellowships and summer institutes and (2) information from students who have been supported by the RIMI program. Health Scholars (students of the first three years of the grant) worked closely with three faculty members (Health Scholars Directors) and conducted research with RIMI funds. The Health Scholars were interviewed, and the interview videos are in the archives as well. To better understand their work, one may also request a link to the archived videos.

The "Resources" page consists of useful information, such as "Digital Library" and "Media." The Digital Library is designed to increase efficiency and streamline research endeavors by integrating and aggregating content-specific research (such as research article databases related to health disparities) into a centralized location. Using the university's existing resources, the RIMI EC and CSUSB librarians co-constructed a database that may be searched using the subject term "Health Disparities" [28]. This collection of resources allows users to view publications related to health disparities from private and government related databases. The "Media" section contains presentations and training that were supported by RIMI. These are available on the website in different formats: Flash (allowing users to view presentations via streaming video on a computer), MP3 (allowing users to listen to audio files using a portable media player, e.g. iPod), and MP4 (allowing users to view training material using a device, e.g. iPod). All aforementioned information is available to the public except for some material in the Digital Library that is open to only faculty and students who belong to the university and subscribes to the journals.

In addition to "Digital Library" and "Media," the "Resources" page also contains information pertaining to RIMI online forms and facilities of the grant, such as The Teleconference Room, The Bio-Behavioral Lab, and The Human Performance Lab. The online forms and facilities are discussed in later sections.

B. A variety of technologies

As a culture of collective and dynamic learning [3], [4] the RIMI community, including administrators, faculty, and students, has been using various technologies to enhance communication and collaboration, to augment productivity, and to increase efficiency. This section describes how the RIMI community members have used technologies for their collective and dynamic learning.

During the first three years of the grant, three faculty members (Health Scholars Directors) worked closely with nine selected students, "Health Scholars." The faculty members created a RIMIHS listserv and used it to communicate with the health scholars, keeping them informed, and responding to their requests. The faculty subscribed to different webcasts that were available for viewing in the university library rooms. To take advantage of different course management systems, the faculty used Moodle [29] and Blackboard [30] interchangeably with the Health Scholars. They frequently used Skype [31] to plan and collaborate on weekly seminar work, set up conference trips, and work on professional papers and presentations. In addition, they used concept mapping software to brainstorm/organize ideas and qualitative analysis software, e.g. Qwalrus [32], to analyze qualitative data. Under the guidance of three technology-savvy faculty members, the Health Scholars developed projects using PowerPoint with embedded videos, experimented with e-portfolio, studied Geographic Information System (GIS), conducted work on SPSS [33], and utilized a variety of online databases of the county and Center for Disease Control.

Several faculty members are currently using GIS along with Global Positioning System (GPS) hand held devices to obtain data for a research study. At present, five faculty members are also conducting research with existing data from the database of the Health Assessment Resource Center (HARC). Wikis, one of Web 2.0 tools, has been employed by the RIMI EC to compile items for program evaluation, and RIMI staff members have been using Doodle [34] to schedule meetings. Furthermore, listservs have been created for two groups. One of the RIMI listservs is solely for RIMI project directors who work at different institutions; this listserv allows the directors to share strategies on carrying out RIMI projects and brainstorm ideas on overcoming challenges. Another listserv connects faculty and students at CSUSB as well as professionals who are interested in the CSUSB RIMI grant activities. A couple of faculty members have been frequently using the listserv to share information with professional subscribers. Instructions for signing up on the listserv are available at [35].

Many of the faculty members employ online forms as part of their data collection methods when conducting individual or collaborative research projects, for example, Qualtrics [36], Survey Monkey [37], and Google Docs [38]. These software systems allow users to conduct some of the following tasks: (1) recruit prospective participants through email and/or post the study link online, (2) conduct informed consent online before the study begins, (3) randomly assign participants to different conditions or groups (i.e., experimental research design), (4) assign participants to different conditions or groups depending on their answer to particular questions, (5) play video, audio, or display images as a way of manipulating a variable, (6) collect Time 1 and Time 2 data, or more if the research calls for a longitudinal research design, (7) ask different types of questions (e.g., forced-choice, open-ended, etc.), (8) download aggregated responses and data directly into Excel or SPSS, (9) choose exactly which questions or variables to download, and (10) conduct both qualitative and quantitative studies.

Online forms, particularly Google Forms [39], are used not only by faculty for their research data collection but also by RIMI internal evaluators for program evaluation and project staff for administrative needs. Google Forms are created for event registrations, formative evaluation, records of the facilities' use, and collecting data pertaining to faculty presentations and publications. The use of the software not only assists with data collection but also helps with hold individual participants accountable for completing the evaluations in a timely manner. Data collected from Google Forms and converted to Google Spreadsheets has enabled the grant administrators to easily identify needs for change and make data-driven decisions for the project. In addition to Google Forms and Spreadsheets, Google Analytics [40] has been employed to collect RIMI website utilization data. This application tracks how many people access the website each day, which web pages are directly accessed, how much time users spend on a webpage, as well as where users are located. Such data has been helping the grant administrators to better understand the end users as well as prospective grant participants.

C. Teleconference room

The teleconference room consists of an integrated system of Polycom [41] and PolyVision [42] hardware and software that allows grant administrators, faculty, students, and IT support staff to simultaneously conduct interactive videoconferencing in up to three remote sites. The room is used for administrative meetings, professional development, instructional delivery, IT support staff meetings, and videoconferencing with remote scholars at other universities and research centers. The Polycom unified communications technology is capable of integrating large LCD main displays, HD cameras (with 12x zoom, 180-degree panning, and 72 degree wide viewing angle), document cameras, DVD players, projectors, in-ceiling speakers, and Polyvision whiteboards into a unified system housed in a single room and controlled from a single touch control unit.

Figure 1. Teleconference room

The integrated components allow users to: (1) call or join with multiple remote participants in a videoconferencing call, (2) share and receive HD content such as videos, images, spreadsheets, drawings, documents and multimedia, (3) share and receive HD video capture of all persons in the room and media being displayed on any of the main screens or the Polyvision board, (4) hear voices from remote sites and other audio in surround sound, and (5) control videoconferencing calls, administrative settings, and content sharing capabilities directly from the main touch control unit. Remote sites and users are not required to have a complete integrated Polycom system in order to participate in videoconferencing or content sharing. Polycom provides single licenses for its video conferencing software application, which delivers video, audio, and content directly to a PC and web camera.

The integrated Polyvision whiteboard may be used as a regular whiteboard while allowing users to save what was written on the board directly to a computer. The Polyvision whiteboard uses resistive sensor technology to sense the location of the included pens and eraser, similar to the way other touch screens function. It is connected to a computer via a standard USB. With an LCD projector, users may project an image onto the whiteboard (e.g., a website, a PDF, etc.), write on the image using a Polyvision pen, and save both the background image and writing into a single document. Users may save the information as an image, which can be exported to multiple formats (e.g., JPG, HTML, PDF, etc.). The Polyvision system was a very effective tool for webpage revisions when the RIMI website was restructured due to the establishment of The Center for the Promotion of Health Disparities Research & Training. During this revision phase, the technology staff and RIMI administrators displayed a webpage on the Polyvision big screen, the administrators pointed out what should be changed, the staff then made notes on the screen using the Polyvision pen, and saved the page as an image file. The staff repeated the same steps for a variety of webpages. After the meetings, the staff retrieved the saved image files and revised the webpages following the notes on the images. With Polyvision, the RIMI staff and administrators were able to work on the tasks efficiently and effectively.

The RIMI program has been using the room for meetings several times per week. Other academic units on campus and grant coordinators have been using the facility as well. Connection to remote sites from the room remains a challenge and the room will reach its full potential once certain network issues are solved and the budget is approved for hiring technology staff who have access the university network to trouble-shoot issues with Polycom vendors. Recommendations on the use of such technologies will be discussed in the "Discussions and Recommendations" section.

D. Bio-behavioral laboratory

The Bio-Behavioral Laboratory funded, in part, by the CSUSB RIMI grant, is used for studies that examine behavior and/or physiological responses during an experiment. The laboratory utilizes both Mindware and E-Prime technology. Mindware is designed to record the electrical activity of the heart and monitor the cardiac cycle during exposure to a stimulus. This technology is used to identify the components of an EKG waveform for studying the parasympathetic influence on the heart. The lab also has audiovisual capability. There are four cameras that allow for the integration of up to four images. The cameras make it possible to videotape participants' behavior, regardless of where they move in the laboratory. The synchronization between the physiological and behavioral measurement allows researchers to examine behavior associated with physiology collected at the same moment in time. The Mindware technology is also capable of recording electrodermal activity (EDA) or skin conductance which measures the change in skin temperature. In addition, the lab has E-Prime software which allows the researchers to create visual instructions for studying participants and recording their responses to the presentation of experimental stimuli. The E-Prime software is connected to the Mindware system, which allows for synchronization of the physiological measurement and stimulus.

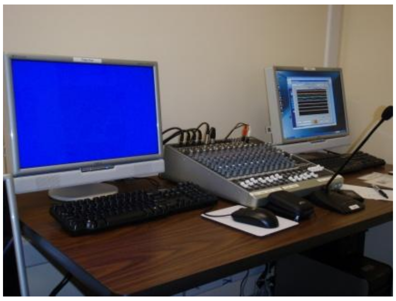

Figure 2. Bio-behavioral laboratory

Utilization data indicates that this facility is not yet frequently used. The lab was used for seven activities that all occurred during the second year of RIMI. These activities consisted of open house events designed to generate professionals' interest in the lab services and equipment. One student used the facility and received her master's degree in General and Experimental Psychology. She was later accepted to a doctoral program at Oregon State University. The infrequent use of the lab was due to a lack of awareness about the equipment's capabilities. Creating a way to introduce the equipment to the campus community and help professionals understand how it can be applied in their research is of primary importance at this stage.

E. Human performance laboratory

The Human Performance Lab is outfitted with a wide range of equipment for health studies. The laboratory features two metabolic carts, Medgraphics and Viasys (a portable cart), which allow for collection and analysis of expelled gases and for the measurement of resting metabolic rate and a variety of spirometry tests for lung volumes. The current laboratory equipment allows for graded exercise testing of participants on treadmills, electronic and manual braked cycle ergometers, the participant's personal bike (brought into the laboratory by the participant), an arm ergometer, and the ability to go into the field and perform testing in different situations. The lab is also equipped with a Quinton EKG machine and a portable EKG machine, both of which allow for the monitoring of the heart's electrical activity while at rest or during exercise.

Figure 3. Human performance laboratory

The Human Performance Lab also has several portable lactate analyzers (Accusport) [43] for the assessment of blood lactate and a Cholestech machine [44] that provides the ability to assess lipid and glucose profiles. The laboratory is well equipped for the assessment of body composition using techniques such as hydrostatic weighing, dual energy x-ray absorptiometry (DXA) [11], bioelectrical impedance, skinfold calipers, and the BodPod [45]. The BodPod uses air displacement to assess body composition. The DXA gives professionals the capability of assessing bone density and body composition. The laboratory also contains Biodex Isokinetic Strength testing equipment [46] allowing for the determination of both concentric and eccentric strength at a variety of joint angles and angular velocities. The technology in this lab provides a way for researchers to study different physical attributes of the human body. Using the facility, CSUSB faculty conducted a variety of projects in this lab, for example, studies completed by Haddock, Siegel, and Wilkin [21] and Wilkin, Jackson, Sims, and Haddock [22].

Utilization data indicates that this facility has been frequently used, not only for research, but also for teaching and training purposes. From year one to year three of RIMI, the lab was used for a total of 16 major activities with the primary users being students and faculty from the CSUSB Kinesiology department. These activities consisted of open house events to advertise the lab services and equipment, physical (kinesiology) testing, and student and faculty research. The second year of RIMI had the most lab activities, most of which were physical testing. Two CSUSB Psychology students used the lab resources for thesis research, and both received their master's degree. Additionally, a Loma Linda University student used the lab for dissertation research and later received her doctoral degree in Physical Therapy.

IV. Discussions and Recommendations

The CSUSB RIMI program uses an online learning community and a variety of technologies to strengthen the university's research infrastructure. As stated at the beginning of this manuscript, the 4.7 million RIMI project has several cores (e.g., Faculty Core, Student Core), and this paper focuses on only the Shared Resource Core. Therefore, the discussions and recommendations that follow pertain to the online learning community and technology for this particular core.

Senge defined learning organizations as places where people generate results they desire, where creative thinking is fostered, and where members learn together [1]. Learning communities become active when the community members long for the same outcomes and have collective aspirations. Several online learning communities in the RIMI program have been active, for example, the community built by (1) the grant EC, (2) the collaborative Health Scholars team, which includes faculty leaders, and (3) the faculty research teams. Each community has specific goals and a mission, and the online communities support completion of these goals. Communities are strengthened when the goals and mission remain clear to the community members, and are weakened when the goals change. Such dynamics have been reflected in the RIMI online learning communities. For example, during the first three years, email exchanges among the grant EC members were very frequent, including several messages per week. The goal of the EC during that time was to jumpstart and carry out the project, and the EC community was vibrant. Similarly the community formed by the Health Scholar Directors was active as well. They had clear goals and missions for their core project: all of the nine Health Scholars mentored by them are either in a doctoral program or working in health-related fields. In the fourth year, both of the communities changed, which affected not only the faculty, but also the community members. Examining outcome of this change is interest of the grant administrators.

The RIMI program hopes to serve the communities both on and off campus. Due to time needed to strengthen the research infrastructure at the university, efforts to serve off-campus communities have not been the main focus. However, one of the RIMI activities during the second year revealed the needs of off-campus communities. As previously stated, the RIMI program uses Google Analytics to gather utilization data. The data indicated that the RIMI website utilization significantly increased during the months of February and March 2009. Specifically, RIMI home page views increased from 524 in January 2009 to 6025 in February 2009. Likewise, all other page views (i.e. health scholars, faculty, resources, media center, advisory board, community, news, and events) significantly increased during this time period. The advertisement of an event that was open to off-campus communities in February 2009 appeared to be the cause, particularly because utilization declined once the event ended in March 2009. Apparently, an online learning community that involves health professionals in the field is needed based on the considerable number of website hits and participants present at the event. This event also suggested that technology may bridge off-campus professionals with on-campus scholars to form a larger online collective learning community. It is recommended that RIMI or similar programs enlarge their learning communities by including not only researchers in higher education, but also health professionals in the health-related fields. When a project requires communication among a number of participants and is open to the larger community, an online community similar to Tapped-In may be needed and formed.

CSUSB RIMI participants use a variety of online forms for data collection, and many of them are free to use (e.g., Google Forms [39], LimeSurvey [47]). Other online tools are also available including Formsite [48], Psychdata [49], Qualtrics [36], Survey Gizmo [50], and Survey Monkey [37]. Some of the tools contain advanced features and allow for increased capabilities when one pays a monthly or yearly fee. For example, SurveyMonkey, one of the most commonly used websites, allows unlimited access at a cost of $200 per year. A site such as Psychdata, which is more secure and provides for greater participant confidentiality, costs $695 per year for unlimited access. More comprehensive tools, such as Qualtrics, which allow for control of all elements of a study and include every feature listed above, cost up to $5,000 per year (note: this license provides access for an entire department, including faculty and students).

The CSUSB RIMI Teleconference Room utilizes an integrated system of Polycom and Polyvision. The integrated system supports the collaborative efforts of the RIMI communities that are integral to the infrastructure of the grant project as well as the university. This collaboration takes place in a technological context that allows for interactions over distance, more efficient productivity through real-time decision making, travel cost elimination, and broader reach across geographically diverse organizations and research institutions. Researchers, for example, are able to connect and interact with subject matter experts and community partners instantaneously without paying for travel expenses or losing time through travel. This dynamic mobility increases financial, research, and organizational efficiency. Furthermore, integrated solutions such as Polycom support the foundational goals of organizations such as RIMI in that they can be used to combat geographic and socioeconomic barriers that enhance the likelihood of equitable education. For example, they can be used to expose subject matter experts to students who live in remote areas. Remote sites and users are not required to have a complete integrated Polycom system in order to participate in videoconferencing or content sharing. The use of this software may be especially beneficial for institutions or individuals who do not have dedicated IT support.

Despite these benefits, several considerations would need to be taken into account by professionals in the educational, business, and community contexts before integrating videoconferencing technology into their organizational infrastructure. In any situation where an organization is hoping to install a system (or software) that is intended to communicate with remote locations, network compatibility issues may arise. Depending on the organization's network and firewall settings, users might find that they are unable to make videoconferencing calls to remote locations until the videoconferencing system has been granted special permission by the network administrators (or IT support professionals) to connect with remote servers and networks. Another issue is related to the functionality of the videoconferencing software across different platforms. Some videoconferencing software and hardware are only compatible with certain platforms such as Windows PC, but not others. Users are advised to confirm the software and hardware compatibility before making connections with remote sites. Users should also be advised that many integrated videoconferencing systems (such as that provided by Polycom) require remote sites to purchase their software in order to connect with the host site via videoconferencing (at a price of upwards of several hundred dollars).

The Mindware technology in the CSUSB RIMI Bio-Behavioral Laboratory is an advanced way of measuring heart activity. It is easy to use, portable, and good for editing the data collected. However, editing the data can be time consuming if a participant is connected to the system for a long period of time. The Mindware system only permits the data to be edited in 600 second intervals; therefore, it is recommended that participants are connected to the system for the shortest amount of time. One of the authors worked with Mindware technical support and found them to be very helpful and experienced. In addition, Mindware can also be used with the E-Prime software. It allows for a wide range of experimental designs, which makes it versatile to use in research. The advantage of the software is that it works well for both advanced and novice researchers. It requires some knowledge of computer script for more complex experimental designs. However, E-Prime's website and user manual have been helpful with creating specific experimental designs and can be beneficial for researchers of different levels. When using E-Prime, it is suggested that one allow ample time to design the experiment.

As stated previously, the Bio-Behavioral Laboratory has not been frequently utilized, mainly due to the lack of awareness in the campus community. It is recommended that the new facilities be advertised as soon as they become available, and that announcements are made several times and in multiple formats. For instance, the labs can be advertised via an open house, flyers in faculty mailboxes, email announcements, and offering internal funds for faculty who use the lab for research and/or teaching. We found that the most successful means of advertising included an open house with refreshments and faculty mini-grants (i.e., internal funding).

The Medgraphics metabolic cart in the CSUSB RIMI Human Performance Lab is simple and easy to use. All of the equipment requires very specific protocols be followed. If they are not followed, the equipment will not function. Medgraphics technical support and user manuals are valuable for troubleshooting problems with the system. The Viasys system can also be challenging to run. When it has been idle for days, there may be problems with calibration. We also experienced issues with the heart rate monitor dropping its signal during measurement, which caused gaps in data collection. However, the Polar Heart Rate RS400 monitor [51] has been found to work well with the system. Technical support for Viasys was helpful in restoring the system back to operating order. The portability and its use of telemetry by the Viasys system makes it ideal for field studies which allows research subjects to travel distances without being attached to a computer. The BodPod is user friendly and comes with step-by-step operating instructions. The DXA is a useful tool in that it can measure body composition and bone density; however, the need for a license to operate the machine requires dedication by researchers who are interested in using it. Medgraphics, Viasys, BodPod, and other electronic equipment should be maintained and used properly to ensure optimal working conditions. Technical support should be contacted if questions arise about the equipment usage. Also, it is recommended that ample time be allocated for checking and calibrating the systems.

V. Conclusion

The success of educational institutions is dependent upon intra- and inter-campus connectivity and collaboration, efficient operation, and reduction in extraneous costs. Continuing budget cuts in education have made the issue of operational costs and preservation of resources a priority for every educational and research institution. In an effort to increase efficiency, reduce cost, and enhance collaboration with professionals within CSUSB and across institutions, the CSUSB RIMI program builds online learning communities and employs a variety of technologies. Some of the RIMI online communities with clearly shared goals and roles have been vibrant and active. Online learning communities that involve professionals in the health-related fields in addition to researchers in higher education are clearly needed.

Technologies used by the grant participants include, but are not limited to, course management systems (Blackboard and Moodle), Podcast, Wikis, Skype, Listserv, Doodle, Google Docs, various online forms, existing databases in different organizations, GIS, GPS, and technologies in three facilities: Teleconference Room, Bio-Behavioral Laboratory, and Human Performance Lab. All technologies have their strengths and limitations, and selecting the best technology based on the team's needs is crucial for success and effectiveness.

With strong leadership, the RIMI program has been strengthening the research infrastructure at CSUSB and enhancing the collaboration of scholars. The joint efforts of the RIMI communities on- and off-campus, and of health professionals in the field have been helping to reduce health disparities across racial and ethnic groups. It is our hope that the information presented herein will help scholars and professionals develop successful techniques for increasing health equity in their respective communities.

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