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Integration of Teaching Practice for Students' 21st Century Skills: Faculty Practice and Perception

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21st Century Skills, including critical thinking, collaboration, communication, creativity and innovation, self-direction, global and local connections, and using technology as tools for learning, are considered essential for success in the workplace by employers. To meet these career needs, many universities use a variety of instructional methods to develop these skills in their students and provide professional development for faculty to integrate newer teaching strategies for students' preparedness with 2st Century Skills (Hixson, Ravitz, & Whisman, 2012; Koehler, Mishra, & Yahya, 2007). However, few studies to date have explored the instructional practices used to develop these skills, nor the instructors' perceptions of their teaching practices related to these skills. The purpose of this study was to investigate the extent to which instructors attempted to develop students' 21st Century Skills in class settings (Attempt), believed students developed those skills in their classes (Belief), and felt they effectively assessed these skills in their students (Assessment). As an exploratory study, the multiple regression statistical analysis results revealed that all three aspects of faculty perceived attempt, belief, and assessment could, in combination, significantly predict faculty frequency of teaching for students' 21st Century Skills. The study also discusses the reliability of a newly developed questionnaire for this purpose, related limitations, and provides suggestions for future study.

Keywords: Teaching 21st Century Skills, critical thinking, faculty perception

INTRODUCTION

Over the past ten years, an increasing amount of attention has been given to the skills and abilities required for success in the workplace after graduation from high school or college (Dede, 2005; Dede, 2009; Dede, 2010a; McWilliam & Haukka, 2008; Kay &

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Greenhill, 2013; Voogt, Erstad, Dede, & Mishra, 2013; Kivunja, 2014a). These skills, often referred to as 21st Century Skills, include critical thinking, collaboration, communication, creativity and innovation, self-direction, making global connections, making local connections, and using technology as a tool for learning (Hixson, Ravitz, & Whisman, 2012). According to McWilliam and Haukka (2008), employers are seeking employees who possess skills that go beyond basic literacy, numeracy, and communication; they seek "creatives" (p.656) who are capable of using imaginative and symbolic thinking to analyze and solve problems. Employers expect new employees to be able to use critical thinking and effective communication skills with teams of peers in collaborative problem solving (Levy & Murnane, 2004; Lambert & Cuper, 2008). Although many universities attempt to develop these critical thinking and problem-solving skills in their students, few studies have investigated the instructional practices faculty use to develop the full range of 21st Century Skills. Clearly, more studies are needed to examine the practices teachers use to cultivate these skills in students to ensure that they are competent in the workplace after completing their education. Moreover, additional research is needed on the effect of these teaching practices on course and curriculum design and faculty development.

Today's students, described as "digital natives" (Prensky, 2001; 2009), regularly use a variety of technologies in their daily lives, and employers require employees to use these same technologies in the workplace after graduation. Mobile phones, tablets, laptops, learning management systems, and virtual classrooms are used to access social media, video, learning modules, courseware, e-learning, microlearning and other technology-based instruction. These technologies are used by both educators and employers to disseminate learning and workplace materials that must be used in collaborative work with others to solve real problems. In education, this approach, known as Problem-Based Learning and Project-based Learning (PBL) (Barrows, 1980, 1986; Barrows & Myers, 1993), is used to create authentic learning experiences. Research indicates that the integration of PBL with the intentional use of technologies creates a positive impact in preparing students for the world of work after graduation (Trilling & Fadel, 2009; Hixson, et al., 2012). Despite the fact that teachers understand the importance of 21st Century Skills, research indicates that these skills are not necessarily addressed in educational practice (Darling-Hammond et al., 2008; Shear, Novais, Means, Gallagher, & Langworthy, 2010; Symonds, Schwartz, & Ferguson, 2011; Fink, 2013; Voogt et al., 2013). As employers increasingly are demanding graduates who possess these 21st Century Skills, the present study investigated whether and how instructors use PBL and technologies together to develop 21st Century Skills in their students.

The present study was conducted by a cross-disciplinary research team at a large (22,000 students), Master's granting public university located in the mid-Atlantic region of the United States. At this university, students are encouraged to participate in a variety of experiential, service, and problem- and project-based learning experiences, and faculty members regularly use a range of technologies in their courses to address the learning needs of this generation of students. In the 2016-2017 academic year, this cross-disciplinary research team convened to examine whether the university's professors are creating intentional PBL opportunities that foster the development of critical 21st Century Skills, and how their attempt, belief, and assessment of these skills affect their teaching practice.

The research on 21st Century Skills extended prior research by the same team on how the various features of a learning management system influence the way instructors design courses and contribute to the overall student learning experience (Wilcox, Thall, & Griffin, 2016). The researchers determined it would be more informative to investigate the general approaches and specific practices taken by faculty to develop students' 21st Century Skills.

The present research study attempted to answer the following questions:

- How do faculty incorporate 21st Century Skills development into their teaching practices?
- How do faculty members' attempt, belief, and assessment of 21st Century Skills correlate with their frequency of integrating these skills into their teaching practices?
- What challenges do faculty perceive in integrating 21st Century Skills into their teaching practice?

To answer these questions, the researchers adopted a cross-sectional survey research design (Lindell & Whitney, 2001; Hall & Lavrakas, 2008). The study was conducted by an interdisciplinary team, from health education, human resource development, educational leadership, educational technology, and instructional design and evaluation. The same group collaboratively conducted several educational technology research projects over the past several years, with each individual contributing a discipline-specific perspective on teaching practice. Together, these individuals determined the context for the research methodology chosen in the present study.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

21st CENTURY SKILLS DEFINED

Over the past decade, much has been written about the importance of developing K-12 and college students' 21st Century Skills (Dede, 2005; McWilliam & Haukka, 2008; Dede, 2009; Kivunja, 2014a; Voogt et al., 2013). According to Trilling and Fadel (2009), 21st Century Skills encompass 4 key domains:

1. Core subjects and skills
2. Learning and innovation skills
3. Career and life skills
4. Digital literacy skills

The essential skills that are the focus of this study are subsumed under the domains of Learning and Innovation Skills, Career and Life Skills, and Digital Literacy Skills. Critical thinking, communication, and creativity and innovation are subcategories of Learning and Innovation. Collaboration, self-direction, making global connections, and making local connections are essential Career and Life Skills. Using technology as a tool for learning is related to computing, information, information and communication technology (ICT), and media literacy, which are all Digital Literacy Skills (Trilling & Fadel, 2009; Hixson et al., 2012; Kivunja, 2014b). Definitions of the 21st Century Skills investigated in this study are explained below, and primarily are derived from the work of Trilling and Fadel (2009), Hixton, et al. (2012), and Kivunja (2014a, 2014b).

Critical Thinking Skills enable students to analyze and evaluate difficult or complex problems for which there are no prescribed solutions. According to McCain (2005), critical thinking skills encompass time management, project management, research, project design, and teamwork, all of which are key process skills that facilitate problem solution in the real world. When students exercise critical thinking skills, they are able to research and evaluate the quality of information, conceptualize and develop original solutions for messy or ambiguous problems, and evaluate the appropriateness of their solutions. They also use critical thinking skills when comparing, drawing inferences, summarizing, analyzing and developing arguments.

Communication Skills are critical for working collaboratively and effectively in the 21st Century and are keys to ongoing learning and self-development throughout the lifespan. These skills enable students to convey their thoughts and ideas in oral, written, or nonverbal forms; listen effectively and then derive meaning, knowledge, values, and

attitudes from the interaction; use a variety of media effectively and appropriately to articulate, instruct, teach, motivate, or inform, and then evaluate whether the chosen media message reached the target audience.

Creativity and Innovation Skills are important 21st Century Skills that increasingly are desired by businesses. Historically, creativity was considered an innate ability that was possessed by artists and inventors and was not considered a teachable skill. Creativity and Innovation Skills enable students to think flexibly, to be open to new ideas, combine thoughts and ideas in new and original ways, use a wide range of idea generating techniques (like brainstorming) to develop original ideas, invent solutions, test ideas, demonstrate ideas, refine and evaluate their ideas, demonstrate originality, and use mistakes (failure) to inform new creative solutions.

Collaboration Skills involve working as part of a team to set common goals, analyze and solve problems, answer questions, conceptualize and create collaborative products, provide individual and team-based feedback, and evaluate the overall effectiveness of the team. Effective collaboration requires a willingness to listen to the ideas of others, the ability to be flexible, the ability to value the contributions of individual team members, the ability to share both responsibility and recognition for work achieved by the team, the ability to compromise, and the ability to be respectful of others.

Self-direction Skills refer to the ability to initiate plans and actions to solve problems, monitor individual progress, and use assessment criteria and peer feedback for modifications. In the 21st century, students are and will be faced with an inordinate amount of data that must be culled, examined, analyzed and categorized (Dede, 2009). These data are often incomplete, unreliable, or perverted. In order to assess the data and transform it into meaningful and usable information and knowledge, students must persist in the face of data incongruities and act using intuition and judgment based upon past experience. Because both work-centered and learning-centered problems are often ill-structured, students have multiple ways in which to seek solutions and thus must rely on their own self-directedness and autonomy to choose from among many possible solutions based on their own assessment of the information at hand (Barrows, 1996).

Global Connection Skills refer to the ability to comprehend and behave with an understanding of issues and experiences from different cultures, geographical locations, and global domains. Often considered the most difficult skills students need to acquire, global connection skills help students examine and analyze multiple forms of data that are deeply embedded in culture (norms, values, beliefs, ideologies, and assumptions about the world and the way it works) (Savin-Baden, 2014). These skills enable students to prosecute different knowledge structures and the underlying beliefs upon which they are based. By using active listening, observation, and sensing skills, students must practice the subtle and highly nuanced process of assessing backgrounds, language contexts, beliefs, motivations, and values through the lens of culture (Trilling & Fadel, 2009). The impact of the global digital economy coupled with the erosion of time, space, and place make global connection skills essential for knowledge workers who may live in one area of the world and work with people in another area of the world.

Local Connection Skills refer to the ability to connect with the local community, apply their knowledge to solve local issues, analyze different local stakeholders, and respond to needs from local community. There continues to be a growing emphasis on the importance of local community engagement and corresponding online platforms to both foster and speed community building (Ognyanova et. al, 2013). These highly engaged digital spaces help neighbors and their neighborhoods to keep track of demographic growth, school assessment, recreation, crime, green space, and urban/suburban planning. Especially significant in high density urban areas, characterized by diversity and high levels of economic productivity, these digital platforms offer mediated spaces for civic engagement,

political influence, communication, and entrepreneurship (Ball-Rokeach, Kim, & Matei, 2001; Robinson, 2014; Russell, 2011). Chen, Ball-Rokeach, Parks, and Huang (2012) argue that community civic engagement is enhanced through the use of dialogue and storytelling in online social platforms. Effective local connection skills are critical for students' deep understanding of, and participation in, their local communities.

Using Technology as a Tool for Learning Skills refer to the ability to use and select right technology for learning, access information, analyze, and interact with the right source of information. Often described as "digital natives" (Prensky, 2001), students of today have spent all of their lives accessing and using different technologies to live, learn, and work. Students' future careers will focus less on manual and routine tasks and more on accessing and manipulating abstract information (Voogt et. al, 2013). Students already have the basic skills to manage digital networking. However, while Millennial learners assert their claim to all things "digital", the rules, norms, and technical requirements for specific technology tools often allude them. Proper use of technology in pursuit of knowledge for learning requires a more sophisticated approach; one that takes into account: 1) the purpose, nature, and specifications of the technology ("tool literacy") (Tyner, 1998); 2) the need for resilience to persist through technical malfunction or glitches, and 3) the ability to discern the pedigree of information found on digital platforms ("literacies of representations") (Tyner, 1998). According to 21st Century Skills, learning is thought to be a function of four distinct skills: 1) "learning as a consumer of information, 2) learning as a producer of information, 3) learning in the development of social capital, and 4) learning in the development of intellectual capital" (Binkley et. al, 2012, p. 7). Skill in learning with and through digital technologies is essential for the 21st century workplace.

THEORETICAL/CONCEPTUAL FRAMEWORK

The conceptual framework used in this study displays the relationship between learning theories in which the research has been grounded, that is, Social Constructivism and Connectivism, the Key Domains represented (Learning & Innovation Skills, Career & Life Skills, Digital Literacy Skills), and the essential 21st Century Skills addressed in PBL. In the same teaching and learning scenarios of practice, the socially-connected instructors are assumed to be reflective practitioners that perceive: 1) their *Attempt* to develop these skills, 2) their *Belief* that their teaching practices intentionally developed these skills in their students, and 3) their effective *Assessment* of these skills (Figure 1).

Historically grounded in a *Social Constructivist* learning perspective, PBL involves the presentation of ill-structured problems where there is no single correct answer (Barrows, 2002; Walker & Leary, 2009). This affords students the opportunity to generate multiple solutions in pursuit of problem resolution, requiring them to draw on both their experiences and creativity when attempting to solve the problem. According to social constructivist theory, learners construct their knowledge through the interactions with others in a particular environmental context (Schunk, 2012). Therefore, a social constructivist learning environment is one that poses a problem for learners, and requires them to generate hypotheses, test ideas, and collaborate with others in the solution of the problem. In PBL environments, instructors play an important mentoring role by: 1) creating problems or scenarios that can scaffold students' deep thinking about hypotheses, 2) helping them test hypotheses with sound research design, 3) enabling students to collect valid information, 4) showing them how to effectively collaborate with others, and 5) clearly communicating the PBL results.

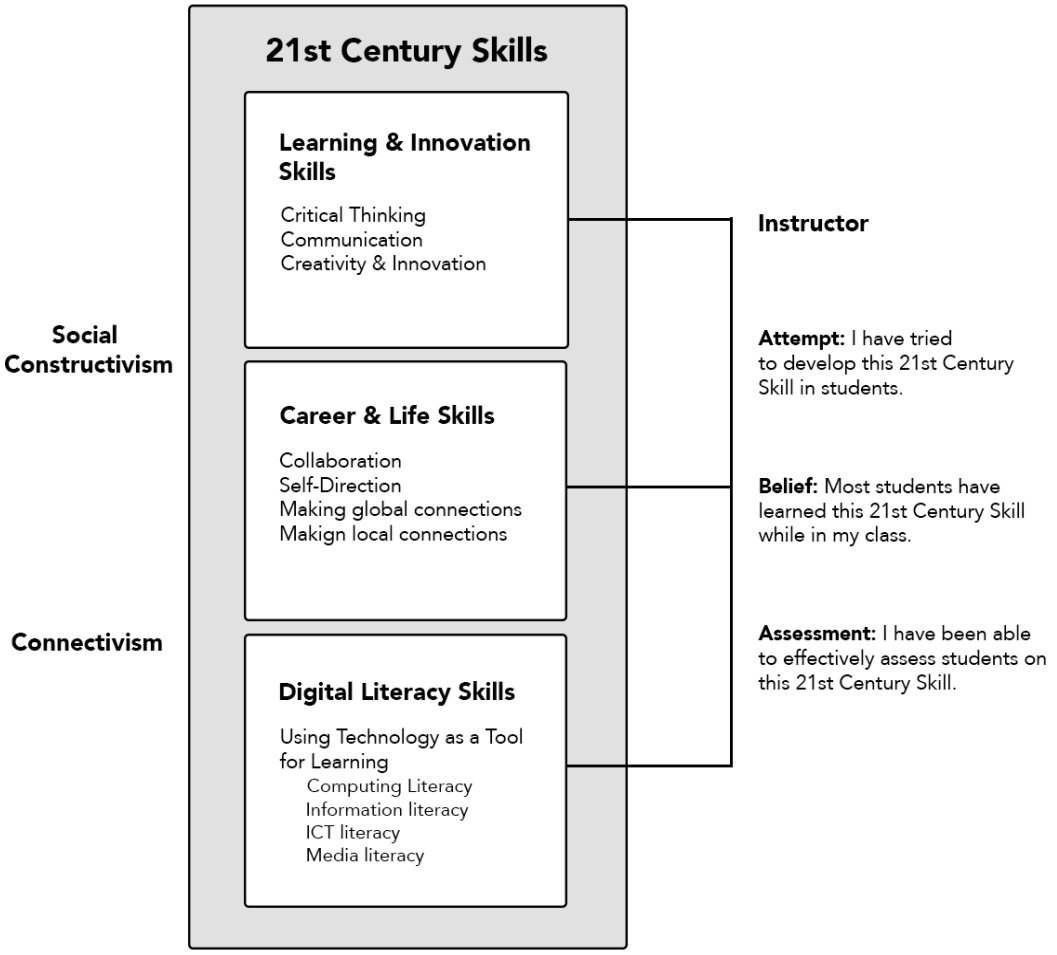

Figure 1. Theoretical/conceptual framework

Contextualized in a range of technologies and active teaching and learning strategies, the present study is associated with *Connectivism* (Siemens, 2005), a learning theory that attempts to explain learning in terms of sharing of information across people in a digital world. According to Connectivism, learning occurs through the connection of information sources (digital nodes) in a constantly changing environment. Connectivism's principles claim that learning is grounded in a diversity of opinions, rapidly shifting foundations, current trends, the capacity to know more, the nurturing and maintaining of connections, the ability to recognize connections, and the ability to decide what and how to learn within the shifting reality. When one considers the tremendous change in society, work processes, and information sharing practices since the advent of the Internet, and the range of new skills required to address this constantly shifting environment, it is easy to understand why Connectivism was proposed to explain learning in the digital age. According to Kivunja, (2014a, 2014b), we need to prepare our students for the connected digital age by teaching them skills that enable them to successfully navigate this information-laden world. These skills include digital literacy skills, especially using technology for life-long learning. For this reason, the present study is grounded in both social constructivism and connectivism, and together these form the basis of our conceptual framework (Figure 1).

METHODOLOGY

With the purpose of informing and improving teaching practices for relevant stakeholders in higher education, the study used a cross-sectional survey design through 4 phases that included: 1) *conceptualizatio*n, 2) *sample selection*, 3) *survey instrument design*, and 4) *cross-section survey operation to sample groups.* Those surveyed represented interdisciplinary groups in education during one academic year (Lindell & Whitney, 2001; Hall & Lavrakas, 2008) (Figure 2). The researchers determined sample selection of participants based on the literature review, the conceptualization of the study, and the research purpose and questions.

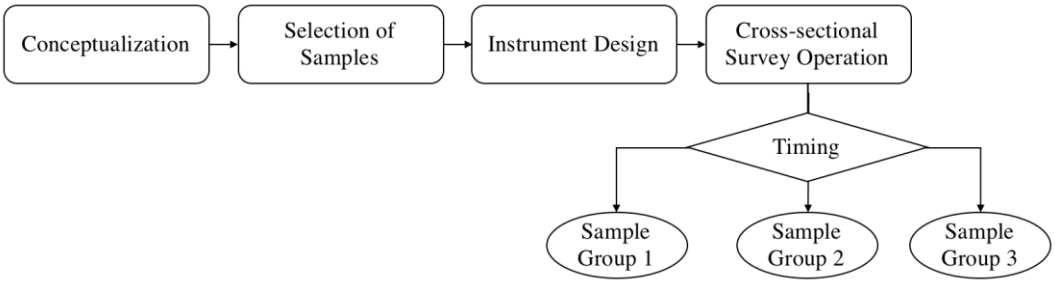

Figure 2. Cross-sectional survey design

PARTICIPANTS

Following the conceptualization at the literature review stage, the team selected sample populations at *Phase II* (Hall & Lavrakas, 2008). The population base included faculty members from a Master's Degree comprehensive university in the mid-east Atlantic region of the United States, and those representing a broader range of faculty members on listservs in educational technology, teacher education, and educational assessment. The rationale behind this selection was to cover a broad range of technology-using interdisciplinary faculty within a specific timeframe, who employed a variety of discipline-specific pedagogies (Hall & Lavrakas, 2008; Nielsen, Yarker, Randall, & Munir, 2009; Schneckenberg, 2009; Brownell & Tanner, 2012). Demographic data were not collected due to the length and anonymity of the survey and the primary purpose of the research.

SURVEY DEVELOPMENT

During *Phase III*, the researchers selected a survey instrument, the West Virginia 21st Century Teaching and Learning Survey (WVDE-CIS-28) (Hixson et al., 2012). After an online consultation with one author of the WVDE-CIS-28 survey, the team modified the questionnaire for the current study, with two focused areas of research interest. One focus consisted of eight sub-scales related to general teaching practices for the development of 8 categories of 21st Century Skills, including 1) *Critical Thinking*, 2) *Collaboration*, 3) *Communication*, 4) *Creativity & Innovation*, 5) *Self-Direction*, 6) *Making Global Connections*, 7) *Making Local Connections*, 8) *Using Technology as a Tool for Learning*. These practices were measured with a 5-point frequency scale, with 1=Almost never, 2=A few times a semester, 3=1~3 times per month, 4=1~3 times per week, and 5=Almost daily.

The second focus related to each of the eight categories of the 21st Century Skills and investigated whether the teachers attempted to develop the skills (Attempt), believed the skills were developed in their classes (Belief), or effectively assessed the development of these skills (Assessment). The attempt, belief, and assessment variables were measured with a 5-point scale, with 1=Not Really, 2=to a minor extent, 3=To a moderate extent, 4=To a great extent, and 5=To a very great extent. In addition to the reliability and validity

information presented in the existing literature, the researchers also established the reliability and face validity of the instrument by repeatedly reviewing the question stems and responses, and conducting a statistical reliability test (Fraenkel, Wallen, & Hyun, 2015). Presented in Table 1 are the questions for each of the 8 categories in the 21st Century Skills questionnaire.

Table 1. *Teaching for 21 Century Skills Survey: General Practice*

In your teaching of your classes, **how often** have you asked students to do the following:
Critical Thinking Skills
a. Compare information from different sources before completing a task or assignment?
b. Draw their own conclusions based on analysis of numbers, facts, or relevant information?
c. Summarize or create their own interpretation of what they have read or been taught?
d. Analyze competing arguments, perspectives, or solutions to a problem?
e. Develop a persuasive argument based on supporting evidence or reasoning?
f. Try to solve complex problems or answer questions that have no single correct solution or answer?
Collaboration Skills
a. Work in pairs or small groups to complete a task together?
b. Work with other students to set goals and create a plan for their team?
c. Create joint products using contributions from each student?
d. Present their group work to the class, teacher, or others?
e. Work as a team to incorporate feedback on group tasks or products?
f. Give feedback to peers or assess other students' work?
Communication Skills
a. Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs)?
b. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)
c. Prepare and deliver an oral presentation to the teacher or others?
d. Answer questions in front of an audience?
e. Decide how they will present their work or demonstrate their learning?
Creativity and Innovation Skills
a. Use idea creation techniques such as brainstorming or concept mapping?
b. Generate their own ideas about how to confront a problem or question?
c. Test out different ideas and work to improve them?
d. Invent a solution to a complex, open-ended question or problem?
e. Create an original product or performance to express their ideas?
Self-direction Skills
a. Take initiative when confronted with a difficult problem or question?
b. Choose their own topics of learning or questions to pursue?
c. Plan the steps they will take to accomplish a complex task?
d. Choose for themselves what examples to study or resources to use?
e. Monitor their own progress towards completion of a complex task and modify their work accordingly?

f. Use specific criteria to assess the quality of their work before it is completed?
g. Use peer, teacher, or expert feedback to revise their work?
Global Connections
a. Study information about other countries or cultures?
b. Use information or ideas that come from people in other countries or cultures?
c. Discuss issues related to global interdependency (for example, global environment trends, global market economy)?
d. Understand the life experiences of people in cultures besides their own?
e. Study the geography of distant countries?
f. Reflect on how their own experiences and local issues are connected to global issues?
Local Connections
a. Investigate topics or issues that are relevant to their family or community?
b. Apply what they are learning to local situations, issues or problems?
c. Talk to one or more members of the community about a class project or activity?
d. Analyze how different stakeholder groups or community members view an issue?
e. Respond to a question or task in a way that weighs the concerns of different community members or groups?
Using Technology as a Tool for Learning
a. Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?
b. Select appropriate technology tools or resources for completing a task?
c. Evaluate the credibility and relevance of online resources?
d. Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?
e. Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?
f. Use technology to support team work or collaboration (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?
g. Use technology to interact directly with experts or members of local/global communities?
h. Use technology to keep track of their work on extended tasks or assignments?

Table 2 presents the sub instrument (for Critical Thinking Skills) used to gather data on faculty's self-perceived attempt, belief, and assessment of teaching practices. This sub instrument was used to gather these data for all eight categories of 21st Century Skills. These two sub instruments with 50 questions and 2 additional open-ended questions were transformed to an online survey and were re-visited by the team for a face validity check in the online format.

Table 2. *Attempt, Belief, and Assessment of Teaching Critical Thinking Skills*

a. I have tried to develop students' critical thinking skills.
b. Most students have learned critical thinking skills while in my class.
c. I have been able to effectively assess students' critical thinking skills.

CROSS-SECTIONAL SURVEY OPERATION

After successfully soliciting the approval of the university's Institutional Review Board (IRB), the researchers used Qualtrics, an online survey platform, to distribute the questionnaire. An email invitation was sent through the university faculty listserv to all instructors who opted to use the listserv. The online survey was active for five weeks between late February and early April of 2017. During the summer of 2017, the researchers sent the survey link to the listservs of three professional organizations related to teaching, educational technology, and assessment with two intervals. The three deployments of the survey resulted in the receipt of 122 responses.

DATA ANALYSIS AND RESULTS

Since responses to the survey were not mandatory, some participants chose not to answer certain questions. After an initial data screening, the researchers decided to use the 76 complete datasets for data analysis. These complete datasets were used to analyze the reliability of the instrument in this current study, which differed from the context of Hixson, et al.'s (2012) K-12 study in that the present study was conducted primarily in a higher education setting. Statistical analyses were performed with IBM SPSS 24. Descriptive statistics were analyzed to answer Research Question 1. Canonical correlation analyses were performed to explore answers to the 2nd research question. Thematic analysis of responses to open-ended questions was used to answer Research Question 3.

ANALYSIS OF RELIABILITY

The results from the data analysis indicate that the Cronbach's alpha reliability estimates for the complete scale and subscales are comparable to those obtained in Hixson et al.'s (2012) study, as presented in Table 3. This provided the foundation for further data analysis - to examine the correlation between each subscale of the frequency of teaching 21st Century Skills and the instructor's attempt, belief, and assessment.

Table 3. *Reliability of Teaching 21st Century Skills Instrument*

	Cronbach's alpha
All Items	.950
Critical Thinking Skills Sub-scale	.877
Collaboration	.899
Communication	.848
Creativity and Innovation	.892
Self-Direction	.902
Global Connections	.922
Local Connections	.904
Using Technology as a Tool for Learning	.879

For each of the eight categories of 21st Century Skills, there was an accompanying sub-scale that investigated the extent to which instructors tried to develop the skills, the extent to which they believed the students learned the skills in class, and the extent to which they were able to assess these skills in their students, as below.

DESCRIPTIVE STATISTICS OF FACULTY TEACHING PRACTICES FOR 21ST CENTURY SKILLS

The teaching practices used to develop 21st Century Skills were measured with a 5-point frequency scale, with 1=Almost never, 2=A few times a semester, 3=1~3 times per month, 4=1~3 times per week, and 5=Almost daily. Descriptive statistics were obtained to answer Research Question 1, How do faculty incorporate 21st Century Skill development into their teaching practices?

An examination of the descriptive statistics by category indicated that instructors felt several skills received more development than others. The Critical Thinking Skills most frequently developed allowed students to *Draw their own conclusions based on analysis of numbers, facts, or relevant information* (46.97%), and *Summarize or create their own interpretation of what they have read or been taught* (43.94%). In Collaboration Skills, they most frequently had students *Work in pairs or small groups to complete a task together* (40.63%).

Other Critical Thinking Skills that were developed to a lesser extent included letting students *Try to solve complex problems or answer questions that have no single correct solution or answer* (36.36%), *Analyze competing arguments, perspectives, or solutions to a problem* (34.85%), and *Compare information from different sources before completing a task or assignment* (31.82%). Communication Skills that were more frequently developed included having students *Answer questions in front of an audience* (33.87%).

In terms of Self-direction skills, teaching students to *Use specific criteria to assess the quality of their work before it is completed* (35.48%) was frequently practiced. In the Using Technology as Tool for Learning Skills subscale, student were frequently taught to *Select appropriate technology tools or resources for completing a task* (30.51%), *Evaluate the credibility and relevance of online resources* (32.20%), and *Use technology to keep track of their work on extended tasks or assignments* (30.51%). The detailed results are presented in Appendix 1.

CORRELATION BETWEEN FACULTY ATTEMPT, BELIEF, AND ASSESSMENT AND TEACHING 21ST CENTURY SKILLS

Table 4. Canonical correlation analysis results

Attempt/Belief /Assessment	Subscales	Correlation	Wilks Statistic	*F*	*Sig.*
Set of 3 of all Attempt, Belief, and Assessment	Critical Thinking	.767	.358	4.418	.000
	Collaboration	.797	.274	5.945	.000
	Communication	.720	.400	4.871	.000
	Creativity and Innovation	.895	.174	10.777	.000
	Self-direction	.841	.232	5.922	.000
	Global connections	.897	.137	10.106	.000
	Local connections	.904	.139	12.308	.000
	Using Tech as Tool for Learning	.491	.585	1.426	.101
Set of any 2 among Attempt, Belief , and Assessment	Critical Thinking	.325	.868	.952	.488
	Collaboration	.456	.751	2.029	.035
	Communication	.408	.830	1.662	.113
	Creativity and Innovation	.298	.874	1.168	.323

	Self-direction	.408	.791	1.371	.188
	Global connections	.527	.702	2.476	.010
	Local connections	.392	.765	2.330	.023
	Using Tech as Tool for Learning	.421	.771	1.168	.309
Set of any 1 among Attempt, Belief , or Assessment	Critical Thinking	.171	.971	.496	.738
	Collaboration	.228	.948	.917	.459
	Communication	.066	.996	.100	.960
	Creativity and Innovation	.202	.959	.963	.416
	Self-direction	.226	.949	.721	.610
	Global connections	.166	.972	.460	.765
	Local connections	.310	.904	2.344	.081
	Using Tech as Tool for Learning	.250	.937	.669	.675

A multiple regression analysis was conducted to explore the correlation between faculty self-perceived attempt, belief, and assessment in a specific category and the frequency of their teaching practices with 21st Century Skills. A canonical correlation procedure was selected for the exploration because it was possible to have different configurations and combinations for the independent variables of perceived attempt, belief, and assessment when analyzing the correlations with the sets of subcategories of 21st Century Skills (Meyers, Gamst, & Guarino, 2016).

The exploratory results of the canonical correlation analysis reveal that the combination of attempt, belief, and assessment correlate significantly with all 8 sub scales of teaching for 21st Century Skills (p <.001). The combination of any two among attempt, belief, and assessment correlate fairly significantly with teaching Collaboration, Global Connections, and Local Connections skills (p <.05) (Table 4). However, any single factor among the attempt, belief, and assessment did not significantly correlate with the frequency of teaching practice.

To further analyze the correlation, a general multiple regression was performed between each of the 8 categories and the attempt, belief, and assessment in that specific category (Appendix 2). In scaffolding student *Communication Skills*, all practices related to presentation format, manner, and responsiveness, with the exception of *Structuring data for presentation*, were significantly correlated with the instructors' attempt, belief, and assessment (p < .01). Four practices in scaffolding students' *using technology to learn* were not significantly correlated with instructors' attempt, belief, and assessment. These were practices related to *using technology to evaluate information*, *analyzing information*, *connecting to community experts or members*, and *keeping track of tasks*.

CHALLENGES IN TEACHING 21ST CENTURY SKILLS

To answer Research Question 3, an applied thematic analysis was performed to analyze the responses to two open-ended questions (Guest, MacQueen, & Namey, 2011). One question invited responses related to barriers in adopting 21st century teaching practices; the other asked about perceived challenges in teaching digital literacy skills to students. In addition to some attempts to clarify the definition of digital literacy, the participants perceived the following challenges:

Time: Time spent on learning newer teaching practices and technologies is not always rewarding. Class time is limited and should focus on subject content areas.

> "Because time is short, I'm not able to learn a new technology while trying to deliver a challenging curriculum."

Pressure of tenure and promotion: attention is needed to focus on generating scholarship.

> "It takes a lot of extra time to plan and implement innovative teaching strategies in the beginning, which means taking time away from scholarship which can be detrimental for tenure and promotion. Going above and beyond in the area of teaching is not always rewarded in proportion to the effort it requires."

Risk effect: the risk of failure in adopting new methods and technologies and the risk of receiving poor evaluations from students are noted concerns.

> "I think that there is sometimes a steep learning curve in adopting new technologies, but the university culture is one of safety and if you want job security, you go with safe. If there was more institutional support in adopting new technologies and strategies, it would be so much easier."

Student readiness, *resources*, and *institutional support* were other representative themes expressed by the survey respondents.

> "The primary challenge has been in getting students to spend sufficient time to use the sources appropriately."
>
> "Not all departments have adequate funding to sustain innovative technologies."
>
> "One of the biggest challenges I have faced is in terms of incoming students' lack of digital literacy skills."
>
> "I consider the risks associated with lack of administrative, departmental, institutional buy-in of the IT-enabled pedagogy aiming at developing the 21st Century Skills the highest barrier to adopting innovative technologies. The lack of technical support and students' and faculty's resistance to change I also perceive as substantial barriers."
>
> "Up to date digital technology for classroom use and enough professional development support to ensure I am up to date on the technologies I am employing. The digital space develops rapidly and requires a significant time to understand and integrate technology and the digital environment."

DISCUSSIONS AND CONCLUSIONS

Based on a sample that blended instructors in one comprehensive university in the United States and those from several education professional organizations, this research studied the teaching practices used to scaffold students' development of 21st Century Skills in 8 categories. In addition, the study investigated the correlation between instructors' teaching practices and their perceptions that they **attempted** to develop these 21st Century Skills, **believed** the skills were developed in class, and effectively **assessed** the development of the skills. Using an instrument with acceptable reliability estimates for the whole instrument and sub-scales, the study concluded that the surveyed instructors used a broad variety of approaches to develop students' 21st Century Skills in eight categories, including *critical thinking, collaboration, communication, creativity and innovation, self-direction, making global connections*, *making local connections*, and *using technology to learn.*

The results of the data analysis indicated that over 1/3 of surveyed participants frequently used all or some teaching practices to develop students' 21st Century Skills in *critical thinking*, *collaboration*, *communication*, *self-direction*, *and using technology as a tool to learn*. The instructors' attempt, belief, and assessment, all combined, were correlated in a statistically significant way with teaching each of the 8 categories of 21st Century Skills. Any two combinations correlated fairly significantly with teaching *Collaboration*, *Making Global Connections*, and *Making Local Connections skills*. In scaffolding student *communication skills*, all practices related to presentation format, manner, and responsiveness, except for *structuring data for presentation*, were correlated in a statistically significant way with the instructors' attempt, belief, and assessment. For *Using Technology as a Tool for Learning*, only two of seven skills had statistically significant correlations with all three faculty perceptions (attempt, belief, assessment). These were *Using Technology for Self-Instruction* and *Using Technology for Teamwork or Collaboration*. All other skills were either not taught in class, that is, the instructors did not believe the students learned the skills in class, or the instructors were unable to effectively assess the development of these skills in their classes. These results imply that information literacy education with appropriate teaching strategies is necessary.

The results of the present study indicate that the faculty surveyed made a conscious effort to develop certain subcategories of communication skills, critical thinking skills, self-direction skills, and collaboration skills. However, the lack of emphasis on teaching practices related to using technology for learning is somewhat alarming given the reputation of Millennial and Post Millennial learners as avid technology users. As today's students have been raised with technology, many instructors assume that their students are naturally more skilled in using technology for learning. Consequently, they can possibly not make an active attempt to help students develop technology skills for learning. While Millennial and Post-Millennial students may be familiar with learning technologies, it might be misleading for instructors to assume that familiarity with technology equates with expertise in technology use. New technologies are developed and released at a prodigious pace, and students are continuously overloaded with multiple channels of information. Given the vast numbers of technologies and many avenues for obtaining knowledge, many students simply have not had the opportunity to adopt new learning technologies or develop appropriate strategies for integrating them into their school work. It is the responsibility of instructors and educational institutions to help students realize the potential of technology learning tools by creatively integrating the technologies into their class activities.

Virtual reality is an example of a technology that has the potential to profoundly change the learning experience but has few expert users among Millennial and Post Millennial learners. While few students have experienced it, even fewer instructors have used it in their classes. But for some content areas, such as medical education or chemistry, the visualization of content afforded in virtual reality enables students to create realistic mental models that solidify and expand the learner's understanding of the content. For example, cubic and hexagonal close packing in chemistry is difficult to visualize for most learners. In virtual reality, though, learners can walk around the spheres, view them from above, or view them from below, gaining a complete understanding of how close packing works. This would be difficult, if not impossible, to convey in another technology that relied on 2-dimensional objects. Therefore, instructors need to be thoughtful when selecting appropriate learning technologies to use in their classes and actively model the best strategies and approaches for using the technologies in the learning environment.

The present study has the ability to make a contribution to the literature, as it is one of only a few studies that have examined instructors' intentional development of 21st Century Skills in Millennial and Post Millennial students. However, the results must be interpreted with caution as the sample size was small, which may affect the generalizability of results

to other institutions and settings. To extend their research, the instructors are planning to continue their study with an alternative research design, for instance, collecting similar survey data from a student population, and conducting interviews and/or focus groups to further the investigation. Another future direction is to define the teaching and learning practice such as *structuring data for presentation* to identify its' scope and details of specific and/or interdisciplinary practice.

The researchers are also interested in gathering information from college students on their perceptions of 21st Century Skills. Do they feel like these skills are being embedded in their curriculum? Do they feel these skills are important? Do they feel adequately prepared to enter the workforce with the skill set they have developed in school? How do students feel educational institutions can better prepare them for a continuously evolving work life after school?

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APPENDEICES

APPENDIX 1

Frequency of Teaching 21st Century Skills

Category/Questions	Almost never	A few times a semester	1-3 times per month	1-3 times per week	Almost always

Critical Thinking Skills					
Compare information from different sources before completing a task or assignment?	3.03%	39.39%	13.64%	12.12%	31.82%
Draw their own conclusions based on analysis of numbers, facts, or relevant information?	1.52%	15.15%	16.67%	19.70%	46.97%
Summarize or create their own interpretation of what they have read or been taught?	0.00%	22.73%	18.18%	15.15%	43.94%
Analyze competing arguments, perspectives or solutions to a problem?	9.09%	22.73%	16.67%	16.67%	34.85%
Develop a persuasive argument based on supporting evidence or reasoning?	7.58%	28.79%	24.24%	15.15%	24.24%
Try to solve complex problems or answer questions that have no single correct solution or answer?	4.55%	22.73%	21.21%	15.15%	36.36%
Collaboration Skills					
Work in pairs or small groups to complete a task together?	6.25%	15.63%	20.31%	17.19%	40.63%
Work with other students to set goals and create a plan for their team?	20.31%	32.81%	15.63%	12.50%	18.75%
Create joint products using contributions from each student?	21.88%	35.94%	17.19%	6.25%	18.75%
Present their group work to the class, teacher or others?	14.06%	39.06%	15.63%	7.81%	23.44%
Work as a team to incorporate feedback on group tasks or products?	25.00%	34.38%	12.50%	10.94%	17.19%
Give feedback to peers or assess other students at work?	20.63%	33.33%	19.05%	9.52%	17.46%
Communication Skills					
Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	32.26%	27.42%	16.13%	8.06%	16.13%
Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	22.58%	41.94%	14.52%	8.06%	12.90%
Prepare and deliver an oral presentation to the teacher or others?	16.13%	40.32%	14.52%	9.68%	19.35%
Answer questions in front of an audience?	11.29%	35.48%	9.68%	9.68%	33.87%

Decide how they will present their work or demonstrate their learning?	24.19%	35.48%	14.52%	11.29%	14.52%
Creativity and Innovation Skills					
Create an original product or performance to express their ideas?	32.26%	32.26%	14.52%	8.06%	12.90%
Invent a solution to a complex, open-ended question or problem?	17.74%	37.10%	17.74%	11.29%	16.13%
Test out different ideas and work to improve them?	22.58%	30.65%	20.97%	6.45%	19.35%
Generate their own ideas about how to confront a problem or question?	6.45%	38.71%	16.13%	9.68%	29.03%
Use idea creation techniques such as brainstorming or concept mapping?	35.48%	24.19%	11.29%	16.13%	12.90%
Self-direction Skills					
Take initiative when confronted with a difficult problem or question?	8.06%	22.58%	19.35%	20.97%	29.03%
Choose their own topics of learning or questions to pursue?	20.97%	29.03%	12.90%	12.90%	24.19%
Plan the steps they will take to accomplish a complex task?	11.29%	40.32%	14.52%	9.68%	24.19%
Choose for themselves what examples to study or resources to use?	12.90%	30.65%	22.58%	8.06%	25.81%
Monitor their own progress towards completion of a complex task and modify their work accordingly?	17.74%	27.42%	12.90%	14.52%	27.42%
Use specific criteria to assess the quality of their work before it is completed?	8.06%	32.26%	14.52%	9.68%	35.48%
Use peer, teacher or expert feedback to revise their work?	12.90%	27.42%	17.74%	14.52%	27.42%
Making Global Connections Skills					
Study information about other countries or cultures?	30.51%	30.51%	13.56%	8.47%	16.95%
Use information or ideas that come from people in other countries or cultures?	20.34%	37.29%	16.95%	11.86%	13.56%
Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	32.20%	33.90%	6.78%	16.95%	10.17%

Understand the life experiences of people in cultures besides their own?	13.56%	42.37%	16.95%	8.47%	18.64%
Study the geography of distant countries?	69.49%	16.95%	0.00%	5.08%	8.47%
Reflect on how their own experiences and local issues are connected to global issues?	28.81%	25.42%	13.56%	16.95%	15.25%
Making Local Connections Skills					
Investigate topics or issues that are relevant to their family or community?	22.03%	25.42%	15.25%	13.56%	23.73%
Apply what they are learning to local situations, issues or problems?	22.03%	32.20%	10.17%	13.56%	22.03%
Talk to one or more members of the community about a class project or activity?	50.85%	25.42%	5.08%	8.47%	10.17%
Analyze how different stakeholder groups or community members view an issue?	44.07%	22.03%	8.47%	11.86%	13.56%
Respond to a question or task in a way that weighs the concerns of different community members or groups?	45.76%	15.25%	10.17%	11.86%	16.95%
Using Technology as a Tool for Learning Skills					
Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	22.03%	23.73%	13.56%	18.64%	22.03%
Select appropriate technology tools or resources for completing a task?	15.25%	25.42%	15.25%	13.56%	30.51%
Evaluate the credibility and relevance of online resources?	20.34%	23.73%	11.86%	11.86%	32.20%
Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?	28.81%	25.42%	20.34%	8.47%	16.95%
Use technology to help them share information?	17.24%	29.31%	12.07%	13.79%	27.59%
Use technology to support team work or collaboration?	16.95%	28.81%	15.25%	10.17%	28.81%
Use technology to interact directly with experts or members of local/global communities?	62.07%	15.52%	10.34%	5.17%	6.90%
Use technology to keep track of their work on extended tasks or assignments?	28.81%	22.03%	11.86%	6.78%	30.51%

APPENDIX 2

Correlation between Frequency of Teaching Practice in Developing Student 21st Century Skills and Teacher's Attempt, Belief, and Assessment

Critical Thinking Skills	**Attempt**	**Belief**	**Assessment**
Compare information from different sources before completing a task or assignment?	.525**	.581**	.541**
Draw their own conclusions based on analysis of numbers, facts, or relevant information?	.447**	.420**	.381**
Summarize or create their own interpretation of what they have read or been taught?	.488**	.452**	.534**
Analyze competing arguments, perspectives or solutions to a problem?	.639**	.557**	.549**
Develop a persuasive argument based on supporting evidence or reasoning?	.522**	.540**	.548**
Try to solve complex problems or answer questions that have no single correct solution or answer?	.638**	.472**	.470**
Collaboration Skills	**Attempt**	**Belief**	**Assessment**
Work in pairs or small groups to complete a task together?	.687**	.564**	.323**
Work with other students to set goals and create a plan for their team?	.644**	.609**	.460**
Create joint products using contributions from each student?	.579**	.526**	.487**
Present their group work to the class, teacher or others?	.606**	.553**	.526**
Work as a team to incorporate feedback on group tasks or products?	.582**	.598**	.537**
Give feedback to peers or assess other students' work	.563**	.578**	.542**
Creativity and Innovation Skills	**Attempt**	**Belief**	**Assessment**
Use idea creation techniques such as brainstorming or concept mapping?	.664**	.662**	.686**
Generate their own ideas about how to confront a problem or question?	.648**	.663**	.613**
Test out different ideas and work to improve them?	.679**	.703**	.658**
Invent a solution to a complex, open-ended question or problem?	.721**	.695**	.702**

Create an original product or performance to express their ideas?	.696**	.788**	.787**
Self-Direction Skills	**Attempt**	**Belief**	**Assessment**
Take initiative when confronted with a difficult problem or question?	.580**	.508**	.468**
Choose their own topics of learning or questions to pursue?	.568**	.635**	.597**
Plan the steps they will take to accomplish a complex task?	.683**	.689**	.712**
Choose for themselves what examples to study or resources to use?	.633**	.615**	.571**
Monitor their own progress towards completion of a complex task and modify their work accordingly?	.683**	.595**	.601**
Use specific criteria to assess the quality of their work before it is completed?	.531**	.503**	.545**
Use peer, teacher or expert feedback to revise their work?	.644**	.561**	.577**
Global Connections Skills	**Attempt**	**Belief**	**Assessment**
Study information about other countries or cultures?	.773**	.741**	.623**
Use information or ideas that come from people in other countries or cultures?	.849**	.754**	.609**
Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	.716**	.656**	.593**
Understand the life experiences of people in cultures besides their own?	.817**	.760**	.628**
Study the geography of distant countries?	.496**	.522**	.580**
Reflect on how their own experiences and local issues are connected to global issues?	.762**	.736**	.716**
Local Connections Skills	**Attempt**	**Belief**	**Assessment**
Investigate topics or issues that are relevant to their family or community?	.766**	.692**	.651**
Apply what they are learning to local situations, issues or problems?	.743**	.640**	.637**
Talk to one or more members of the community about a class project or activity?	.780**	.767**	.767**

Analyze how different stakeholder groups or community members view an issue?	.755**	.743**	.728**
Respond to a question or task in a way that weighs the concerns of different community members or groups?	.717**	.643**	.734**
Communication Skills	**Attempt**	**Belief**	**Assessment**
Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	.253*	.207	.192
Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	.535**	.604**	.620**
Prepare and deliver an oral presentation to the teacher or others?	.653**	.636**	.556**
Answer questions in front of an audience?	.555**	.529**	.461**
Decide how they will present their work or demonstrate their learning?	.570**	.625**	.612**
Using Technology as a Tool for Learning Skills	**Attempt**	**Belief**	**Assessment**
Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	.304*	.340**	.279*
Select appropriate technology tools or resources for completing a task?	.226	.286*	.269*
Evaluate the credibility and relevance of online resources?	.043	.140	.197
Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?	.183	.174	.256*
Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	.135	.252*	.284*
Use technology to support team work or collaboration (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?	.343**	.412**	.385**
Use technology to interact directly with experts or members of local/global communities?	.114	.234	.284*
Use technology to keep track of their work on extended tasks or assignments?	.073	.178	.276*

**. Correlation is significant at the 0.01 level. *. Correlation significant is at the 0.05 level.