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Medical Students' Experiences of a Project Design

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Abstract
Human capital plays a major role in bringing about appropriate changes in the social and economic areas of a country. In this light, the first president of the Republic of Kazakhstan Nursultan Nazarbayev has launched the program *Ruhani zhang'yru (Spiritual Renewal)*. This program embodies diverse activities oriented to trigger fundamental shifts in people's mind such as the translation of international books into Kazakh, the transition from the Cyrillic to the Latin script for the Kazakh language and other components that would help modernize the culture. Education is one of the key tools to accelerate such a paradigm change. In light of the above Karaganda State Medical University with its approximate 8000 students is contributing to the realization of the *Ruhani zhang'yru* program. A pilot project has been launched at the department of the History of Kazakhstan, whereby 25 medical students from the General Medicine specialty have been taking part. Their research interests are dedicated to examining possible issues that may hinder the paradigm from changing successfully. The students conducted their research over a ten-week period from October, 2018 to December, 2018, when they presented their results. Overall, five focus group discussions and 25 surveys were conducted to explore this phenomenon. The advantages and disadvantages of the pilot project will be presented at the IAFOR ERI conference to receive feedback from the participants. This will be helpful in improving the structure of the pilot project and making it more efficient for next year.

Keywords: project design, public consciousness, students' experiences

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Introduction

Rukhani zhang'yru [translated as spiritual renewal; hereinafter referred to as the Program), which was established by the first President Nursultan Nazarbayev (hereinafter referred to as the First President) contains a pivotal clause that calls upon the engagement of the Kazakhstani nation as a whole. As the First President mentioned in the Program the major political and economic modernization plans have been undertaken and now the third wave shifted focus to the modernization of consciousness (Nazarbayev, 2017). Indeed, it is a long and implicit process that is difficult to measure. Nevertheless, the First President identified the six dimensions that would be incorporated in the modernization of consciousness and suggested six projects to develop the program further.

The first dimension is "compatibility." The First President believes that, at minimum, the Kazakhstani nation requires the three skills related to computer knowledge, foreign language proficiency, and cultural openness (Nazarbayev, 2017). The second is "pragmatism", which is significant to the current study because it is related to the altering of some stereotypes and habits. Stereotypes are ingrained in almost every sphere of life and shape the way people choose their major, educate themselves, participate in sports, and conduct themselves within their families, and it is only by changing previously formed some stereotypes that we can move forward as a nation. The third dimension is the "maintenance of a national identity" by eliminating some elements currently present in the Kazakhstani culture that precludes the harmonic development of the society. The fourth is "cult of knowledge", which also relates to this study since education is instrumental in the development of critical thinking skills that, in turn, nurture flexibility and adaptability skills that help the individual to deal with constant changes. The First President has underlined the significance of education because the younger generation has to be prepared to readily upgrade their qualifications and adjust to permanent global changes (Nazarbayev, 2017). Finally, the fifth and the sixth dimensions have similar content, suggesting the necessity of making wise decisions regarding global issues and to being open to learning from foreign experiences respectively. This is very important as more than 100 different nationalities reside in Kazakhstan, and over 70 of these nationalities have lived in peace as one family, and this should be sustained.

Regarding the six projects suggested by the First President, several activities have been conducted at both national and international levels to introduce the Kazakh culture to the rest of the world; the implementation of these would be better covered in a separate article.

At Karaganda Medical University, university leaders have launched small projects through a project-based learning approach where students identified areas of social issues, hence, providing them the space to formulate their research. This ensures sense of ownership and responsibility for their own projects. It has been recommended that they communicate with each other as well as with other groups of students who have reached different phases in their academic pursuits in Russian, Kazakh and English medium educational establishments. Through this they will interact and develop cultural openness and improve their language proficiency skills, both of which are aligned to the dimensions provided in the Program.

Literature Review

A project-based learning (hereinafter referred to as PBL) is a convenient approach to explore different social issues within the frame of the *Rukhani zhang'yru* program objectives. International experiences show that this approach has been employed to engage learners in a way that triggers their interest in current social problems via their involvement in projects at the school level (Holthuis, Deutscher, Schultz, and Jamshidi, 2018), through the collaboration efforts of schools and universities (Hunter and Botchwey, 2017), in addressing existing issues with members of non-governmental organizations (Banakhr, Iqbal and Shaukat, 2018; Deepamala and Shobha, 2018; Arantes do Amaral and Lino dos Santos, 2018), and by improving students' soft skills by launching long-term projects (Hamon, Casani, Pomeda-Rodriguez and Albacete, 2017). On that account, this study used project-based learning (PBL) to explore issues that impede the social development, and thus, the modernizing of public consciousness, according to the students' findings.

Another convenience of the PBL as it applies to this study, is that the research design can be developed, and then adapted for any component. For example, a study undertaken by Kazun and Pastukhova (2018) presented five countries' experiences using PBL. It was found that in Finland, PBL is used to develop social and communicative skills. Furthermore, in France, the main focus within the implementation of PBL was applying the research results for industrial and practical purposes. In Australia, the PBL approach was oriented to the development of innovation technologies, whereas in China it was utilized to address ecological issues and to enhance foreign language acquisition. On top of that, in the USA, most forms of PBL are utilized in project-based experiences and in schools and universities, this approach is largely employed. These experiences show that depending on weaknesses or areas in need of improvement, PBL can be employed, adapted, and developed by project participants. In the Kazakhstani context, the best projects launched by students might be further explored by other undergraduate students or scholars studying at the master's and doctoral levels.

During collaborative work different roles emerge among the participants. The students of this study were allocated greater freedom to run their own projects. This means that there was no tutor to distribute tasks equally among them. In this regard, they were responsible for setting the time-frame for each section of the project, assigning the various tasks, and maintaining discipline. This entailed the emergence of the diverse behaviors and attitudes of peers while examining social issues. For instance, Zavyalova and Saginova (2017) in their study at Plekhanov Russian Economic University (Moscow, Russia) have found different types of student behavior during completion of their project. This project required much effort on the part of the participants to get along with others, and in this respect, the authors have pinpointed four types of behaviors. The first is 'chalyavsh'iki' [translated from Russian to mean *freeloaders*]. These are students who mainly rely on other students work without contributing their own labor to the work. The second type is the 'dictator.' These are leaders that have concerns about and are distrustful of the other group members, and thus attempt to undertake all initiatives and tasks themselves. The 'procrastinator' is the third type. These students postpone their work to the last moment and cause tension among their groupmates. The final type is the 'zhalobsh'iki' [or *complainers*]. As the name suggests, they continually complain

about their assigned work to their groupmates. Hence, these are the major behavioral types which were noted by Zavyalova and Saginova (2017), and which appear during the implementation of project-based learning. In this regard, Kazakhstani students are no exception. Their possible and unconscious behavior with the four types of behaviors, has been researched in this study.

Hence, this study aimed to explore students' experiences with project design. This paper consists of two sections. The first is the methodology, and the second is the findings and subsequent discussion. In the conclusion section the main experiences of the students are presented.

Methodology

This is a qualitative study that helps to examine a particular issue in-depth and highlight participants' perceptions of the process (Creswell, 2012). A survey questionnaire and focus group discussions were employed to explore students' experiences regarding PBL. The survey consisted of twelve questions, nine of which were related to their project experiences. The focus group questions were related to the challenges and the overall process of conducting the project. In this regard, 23 out of 25 students took part in the survey and focus group discussions; two students were absent due to health issues. 65% of the respondents were female and 35% were male students. Their age varied from 17 to 23 years, the majority of whom 48% (11) were 18 years old and 36% (8) were 19 years old. In addition, in order to develop a holistic picture of students' experiences, their contribution to the project was observed weekly. These results were evaluated by the Vice-Rector for Education, who, after presentations given by the students, provided them with feedback regarding the strengths and weaknesses of each project according to a prepared rubric. The survey questions that were closed-ended were purposefully unused in order to avoid imposing prescribed prejudices on students. Document analysis was undertaken and encompassed the students' project materials.

Findings and Discussions

The members of the student theme were diverse. They struggled to form the theme because they encountered challenges defining their idea of the modernization of consciousness. After thought provoking discussion, they came up with the following areas of research. The first group decided to explore students' sport habits. This was related to whether they practice sports, how often, what kinds of sports they practice, and whether they exercise in the morning. Additionally, they looked at whether there is enough sporting equipment at university campuses. The second group decided to explore students' superstitions that could come up during exams as there are many superstitious beliefs in the society. They examined students from first to fifth year of university and found some interesting facts. The third group came up with the idea of examining the extent to which values between the students and their parents vary. This group interviewed their parents, and from their responses, generated statistics regarding the respondents' values, and then used this model to create a values scale. The fourth group was concerned with the necessity of including social sciences in the curriculum of medical students. By the end of their research, this group understood why subject matters related to the social sciences are important to them. Finally, the fifth group was interested in competencies. Their main interested dealt with

comparing how local and international students tried to identify the list of core competencies of medical students. Students narratives regarding their experiences and research findings is expected to be published in another article which is on the process of negotiation.

The research results revealed inconsistencies between the data collected from the survey and focus group discussions, and weekly observations of the students accomplishing the tasks designed to fulfill the requirements of the project. After making decisions regarding elements of the project work with the students, informal talks with group leaders helped to counteract the indifference of some students. A work plan was prepared (a table with empty lines) where each week, before at the start of the class, students listed the project-related tasks that were to be done either individually or in their group. This sheet was developed for each group with the aim of having students learn to plan their work in advance and take the responsibility of finishing the project on time. In order to avoid placing pressure on the students, the sheets were left on a table and filling it in was optional. Two of the groups had members that have written their reflections on the project and printed them out for each member to read. Yet another group failed to enter anything in the work plan, either before or after their project presentation. However, in the survey 92% of the respondents stated that they had met once a week, whereas 8% pointed out that they had communicated through the mobile application, *WhatsApp*.

The confidence of students regarding their conducting this project was underpinned by their previous experience. Informal talks with the students before launching the project showed that they are familiar with research methods since they studied them in a previous sociology class, which they took during their first year of studies. According to the survey, 30% of respondents mentioned that their decision to join this project and become members was based on their previous experiences, for instance, as this extract pointed out:

because I did a project with this group last year (Survey_Student_3, Male_19_years old)

The survey results confirmed that 65% of the respondents have experienced conducting project work versus 35% who have not. Those students who lacked project work experience seemed to face challenge just building a project team, for example, 22% of the respondents stated that they joined their group accidently, as this extract shows:

The five of us remained without a group, and this is how we became a group (Survey_Student_10, Female_19_years old)

It seems that this approach of grouping members for the project placed those who are sensitive to conducting this type of work with others in a difficult position. The following extract indicates that not all members were involved in group work:

The tasks were distributed according to form, but in reality, all the work was done by one person (Survey, Student_10, Female_19_years old)

This state of affairs lacked an explanation as to why this problem was not raised in a timelier manner. The only response that could be allocated to this was that it was due to the characteristics of the 'complainer' behavior provided by Zavyalova and Saginova (2017) and referred to above; however, this could also have been caused by the "dictator" or leader who suffered due to a lack of trust among her or his peers. Nevertheless, 48% of the respondents adopted a rational approach in selecting their group members. They mentioned the different characteristics of their peers that attracted them to invite them to join the groups. Among these characteristics are motivation, tranquility, open-mindedness, similar interests, and diverse skills. Here is a short extract that pointed out some of these characteristics:

They were really open-minded and responsible people (Survey_Student_8, Female_18_years_old)

As can be seen, this experience of the students indicates that from the early stages of the project, they took their responsibilities seriously and adopted a rational approach in selecting the most suitable teammates to work with. It seems that their previous experience helped them to understand that project completion depends on the responsibility of group members as well as individual contributions. The importance of the choice regarding whom they wanted to complete their project with was directly related to their strategy. Survey results showed that 92% of respondents distributed tasks among themselves, as mentioned in this extract:

Some did the survey, some did interviews, some create discussion questions (Survey_Student_20, Female_19_years old)

The same responses were consistent in focus group discussions. The students found this to be a very convenient and efficient method of working together. Here is the extract that pointed this out:

We have divided everything at once. You will do this, you will do this, and we laugh to our presentation because in each page we wrote "You [name of a student] will do this". Then everyone conducts own part. Then we explain each other (Focus group_4, Student_1, Female)

This way of selecting of group members and the subsequent division of roles places pressure on each participant because they do not wish to fail their friends and teammates, who relied on him or her. Nevertheless, the observation of one another's other skills and consequent delegation of tasks was done according everyone's capability, as this extract shows:

We worked together before, therefore, we know each other's skills (Focus group_4, Student_2, Male)

In addition, they developed a sense of trust towards each other during the practical class where before each class, they played team-building games. Besides giving a presentation, students have to draw a concept map with their peers, write reflections on articles they read, and search for answers and information from these articles. These activities require diverse skills in timing and presenting the provided

information accurately. These events seem to have had an impact on the project work, as this extract from focus group discussion presents:

Conducting work in team was easy because we played team-building games every week during practical class. We learned to work with different people. Then we found out who the best speaker is, and who the best writer is. It helped us to distribute tasks among our members in such order as " you will do this; you will do that." This is how we completed our project quickly (Focus group_2, Student_2, Female)

In these extracts the word 'we' causes ambiguity. How could they all can decide at once? One of the respondents in survey mentioned, for instance, 'our leader decided it' (Survey, Student_2, Female_18_years old), pointed out that there was someone whom they trusted to delegate all the tasks, hence, the role of the leaders in this study referred to as the 'dictator that was found in the study by Zavyalova and Saginova (2017). However, this task distribution has also created obstacles to their team work. According to the survey, 30% of the respondents mentioned difficulties in building a common understanding among their group members, 22% mentioned the incommensurability of individual characteristics, and 8% found it challenging to find a suitable time for everyone. Focus group discussion also revealed this issue, as the following extract points out:

We had a lot of misunderstandings among ourselves during the project (Focus group_2, Student_5, Female)

These are related to challenges of team work, whereby the division of responsibilities created some tension between some participants as 13% mentioned that they had experienced difficulties in conducting literature review, and 17% mentioned such difficulties arising during the data collection and analysis. In the former the students were even challenged during practical classes because of a school experience of recalling information, whereas in the latter, they lacked the experience in these tasks. The analysis and synthesis of the reading material, as it appeared in the project work, was the most difficult part for these students during the practical classes. This was also visible during their presentations, as the vice-rector's feedback for all five projects pertained to a lack of data interpretation skills.

One of the questions was allocated to having the students determine the most enjoyable part of the project. Interestingly, even though they were familiar with research methods, 87% of the respondents mentioned that this was the data collection process. By interviewing medical students in different years of studies, from different mediums of instruction – English, Kazakh and Russian and even international students, they experienced another communication format. This format had them posing the types of questions that they might never have asked their peers before in their informal communication with them. The remaining 13% enjoyed the process of preparing and rehearsing their presentation with their friends. This is also enabled them to bond together.

The final two questions were related to the new skills they have obtained and their suggestions for the next group of students. 87% of students mentioned that as a result of this project, they have improved their public speaking skills, and 13% stated that they have gained data analysis and information-searching skills. In searching for

information, articles were selected from credible resources such as Scopus, Web of Science, and Elsevier.

In terms of suggestions, here again, the previously mentioned inconsistency in student responses emerged; for instance, despite the fact that 92% of the respondents mentioned that they had met weekly, 70% suggested completing the work on time without leaving tasks to the last minute, as was pointed out in this extract:

Work every day because time moves on and does not return (Survey, Student_22, Female_18_years old) or Work steadily on small tasks and do not to leave everything to last minute (Survey, Student_10, Female_19_years old)

Although these extracts contain positive advice they were based on the students' own experience. From this, it appears that the students completed their work at the last minute, and this was the reason for most students neglecting to fill out the work plan that was provided at the beginning of the semester for them to utilize optionally. In addition to this one, another three possible strategies that emerged from the suggestions included 'asking advise from a tutor', 'working as independently as well as in a team', 'being proactive and having some original ideas to conduct research'.

To conclude, according to research that was conducted by Kazun and Pastukhova (2018), PBL was used in five countries for different purposes, and this study enlargens the area of PBL by employing it to explore implicit believes and stereotypes in society, thus, contributing to existing knowledge.

This study uncovered three out of the four of the suggested behaviors of students that arise during project work that were highlighted in Zavyalova's and Saginova's (2017) study. These were the "complainer," "dictator," "procrastinator." The division of responsibilities among participants helped them to avoid having 'chalyavsh'iki' members who are those who do no work, but instead merely benefited from other people's work. This is why it is beneficial to remind students to fill in the weekly work plan, even if this is not required, as this would help them realize the extent to which they contributed to the project overall.

Conclusion

To sum up, this study employed project-based learning to enable students to explore issues that are ingrained in people's minds due to the inhibition of modernizing trends and ideas being acceptable to them in a way that affects their consciousness. The students' experiences conducting this project indicate that, to some extent, they were overly confident because of their previous experiences with research methods in their sociology courses. Their previous ideas of team work were vastly altered by this experience. Yet they maintained a sense of responsibility for their own part, which prevented them from seeing the project as a whole process. This also related to a lack of experience in analyzing data. Despite the fact that they stated that they attended regular weekly meetings, their suggestions emphasized the fact that they conducted their work at the last minute, which created some tension and misunderstandings among each other. The leaders were responsible for the project, overall, and they delegated their tasks among members by taking on the role pf 'dictator'. Though there were complainers as well, they were a minority. There also have been a leader who,

instead of delegating and trusting her group members, took everything in her own hand to make sure that the project would be completed on time. Lastly, there were 'procrastinators', people who said that they did not have enough time to complete their work and postponed meetings because their tasks had not been completed by due date. Nevertheless, students' experiences emphasized the fact that the delegation of tasks among members eliminated the fourth type of behavior, '*chalyavsh'iki*.' Hence, in the early stages of the study, it was better to prepare a work plan where students had to fill out what was done weekly, because, even though some students neglected it, most of them understood that each student's contribution will be questioned at the end of completion. Therefore, they tried to show in focus group discussions, in their presentation and even in their survey results that everyone was engaged in the process.

The limitation of the study is that it was used only at the level of one university with a small scale of participants, which presented limits to the drawing of a solid conclusion. This pilot project experience, nonetheless, serves to frame structure and procedure of further projects. For the next project, the area of research could be expanded to a collaboration with schools as was done in the study by Hunter and Botchwey (2017), or to invite other non-governmental organization as was done by the following scholars, Banakhr, Iqbal and Shaukat (2018), Deepamala and Shobha (2018), and Arantes do Amaral and Lino dos Santos (2018).

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Factors Influencing Mobile Learning in Selected Universities in Nigeria and the United States

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Abstract
The prevalence of mobile devices in today's society has made mobile learning a fast spreading alternative to face to face education for underserved learners. Even though it operates on low information communication technology infrastructure (ICTI), a favorable feature for successful implementation of mobile learning especially in rural areas with less internet infrastructure such as rural United States (U.S.), there still exists a gap in its implementation at many higher educational institutions in the U.S. and Nigeria. As a measure of the factors influencing mobile learning in selected universities in these two countries, a modification of the Technology Acceptance Model (TAM) was used to conduct the study. The study investigated the impact of ICTI, institutional support and faculty teaching tasks, on mobile learning in both countries. The study encompassed an online and paper survey of 233 participants drawn from eight selected universities in the two countries as well as a virtually conducted semi structured interview of five respondents. Out of the 233 respondents only 119 data were found useful as the remaining 114 data were found to be incomplete. Data analysis was conducted using Descriptive Statistics and Structured Equation Modelling. The results and findings revealed that ICTI was critical to the implementation of mobile learning in Nigeria while in the United States perceived ease of use was the most critical factor. The implications of mobile learning for higher education in both countries were discussed.

Keywords: Mobile technology, mobile devices, Technology Acceptance Model, mobile learning, Nigeria, United States

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Introduction

The role of education in the social uplifting of an individual and the economic development of a nation has been voiced by several leaders. Nelson Mandela described education as the most powerful weapon to use in bringing about change in the world (Mandela, 2003). Teferra and Altbach (2004) posit that higher education is key to modernization and development. Unfortunately, around the world access to higher education has not matched demand, and current enrolment is dwindling due to many factors including:

1. Rising higher education costs and budget cuts for educational institutions in developed countries like the United States (The Economist, 2012), In 2003 58% of parents in the rural U.S. expect their children's educational attainment to be at least a Bachelor's degree, however, as at 2010 it is doubtful if there was any significant improvement in their expectations (Provasnik, KewalRamani, Coleman, Gilbertson, Herring, and Xie, 2007).

2. An inadequate number of academic institutions, limited infrastructure, and shortage of requisite faculty in developing countries, like Nigeria, where less than 20% of qualified candidates get admitted annually into the few available universities and colleges (Moti, 2010; Ajadi, 2010).

To address this decline, and changes in learners' demand, stakeholders will need to embark on other paths to provide education with less infrastructure and at a cheaper cost. The introduction of mobile technology, according to Tai and Ting, 2011 has brought about mobile devices such as smartphones with potentials beyond the basic functions of voice calling and a host of other things. These mobile devices have become global commodities for people irrespective of their literacy or age. In the U. S. and other parts of the world, college students possess some sort of Internet enabled mobile device, such as a 3G cell phone, personal digital assistants (PDAs), and smartphones (El-Sofany, Al-Turki, El-Howimelm, Al-Sadoon, and El-Seoud, 2013), and the prices of these devices continue to fall (Maccallum Jeffery, 2009). These devices have the capacity to run educational applications that will supplement faculty's teaching activities inexpensively.

Traxler (2009) recounts that between 2002 and 2009; the mobile learning community has demonstrated that learning can be provided to underserved citizens. This assertion is based on the fact that mobile devices operate on batteries that can be powered and backed up for use when there is no availability of electrical power supply. This infrastructure is in short supply both in the developed and developing worlds. Despite policies to bridge the gap between telecommunication infrastructure in the city and rural areas in the U.S. (Mills and Whitacre, 2003), some states still lack adequate availability of quality broadband networks, for example, Louisiana State ranks 47th of 50 states of the United States in broadband networks (TechNet, 2012). Considered against these backdrops, the researchers investigated the role of ICTI, Institutional Support (INSSUP) and Faculty tasks (TASKS) on the implementation of mobile learning.

Theoretical Background

Mardis, Hoffman, and Marshall (2008) suggested that since educational research often focuses on practitioner's evaluation, and organizational studies to place schools in a social and technological context. it can be enhanced by borrowing from the theoretical frameworks which guide information systems. Chuttur (2009) reported that the technology acceptance model (TAM) has been the only theory to capture the most attention from the information systems community in investigating user technology behavior. This study was an investigation into faculty user acceptance of mobile learning as an alternative to face-to-face education. Based on this premise the study was conducted using the Technology Acceptance Model (TAM).

Technology Acceptance Model

The Technology Acceptance Model is a theory that specifies the causal relationship between perceived usefulness, perceived ease of use, user attitude, intention and actual usage (Davis, Bagozzi, &Warshaw, 1989). Acceptance has been defined as an act of adoption, meaning, the initial decision to use or not to use a technology. Perceived usefulness (PU) was defined as the degree to which a person believes that using a particular system would enhance his or her job performance, and perceived ease of use (PEOU) is the degree to which a person believes that using a system would be free of effort (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989). The proposed model, therefore, incorporated the constructs ICTI, INSSUP and TASKS into TAM as external variables as well as PU and PEOU as mediating variables between external variable and actual usage (the proposed conceptual model is as depicted in figure 1).

Research Model and Hypotheses

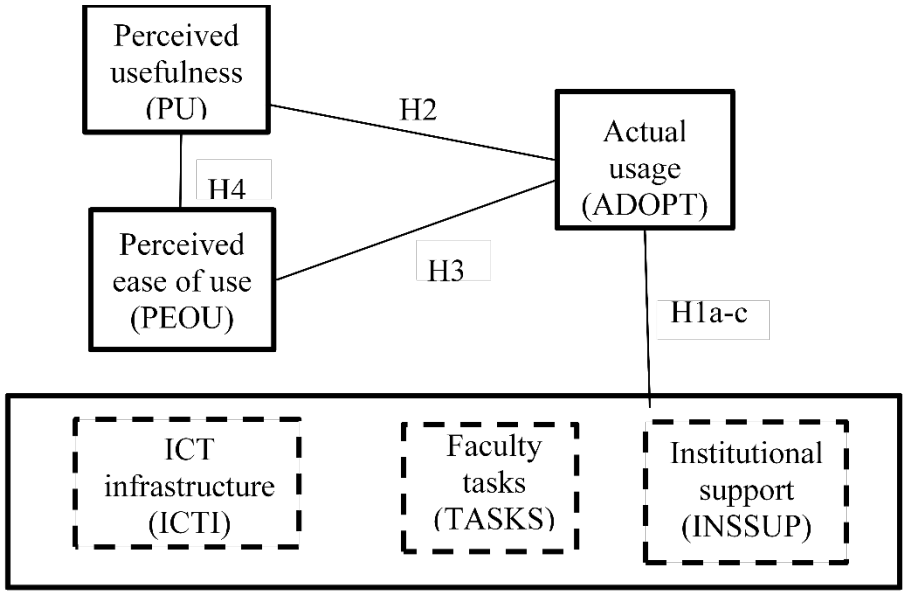

Figure 1: Conceptual Framework Based on TAM Constructs

(dashed boxes introduced by researcher)

ICT Infrastructure and Adoption.

According to Chuttur, (2009), perceived behavioral control (PBC) is influenced by the effects of two beliefs: control belief and perceived facilitation control belief, which are the individual's assessment of available resources to the achievement of a given set of outcomes. Availability of infrastructure is crucial to the usage of any digital device, though mobile technology has been found to be low in infrastructural needs, yet network access and bandwidth size are crucial to its operations. The researchers hypothesized:
H1a: ICT infrastructures have direct effects on actual usage of mobile devices in teaching activities.

Faculty Teaching Tasks and Adoption.

Rapid advances in information and communication technologies have resulted in users' ability to choose from a range of systems, while using the same systems for tasks that are different from what the system was initially designed for, thus leading to user's preference for a system (Sun, 2012). Shih and Chen (2013) reported that TAM usage is attitude related, so a user may use a technology perceived not as useful or easy to use if the technology improves their job performance. Though mobile devices were initially not designed for teaching and learning activities, through innovation and the capabilities possessed by mobile devices, users have extended these tools to teaching activities such as posting information, assignments, lecture delivery, and test taking. To empirically test the direct effect of tasks on adoption, the hypothesis that follows is proposed:
H1b: Faculty tasks have direct effect on actual mobile devices usage in teaching activities.

Institutional Support and Adoption.

Institutional support is the degree to which a technology user believes there exists within the institution both technical resources and management support that will facilitate use of the technology (Al-alak & Alnawas, 2011). Samarawickrema and Stacey (2007), in their study of web-based approach to teaching in six Australian universities revealed that the use of the technology with ongoing training had more impact on usage than ease of use of the technology. To validate the influence of institutional support on usage the hypothesis is proposed:
H1c: Institutional support has direct effect on actual mobile devices usage in teaching activities.

Perceived Usefulness as Moderators of Adoption.

A technology will be used when its perceived benefits outweigh the cost of using it (Lambooij & Hummel, 2013) - benefits such as usefulness of the technology, capabilities of the technology to improve job performance and the ease with which user's goals are achieved with the technology. Two cognitive beliefs which are characterized as perceived benefits and influence adoptive behavior, as posited by TAM, are perceived usefulness and perceived ease of use (Davis, 1989). A user may tolerate a difficult system if it is for accessing the functionality of the system, so long

as it will improve performance of his or her job. To validate the effect of perceived usefulness on actual usage the hypothesis is proposed:
H2: Perceived usefulness has a direct effect on actual usage of mobile devices in teaching activities.

Perceived Ease of Use as Moderators of Adoption.

Gefen and Straub (2000) in their study investigating the importance of perceived ease of use on adoption behavior found that the importance of PEOU on adoption is dependent on the inbuilt value a user attaches to the system characteristics such as the systems usefulness or ability to perform what it specifies to perform, thus effect of PU on adoption far outweighs the effect of PEOU. Wu and Wang (2004) conducted a study on usage of a consumer technology, and their investigation revealed perceived ease of use was not significantly related to usage intention of the technology. To validate the effect of perceived ease of use on adoption, the hypothesis was proposed:
H3: Perceived ease of use has a direct effect on actual usage of mobile devices in teaching activities.

Van Raaij and Schepers (2006), in their quantitative study of 45 MBA students on acceptance and use of a virtual learning system, found that PU had a direct positive impact on system usage but not PEOU, which was found to have an indirect effect on adoption through PU. The effects of perceived usefulness and perceived ease of use on systems usage have been in a mediating role between external variables and actual usage. Consequently, Burton-Jones and Hubona (2006), in their qualitative study of usage behavior of 125 employees of a company, with regards to two different applications found that external variables do have a direct effect on usage behavior, and that the direct effect of external variables on usage is greater than the effects of external variables through the mediating role of perceived ease of use and perceived usefulness. They argued that a technology becomes easy to use and perceived to be useful after routine use, thus making the effect of PU and PEOU become a non-issue to usage. Based on the foregoing, the hypothesis that follows was proposed to validate earlier findings:
H4: Perceived ease of use has a direct effect on perceived usefulness of mobile devices in teaching activities.

Materials and Methods

Thirty-eight items of which twenty-nine were previously validated research items as well as those developed by the researchers were modified to suit mobile technology adoption for teaching activities. The twenty-nine items were used to measure the constructs for the research framework, while the remaining nine items measured the demographic characteristics of participants and the usage level of mobile devices. Three items adapted from Davis (1989) were used to measure PEOU, and six items adapted from (Davis, 1989; Davis et al., 1989; Moore & Benbasat, 1991) were used to measure PU. Three items adapted from Ajzen (1985) and Rogers (2003) were used to measure INSSUP. Four items adapted from Moore & Benbasat, 1991; Butler & Sellbom, 2002; Burton-Jones & Hubona, 2006; Tai & Ting, 2011 were used to measure ADOPT. Eight items on TASKS variables and five items on ICTI related variables were constructed by the researchers (See Appendix A, Table 1).

All items relating to the latent variables were measured on a five-point Likert-type scale, where respondents had to indicate the extent to which they agreed with a given statement.

1. = "Strongly Disagree"
2. = "Disagree"
3. = "Neither Disagree nor Agree"
4. = "Agree"
5. = "Strongly Agree"

Data Collection Procedure

The survey was posted online for academic staff of eight universities, four each from the southwest of Nigeria and the southern part of the United States. The universities run some form of or total distance education and have on-ground infrastructure for electronic learning and wireless Internet facilities.
At the end of five months, responses were received from 233 faculty members across the two countries but only 77 from Nigeria and 42 from the U.S were found usable due to incomplete data. These responses were both from online and paper surveys as most faculty in Nigeria preferred the paper survey. Five participants were interviewed using in-depth, semi-structured interviews for the qualitative phase of the study. The participants sampled included men and women drawn from various disciplines and rank.

Data Analysis and Results

The quantitative data were analyzed using Statistical Package for Social Sciences (SPSS 12.0) for initial item and descriptive analyses. Testing of the measurement model such as construct validity, instrument reliability, structural model, and the statistical significance of the relationships in the model were done using SmartPLS 2.0 M3 software (Ringle, Wende, &Will, 2005), while the Lincoln and Guba (1985) comparative analysis was used for analyzing the qualitative data.

Testing the Measurement Model

In evaluating the measurement model, the reliability, convergent and discriminant validity were tested through a path analysis of the 29 items—ADOPT1-4, ICT1-5, INSSUP1-3, PEOU1-3, PU1-6, TASK1-8. ADOPT1, INSSUP3, PEOU1, PU1, PU2, and PU3 were dropped because they had factor loadings less than 0.6 (Appendix B, Table 2). Hair, Anderson, Tatham, and Black (1992) recommend that any item with factor loadings of less than 0.6 is indicative of poor item reliability (Appendix B, Table 3) is a full summary of the results of the path analysis. According to Hair (2010), the Cronbach Alpha should be above 0.7 for good internal consistency, but ADOPT (ACTUAL_USAGE) and PEOU had values less than this cut off. However, he also recommends a composite reliability value of 0.6 and above as appropriate value for good internal consistency. Since the composite reliability was ACTUAL_USAGE = 0.7859, ICTI = 0.8666, INSSUP = 0.9228, PU = 0.9210, FACULTY_TASKS = 0.9177, and PEOU= 0.7965, these items therefore had a high level of internal consistency. The value of the average variance extracted (AVE) of constructs according to Nunnally (1967) should be greater than 0.5 for good

discriminant and convergent validity to be achieved. The AVE for (ACTUAL_USAGE = 0.5525, ICTI = 0.5685, INSSUP = 0.8567, PU = 0.7975, FACULTY_TASKS = 0.5827, PEOU= 0.6642), which showed good discriminant and convergent validity among constructs. The Fornell and Larcker (1981) criterion for good discriminant validity among constructs is that the square root of the AVE of each construct must be greater than the correlation value between the constructs. Appendix B, Table 4 reveal the square roots of the AVE which are on the diagonal, while the correlations between constructs are in the lower triangle below the square root of the AVE. For example, the square root of AVE for ACTUAL_USAGE = 0.7433 which is greater than the correlation between ACTUAL_USAGE and FACULTY_TASKS = 0.5197, ACTUAL_USAGE and ICTI = -0.2608, ACTUAL_USAGE and INSSUP= 0.0234, ACTUAL_USAGE and PEOU= 0.1383, ACTUAL_USAGE and PU = -0.0411. Thus, based on the Fornell and Larcker (1981) criteria for good discriminant and convergent validity among constructs, the results stated above have further revealed good discriminant and convergent validity among the constructs.

Appendix D, Tables 5 and 6, are demographic statistics of participants in the quantitative and qualitative phases respectively.

Quantitative Results

Results revealed a 57% usage in Nigeria and 51.9% usage in the U.S. (Appendix D, Table 7). Measuring the usage level across the two countries at $\alpha = .05$, $p = .459$ ($p > .05$) (Appendix D, Table 8). This result showed that there were no statistically significant differences between the level of usage in the two countries, though the percentage of users in Nigeria is greater than the percentage of users in the U.S. The results suggest that the selected universities in Nigeria have a greater usage level than the U. S.

The t values for each hypothesized model revealed the following: The Effect of ICT infrastructure on usage in Nigeria was (T statistics = 2.9849, p > 05), tasks for which faculty used mobile devices (T statistics = 5.1647, p > 05), perceived usefulness on usage (T statistics = 4.2365, p > 05)),). Thus, the effects were statistically significant. However, the following were statistically insignificant: perceived ease of use on usage (T statistics = 0.9496, p > .05), institutional support on usage (T statistics = 0.5162, p > 05) and perceived ease of use on perceived usefulness (T statistics = 0.4844, p > .05).

The Effect of ICT infrastructure on usage in the U.S was (T statistics = 1.809, p > .05), Institutional support to usage (T statistics = 1.5006, p > .05), perceived usefulness on usage (T statistics = 1.4297, p > .05). Thus, the effects were not statistically significant. However, the following were statistically significant: perceived ease of use on usage (T statistics = 4.3232, p > .05), tasks for which faculty use mobile devices (T statistics = 5.4925, p > .05), and perceived ease of use on perceived usefulness (T statistics = 2.1501, p > .05). These results revealed a difference in influencing factors for mobile device usage for teaching activities in both countries.

Qualitative Findings

Interviews (Appendix C) with five respondents yielded the following themes: usage level, motivation for usage, factors impeding usage, and improved usage. The researcher asked an interviewee "In your institution, is usage of mobile devices in teaching activities still low despite the need for mobile device usage and good infrastructure, as well as the pervasiveness of the devices in the society at large? "What do you think is responsible for this low usage?". Justified, a U. S. faculty member responded "Faculty do not know they can use mobile devices in teaching activities, even the receptors are laggers - that is, they lag behind in usage, but don't feel a compelling need to use it in all areas of their teaching activities, so they continue to lag behind… Institutional infrastructure is poor, signal strength is bad. In some buildings, you want to access the web and you cannot." The researcher commenting then asked "I have never experienced that in the United States. You mean there are areas where you find Internet access problematic?" Justified reiterated "hmm! Service carriers, you can't get anything, in this area no connectivity and within a few steps away from the area you are connected. Hmm! Down south within a few areas you get nothing."

Another interviewee - Rejoice recounted "usage of mobile devices in teaching activities though mandatory in our institution has been greatly hampered by epileptic power supply and poor Internet access -- for example, bandwidth size and connectivity which are mostly unreliable during the day-time. Many subscribers are on it during the day. My institution does not even give any incentives to using mobile devices." To the question "Can you please detail the reasons for your usage of mobile devices in your teaching activities?", Reliable gave her student-based motivation thus "I come with my own devices, my institution does not even provide. I cannot compromise standards, I do what I do, not to impress any supervisor, but in the interest of my students. I want my students to be able to compete with other students who have been exposed to technology." To the question "Please, can you share with me any additional comments that have not been covered in this interview but are of concern to your use of mobile devices in teaching activities?" Onyx, a Nigerian faculty member was of the view that "we are in the world driven by ICT compulsorily, meaning, the world is a global village and anyone, organizations, institutions, societies, or countries cannot be relevant if they do not embrace the use of ICT in this contemporary world. So consciously or unconsciously, they will all embrace the use of mobile devices at the end of the day."

Discussions

A lower usage level was found in the United States compared to Nigeria. This result corroborates Ellis (2013), who reported that Africa has the highest rate in the world for the use of mobile e-devices for teaching and learning and that mobile devices are perceived as the primary computing device. Moreover, in the United States distance learning stakeholders have used other type of ICT devices such as teleconferencing, and avatars to reach students such that mobile technology may not be a must-use technology for educational engagements.

H1a: ICT infrastructures have direct effects on actual usage of mobile devices in teaching activities.

The results showed that ICT infrastructure was critical to faculty members in Nigeria and the factor played a vital role in mobile devices usage in teaching activities. This finding supported past research findings including Wang (2008); and Nyirigo (2009). These researchers found the availability of appropriate ICT infrastructure to be a contributory factor to the usage of a technology. On the contrary, ICT infrastructure in the U.S. did not have any direct effect on the usage of the devices in teaching activities. This observation may be attributed to the availability of free Internet services in some areas round the clock in the U.S. Contrary in Nigeria, internet facilities are subscribed; therefore, where institutional facility does not support Internet services, access will be limited. Faculty members in the U.S may have reported ICT infrastructure was a non-issue, although a U.S. faculty member interviewed in this study reported erratic Internet access in some areas of the United States could negatively impact usage.

H1b: Faculty tasks have a direct effect on actual usage of mobile devices in teaching activities.

The results showed that "faculty tasks" played a vital role in the use of mobile devices in teaching activities in both countries, supporting the findings of Burton-Jones and Hubona (2006) that external variables directly impact usage. It also supports Shih and Chen (2013) that tasks directly impact technology usage provided the technology improves the user's job performance.

H1c: Institutional support has a direct effect on actual usage of mobile devices in teaching activities.

Institutional support was found to be minimal and with no significant effect on usage of mobile devices in teaching activities in both countries. This result however, differed from findings of Wood, Mueller, Willoughby, Specht and Deyoun (2005), Samarawickrema and Stacey (2007), and Al-alak and Alnawas (2011) that institutional support impacts adoption. The classification of the mobile devices, the sophistication and individual preferences play larger roles in influencing usage than the different institutional supports. This may have accounted for the divergent results from previous research findings. The interviewees from both countries indicated that their motivation to use mobile devices in their teaching activities was mostly fueled by their personal desires to assist their students rather than the support they received from their individual institutions.

H2: Perceived usefulness has a direct effect on actual usage of mobile devices in teaching activities.

Perceived usefulness was found to have a direct effect on actual usage of mobile devices in teaching activities in Nigerian institutions. This supported previous studies by Venkatesh and Brown (2001), Van Raaij and Schepers (2006), Smith (2008), and Pollara (2011) that perceived usefulness of a technology has a direct influence on the usage of the technology. The findings in the United States were contrary i.e. perceived usefulness did not have a direct effect on actual usage. Burton-Jones and

Hubona (2006) argued that the users to whom a particular technology had become routine will no longer be influenced by perceived usefulness. This could explain why perceived usefulness influencing usage is refuted in Nigeria, because the Nigerian faculty usage level is greater than the usage level of U.S. faculty members. Similarly, Shih and Chen (2013) reported that a technological device may be perceived as not very useful, but it will still be used if the user perceived it as improving his /her job performance. The Nigerian interviewee affirmed that mobile technology has been found to be the best device for reaching learners at a distance.

H3: Perceived ease of use has a direct effect on actual usage of mobile devices in teaching activities.

Perceived ease of use was not found to have a significant direct effect on actual usage of mobile devices in teaching activities in Nigeria. This is in agreement with Davis (1989) who found that perceived ease of use predicts perceived usefulness rather than actual usage of a technology. Other researchers, Wu and Wang (2004), Burton Jones and Hubona (2006), reported their research findings that perceived ease of use was not directly related to actual usage of a technology. Paradoxically, the findings of this research in U.S. universities is that perceived ease of use had a direct effect on the usage of the mobile devices in teaching activities (Wood et al., 2005). Furthermore, the usage of mobile devices for many tasks greatly aided proficiency level of the Nigerian faculty; hence, ease of use of the technology has become a non-issue, whereas the tasks usage level was still low in the U.S. The more a technology is used, the less difficult usage becomes (Burton-Jones & Hubona, 2006). Some of the participants in the selected universities in Nigeria were mandated to use mobile devices by their university, while all participants in the U.S. were voluntary users. This may have contributed to the ease of use of the technology in Nigeria. Similarly, as reported by Gefen and Straub (2000), perceived ease of use is dependent more on the usefulness a user attaches to it than on the difficulty experienced in its use. Shih and Chen (2013) said a technology may not be easy to use yet the users will use it if they perceive it as improving their job performance. This may be responsible for the non-significant effect of perceived ease of use on usage as found amongst the Nigerian faculty.

H4: Perceived ease of use has a direct effect on perceived usefulness of mobile devices in teaching activities.

The perceived ease of use was not regarded as a factor that would have any effect on the perceived usefulness of the mobile devices in Nigeria. This finding is in contradiction with Davis (1989), who reported that perceived ease of use has a direct effect on perceived usefulness. The Nigerian faculty members are proficient at using the mobile devices in teaching activities. The devices were no longer difficult for them to use; they have also recognized the usefulness of the devices, as the findings from the interview revealed. This may explain why perceived ease of use had no effect on their perceived usefulness. *Perceived ease of use was found to have a direct effect on perceived usefulness of mobile devices in teaching activities in the case of the U.S.* This is in line with the findings of Davis (1989) and Smith (2008).

Conclusions and Recommandations

There is a need to improve the educational status of citizens in both developed and developing economies to increase their human capital. The findings of this study revealed faculty members in both countries found mobile devices to be a good tool for teaching activities. Adoption of mobile technology in teaching will enable governments and institutions reach and educate more, especially in the rural areas, thereby producing more and better graduates.

For Policy and Decision Makers

The current usage level of mobile devices among faculties has to improve, more so when faculty members in Nigeria reported that they use mobile devices despite the poor ICT infrastructure. To achieve this goal, more incentive must be given to faculties to encourage the use of mobile devices for better communication and stronger interactions with students. In addition policy and decision makers should

a. Make the use of mobile devices mandatory for teaching activities, most especially when courses are to be taught at a distance. In making the use of these devices mandatory, enabling factors should be incorporated - for example, paying for internet subscription for faculty members since they must be connected at all times not just when they are on campus. This will promote distance learning and give better opportunities to financially disadvantaged students allowing them to study at their convenience and at an affordable rate. It will also expose students to technologies, making them relevant in the 21st century and beyond.

b. Provide mandatory training to all faculty members in the use of mobile devices for teaching activities.

c. Further promote the use of mobile devices for teaching at a distance by granting frequency of usage some points in the faculty appraisal score sheet. Similarly, financial support towards the acquisition of mobile devices and easy access via Wi-Fi should be made for all faculty members. The desire on the part of faculty members to have institutional support, especially in the United States where usage level is low, was found to be very strong in this study, and one of the major reasons for this was the low morale of the faculty members.

For Researchers

The use of convenience and purposeful sampling has been recommended in situations where time and cost are the main considerations in a study. However, the weakness of this approach, is that the results and findings of the investigation cannot be generalized (Schonlau, Fricker, & Elliott, 2002). The findings of this study are therefore limited to the selected universities.

The sample sizes in the two countries were not the same though they had similar characteristics. It is possible this dissimilarity in sample size may have affected the findings.

The study was self-reporting i.e., the participants reported their usage behavior, which may be subjective or otherwise biased in many ways. Self-reported usage could have been responsible for the disparity in the factors influencing usage across the two countries. Observing users may have given a different result.

Another limitation was that the sample consisted of voluntary users and mandatory users, a situation that may have affected the responses obtained for the level of usage and ease of use in each country. The design of future research should consider either mandatory use or voluntary use but not the mixture of both.

This research should be replicated with more faculty members within each country; this could make findings generalizable unlike this study where findings were limited to selected universities.

The teaching experiences as well as the effect of academic rankings of the participants were not considered in this study - the observations in this study showed that older faculty members have very poor appreciation of mobile electronic devices and this, if not properly addressed, will have a negative effect on the technological development of the students. It is therefore recommended that future research should have these two variables incorporated into the study.

Appendix A

Table 1. Operationalized of item variables

Constructs	Variable Definition	Item for Variable in institution and personal usage
ICT Infrastructure	The information communication technology infrastructure that permits the usage of mobile technology.	ICTI1-- The wireless Internet in my institution is reliable to support the use of mobile technology for teaching activities. ICTI2-- The quality of infrastructure such as bandwidth support the use of mobile technology. ICTI3--The wireless Internet in my residence is reliable to support the use of mobile technology ICTI4--The quality of infrastructure such as bandwidth in my residence is adequate to support the use of mobile technology. ICTI5— Is bandwidth a critical factor to the success of mobile technology adoption for teaching activities?
Faculty Tasks	Different teaching tasks for which faculty may use their mobile devices.	TASK 1-8 – I know how to use mobile device for… Lectures, posting assignments, retrieval of students' submissions, announcements, Test taking, posting results/grades, posting corrections, Posting a course outline.
Institutional Support	Objective factors in the environment that observers agree make an act easy to do, including the provision of computer.	INSSUP1 -- There are technical supports in my institution for faculty using mobile technology for teaching activities. INSSUP2--There are training sessions for faculty in my institution on how to use mobile technology for teaching activities. INSSUP3--There are incentives in my institution for those using

		mobile technology for teaching activities.
Perceived Usefulness	The degree to which a person believes that using a particular system would enhance his or her job performance.	PU1-- I find mobile devices useful in my teaching activities PU2—Using mobile devices in teaching activities enables me to accomplish more tasks quickly. PU3— I accomplish more teaching activities with the use of mobile devices. PU4-- Mobile technology affords me more interaction time with my students. PU5--Mobile technology allows me to respond promptly to my students' enquiries. PU6--Mobile technology affords me real time broadcast for unforeseen events.
Perceived Ease of Use	The degree to which a person believes that using a system would be free of effort.	PEOU1-- Using mobile devices in teaching activities will make it easier for me to do my job. PEOU2-- I find it difficult to prepare my teaching activities using mobile devices. PEOU3-- I don't have a problem uploading my teaching activities using mobile technology.
Actual Usage	A composite measure of both variety and frequency of usage	ADOPT1- I use my laptop for teaching activities ADOPT2 - I use my tablet PCs for teaching activities. ADOPT3- I use my smartphone for teaching activities. ADOPT4--How often do you use mobile devices in teaching activities?

Appendix B

Table 2. Standardized Factor Loadings after dropping items and recoding PEOU3 Across Countries

	ACTUAL_USAGE	FACULTY_TASKS	ICTI	INSSUP	PEOU	PU
ADOPT2	0.6751					
ADOPT3	0.8310					
ADOPT4	0.7152					
ICT1			0.7946			
ICT2			0.8171			
ICT3			0.7833			
ICT4			0.6728			
ICT5			0.6606			
INSSUP1				0.9455		
INSSUP2				0.9068		
PEOU2					0.8829	
PEOU3					0.7444	
PU4						0.7644
PU5						0.7868
PU6						0.7840
TASK1		0.7527				
TASK2		0.7715				
TASK3		0.7581				
TASK4		0.6927				
TASK5		0.7770				
TASK6		0.7758				
TASK7		0.8279				
TASK8		0.7481				

Table 3. Summary after Deleting items to Test for Reliability and Validity

	Cut off Criteria	AVE	Composite Reliability	Cronbach's Alpha
ACTUAL_USAGE	≥0.60	0.5525	0.7859	0.6164
FACULTY_TASKS	≥0.60	0.5827	0.9177	0.8986
ICTI	≥0.60	0.5685	0.8666	0.8067
INSSUP	≥0.60	0.8567	0.9228	0.8372
PEOU	≥0.60	0.6642	0.7965	0.5114
PU	≥0.60	0.7975	0.921	0.8657

Table 4. Correlation among Study Variables and AVE

	ACTUAL_USAGE	FACULTY_TASKS	ICTI	INSSUP	PEOU	PU
ACTUAL_USAGE	**0.7433**					
FACULTY_TASKS	0.5197	**0.7633**				
ICTI	-0.2608	-0.0558	**0.7540**			
INSSUP	0.0234	0.0482	0.2760	**0.9256**		
PEOU	0.1383	0.1969	-0.0996	0.2286	**0.8150**	
PU	-0.0411	0.1868	0.3349	0.2872	0.1738	**0.8930**

Appendix C

Qualitative Phase- Interview Questions

1. What is your highest level of education?
2. How long have you been in faculty?
3. Please permit me to ask if you are a junior or senior faculty or otherwise
4. What is the level of your expertise in the use of mobile devices in teaching activities?
5. What type of teaching activities do you use mobile devices?
6. What will be the extent of your mobile device usage if you become a senior faculty member?
7. Can you please detail the reasons for your usage of mobile devices for your teaching activities?
8. What is your motivation for using mobile devices for your teaching activities considering the fact that the IT infrastructure at your institution is poorer than your residence and there are no institutional incentives for using the devices for your teaching activates?
9. What problems have you encountered in your usage of mobile devices in teaching activities?
10. In your institution usage of mobile devices in teaching activities is still low in spite of the need for mobile device usage and good infrastructure in your country, as well as the pervasiveness of the devices in the society at large, what do you think are responsible for this low usage (U.S.)
11. Is usage of mobile devices for reaching your distance learners mandatory or voluntary in your institution?
12. In your institution, usage is high, infrastructure is good, but this does not hold in other institutions, what may be responsible for this, what type of incentives are you offered by your institutions for using mobile devices (NIGERIA).
13. Please can you share with me any additional comments that have not been covered in this interview but are of concerns to your use of mobile devices in teaching activities?

Appendix D

Table 5. Demographic Statistics of Participants for Quantitative Phase

	Nigeria			United States		
	Count	% Count	Cumulative	Count	% Count	Cumulative
Gender						
Female	32	41.55	41.55	14	33.33	33.33
Male	45	58.44	100	28	66.66	100
Qualification						
Ph.D.	24	31.2	31.2	33	78.6	78.6
M.Sc.	30	39.0	70.1	8	19.0	97.6
First Degree	19	24.7	94.8	0	0	97.6
Others	4	5.2	100.0	1	2.4	100.0
Rank						
Professor	11	14.3	14.3	13	31.0	31.0
Assoc. Prof/Snr. Lect.	9	11.7	26.0	5	11.9	42.9
Asst. Prof/Lect. I	27	35.1	61.0	14	33.3	76.2
Instr./Lect. II- III	2	2.6	63.6	2	4.8	81.0
Adjunct/Part Time	21	27.3	90.9	5	11.9	92.9
	7	9.1	100.0	3	7.1	100.0
Department						
Science	24	31.2	31.2	4	9.5	9.5
Soc. Science	5	6.5	37.7	8	19.0	28.6
Medical	4	5.2	42.9	0	0	28.6
Engineering	1	1.3	44.2	0	0	28.6
Law	4	5.2	49.4	0	0	28.6
Education	12	15.6	64.9	17	40.5	69.0
Agriculture	1	1.3	66.2	0	0	69.0
Business	0	0	66.2	8	19.0	88.1
Others	26	33.8	100.0	5	11.9	100.0
Mobile Devices Used	67	87	Overlap in devices used	31	73.81	
Laptop	43	55.84		10	23.81	
Tablet PCs	51	66.23		6	14.28	
Smartphone						

	Nigeria			United States		
	Count	% Count	Cumulative	Count	% Count	Cumulative
Frequency of Use						
Never	3	3.9	3.9	9	21.4	21.4
Sometimes	18	23.4	27.3	9	21.4	42.9
Don't Take Count	13	16.9	44.2	8	19.0	61.9
Often	24	31.2	75.3	11	26.2	88.1
Always	19	24.7	100.0	5	11.9	100.0

Table 6. The Demographic Statistics of Interviewees

Participant's pseudo name	Country	Gender	Qualification	Teaching experience	Rank	Expertise	Category of use
Affluent	Nigeria	Female	MSc.	3 years	Junior	Proficient	Mandatory
Justified	United States	Male	PhD	5 years	Junior	Expert in some areas.	Voluntary
Reliable	United States	Female	PhD	2 years	Adjunct	Proficient	Voluntary
Rejoice	Nigeria	Female	PhD	7 years	Senior	Proficient	Voluntary
Onyx	Nigeria	Male	MSc.	5 years	Junior	Proficient	Mandatory

Table 7. Level of Usage for Teaching Activities Across Countries

			Usage		Total
			No	Yes	
Country	US	Count	39	42	81
		% within Country	48.1%	51.9%	100.0%
	Nigeria	Count	58	77	135
		% within Country	43.0%	**57.0%**	100.0%
Total		Count	97	119	216
		% within Country	44.9%	**55.1%**	100.0%

Table 8. Significance Testing of Usage Across Countries

	Usage
Mann-Whitney U	5184.000
Wilcoxon W	8505.000
Z	-.740
Asymp. Sig. (2-tailed)	.459

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Spatial Evaluation of Elementary School Libraries: A Prototypical Assessment Instrument

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Abstract
Elementary school libraries are no longer spaces where books are stored and read. They are becoming or have become vibrant spaces hosting many activities fostering discovery, knowledge acquisition, expression and exchange. This paper aims at the development of an assessment methodology for such spaces from the perspective of all stakeholders including architects. The evaluation of their performance is essential to define their design criteria to improve their design and construction. The spatial data collected through the instrument is organized as 'Obtainable' and 'Observable'. Obtainable data are gathered from publicly available sources and by requesting the library personnel. Observable data is collected under the categories of '*Form and Environment'*, '*People*' and '*Activities*'. Such data are to be collected directly from the researcher by means of observation and to be recorded in a form. Under '*Form and Environment*', spatial data regarding the space is collected which is utilized to create organizational charts that would illustrate the spatial complexities of the facility. Under '*People*', data regarding the user characteristics such as occupancy pattern, items used here and activities taking place are collected. Under the third category of '*Activities*', each of the activity taking place shall form a sub heading from which it is deciphered how the space is utilized. The objective of this assessment instrument is the collection of spatial and related data that would eventually allow an evaluation. Early indications from testing the efficacy of the assessment instrument show that libraries are lively social spaces. The outcomes are indicative of the direction regarding the design of such spaces in these times.

Keywords: Spatial assessment, post occupancy evaluation, elementary school library, library design, learning commons.

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Introduction

The learning environment is one of the external factors of learning (Sanoff, Pasalar and Hashas, 2001, p.7) and in this case the learning environment is elementary school libraries. The design of the environment therefore has a significant effect on the learning experience learning (Sanoff et al., 2001, p.7). Advancement of technology over the past few decades have influenced the design of these libraries leading to their transformation (Reiser, 2001). The 'Learning Commons' which have replaced the 'library' are an indication of such transformation (Maxwell and French, 2016).

The topic concerns elementary school libraries from the point of view of architects and other spatial designers. Elementary school in Texas (from grade I to grade IV) have their own unique objectives in comparison to higher grade levels (Brookover, Schweitzer, Schneider, Beady, Flood, and Wisenbaker, 1978). School library as defined by the American Association of School Librarians (2018) is a library within a school where students and teachers among others have access to sources of information along with other resources. This study aims at the development of a methodology framework to collect spatial data of elementary school libraries. The research question to be eventually answered using the instrument is 'How have the purpose of elementary school libraries changed over the past three decades?'. The timeframe of three decades was chosen because that was when computers and internet facilities began to appear in school libraries (Gray, Thomas and Lewis, 2010**;** Cullom, 2013; Loertscher, 2018; Reiser, 2001). The context in this case is the planning and designing of such spaces in Texas. The purpose of this research is to assist architects and designers in developing the design criteria of such spaces.

Literature Study

Advancement in information and communication technologies has made knowledge available everywhere and accessible through a pocket device (Gensler 2015 and Loertscher, 2018). Though this might raise the question regarding the need for library space today, expert consensus concurs that libraries would continue to exist although their priorities shall evolve (Gensler, 2014, 2015).

Although school libraries in the United States have existed since the 19th century, it is only during the next century that they gained relevance as a place not only for books but also for other media as well (Siegler, 2005). Although it is widely accepted that libraries are much more than repositories for books, this knowledge is implicit in nature (Maxwell and French, 2016; Head, 2016). The information to design such spaces are not commonly available to architects and designers. As per a study on academic libraries, less than a third of the sample admitted having used formal methods to gather systematic user data from students or faculty as part of the planning process (Head, 2016). The implication is that most architects do not work in conjunction with the facility users who are the major stakeholders in schools (Head, 2016).

As of 2014, the median cost of construction of an elementary school in the United States is about $16 million in which the per capita cost of construction is $211 per student (School Planning and Management, 2015). The library is a distinct space in a school and requires significant investment to build (Gensler, 2015). The escalating

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cost of construction necessitates the need to justify spaces such as libraries in a school (Gensler, 2015).

Gensler (2014), one of the largest architectural firms in the world, conducted studies on academic libraries to understand the activities happening there today and the future of such spaces. Such research is essential to gain a competitive advantage against entrenched competition who have been designing learning spaces for decades (Gensler, 2015). This requires financial capital obtained from client fees and so the value of the research must match the value of the resources expended (Gensler, 2015). Such work is a trade secret for these firms and is only made public at their discretion. This edges out smaller firms who lack the resources to conduct such research.

This research is on elementary school libraries as against academic libraries, so it is a different context where the learning objectives are different, the students are of a different age group and the activities are structured and supervised (Brookover et al., 1978). Elementary schools have different learning objectives in contrast to middle schools and high schools (Brookover et al., 1978). This research would help architecture firms (small and medium size) in developing design criteria of such spaces. This would create spaces that would enhance the learning experience of its users (Sanoff et al. 2001). This in turn would help school administrators to get the best return on their investment as the instrument would decipher the needs and requirement of today from such spaces (Gensler, 2015).

Post Occupancy Evaluation

Post-occupancy evaluation is defined as the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time (Preiser, White, and Rabinowitz, 2015). The objective of evaluation is to see if the project is meeting the original intentions and to judge its quality (Preiser et al., 2015). Assessment, on the other hand, is to compare a building's performance against a benchmark (Preiser et al., 2015). In this study, three building assessment frameworks were examined namely Evaluating Facilities: A Practical Approach to Post Occupancy Evaluation (1983), School Building Assessment Methods (2001) and Learning Space Rating System (2016).

Evaluating Facilities

Parshall and Peña (1983) formulated Evaluating Facilities: A Practical Approach to Post Occupancy Evaluation as a manual to assess building facilities by identifying how well it meets the original intentions. This manual was formulated by them during their stint at the Caudill, Rowlett and Scott architecture firm to aid building owners to measure the value of their facilities. The tool is meant for real estate executives and facility managers and is suitable to assess facilities ranging from multiple buildings in a complex to any clean room in a laboratory (Parshall and Peña, 1983). It does not specify any particular building typology to which it is most applicable. However, the framework needed in this study is meant for school stakeholders such as teachers, librarians, administrators and architects. So, the target group of 'Evaluating Facilities' differs from that of this study.

This tool is to be used within six months to two years of the occupation of the building whereas the libraries in this study could be decades old (Parshall and Peña, 1983).Although both qualitative and quantitative data is collected, the assessment is carried out by assigning scores to various parameters at the discretion of the user. The outcome is a 'Quality quotient score' (Parshall and Peña, 1983) but there is no benchmark against which the final score is to be compared. Ambiguity is observed in terms of factors such as 'creativity and excellence in design' and 'appropriate symbolism. Regardless of its drawbacks, for this study a tool is needed to collect specific spatial data on elementary school libraries to understand their purpose and to observe the manner such spaces are utilized today. For these reasons, this manual is unsuitable for the study at hand although it was useful reference to approach the subject of building assessment.

School Building Assessment Methods

The School Building Assessment Methods by Henry Sanoff (2001) provides a framework to assess K-12 schools. The tool is meant for stakeholders in schools such as teachers, students, parents, architects and administrators who are anticipating the expansion and construction of such buildings (Sanoff, 2001). The biggest strength of this tool is that it focuses on K-12 school facilities which are similar to this study and thus concerns itself with specific data relating to schools. The scale to which it is applicable ranges from an entire school complexes to a classroom (Sanoff, 2001). The tool primarily collects qualitative data and multiple techniques are employed. Some of the techniques are seven-point Likert scale, yes or no questionnaire, photo questionnaire, wish poems, group interactions and rating of layouts (Sanoff, 2001). The answers are primarily perceptual in nature which makes it limited for this study.

The goal of this method is to identify the stakeholder preference to arrive at the best facility design (Sanoff, 2001). However, in this study, the goal is to collect data from elementary school libraries to understand its evolution. This requires factual data as well as perceptual data. Keeping aside the difference in purpose and its limitations, this is a significant resource which aided the development of the assessment instrument.

Learning Space Rating System

Phil Long's (2016) Learning Space Assessment Method, published by Educause, aims to assess the design of classroom spaces in supporting active learning by defining a set of measurable parameters. Like the framework above, it is meant for school stakeholders such as learners and instructors to assess the performance of their facilities (Long, 2016). The scale of facility to which this tool is applicable is limited to a classroom making it more specialized in approach than the above framework (assessing a school complex versus a classroom).

There are two parts to this framework in which the first part is about context, planning and support. The second part is about environment, furnishings, layout and technology (Long, 2016). Overall, this framework has a rigid structure with a fixed set of questions. There are no open-ended questions in this method where subjective accounts could be documented. Valuable data in terms of preferences, opinion and experiences are missed out. Many of these headings and their parameters are

irrelevant for this study (such as maintenance of the facility, mechanical and electrical systems, etc.). Under these headings, there is a set of parameters which are to be assigned a score (Long, 2016). The outcome of this is a score to measure the classroom performance (Long, 2016). Ambiguity was observed in this tool regarding no clear definition of student performance. It is not explained the reasons behind the weightage of the parameters which are to be scored at the discretion of the researcher. There is a sub-section entitled 'Post-Occupancy Evaluation' which adds to the lack of clarity. However, this is a contemporary framework to assess such spaces and is a useful reference in this study

Data Collection Instrument

Elementary schools have their unique learning objectives in contrast to high schools and universities (Brookover et al., 1978). Although two of the methods discussed can assess school spaces, a framework is needed which is custom made for elementary schools only. Due to the deficiencies of the existing methods, a new data collection instrument was devised. The instrument's purpose is to collect spatial data on elementary school libraries only which shall then be assessed through comparison. This is to be achieved by applying the tool across schools of comparable sizes built in different points in time over the past three decades. The objective is to identify the changes happening in such spaces and identify the existing trends which would provide valuable design information to architects.

Through the instrument, both factual as well as perceptual data would be collected, and the data would be categorized under 'obtainable' and 'observable' data. Observable data are the kind which is to be obtained through an observation study by the researcher. The data is further categorized under *'Form and Environment', 'People' and 'Activity*' which are explained in the following paragraphs.

The techniques used to collect data involve qualitative research techniques (Hesse-Biber, 2017) such as semi-structured interviews and surveys of librarians. Quantitative data (Creswell and Guetterman, 2019) is obtained through observations and through existing records such as building drawings. Overall it is a qualitative research design in which quantitative data is used to support qualitative techniques (Hesse-Biber, 2017).

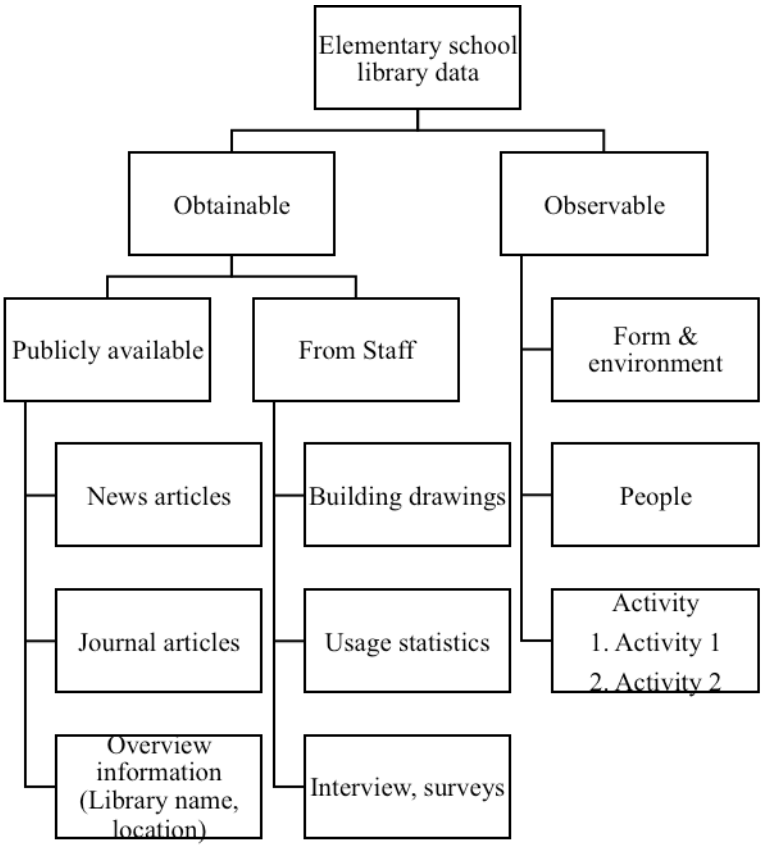

Table 1: Types of data in this study.

Obtainable Data

Obtainable data is collected primarily from the school librarian and other personnel. These include interviews and surveys of librarian and other school personnel. Library usage statistics, building drawings and library resource data also fall under this category. They also include existing journal and newspaper articles on the facility which would provide the relevant data.

Library overview data

The overview provides an outline of the facility within the school. Under the heading data such as school name, location, its year of construction and the total enrolment is recorded. The year of construction indicates if the facility was designed to accommodate equipment such as computers and internet which would be further reflected in its design. The year of construction of such libraries over the past three decades is to be compared against their area to see if the area of the facility has changed over time. The proportion of the library area against the school area is to be determined to observe the change. This would provide a starting point to examine how and why the transformation has taken place. It can be further compared against the total enrolment to see if the per capita area is witnessing a variation.

Semi structured interview

An in-depth account (Hesse-Biber, 2017) of the librarian is necessary to directly obtain facts and to understand the perceptions regarding the space. The interview

requires a structure because the objective is to obtain spatial data but there would information about the space which the researcher as an outsider may not be aware of (Hesse-Biber, 2017). To do so, a semi-open interview structure is adopted to capture the relevant data from the librarian (Hesse-Biber, 2017). An important question to consider if the volume of physical media such as books have changed over the years. From the pilot study, a trend of decreasing volume of books over the years has been observed as online resources such as eBooks are more accessible. Under such a circumstance, the librarian would be able to shed light on how the released space is utilized. In today's context, a librarian may no longer only be a bookkeeper but is viewed as a facilitator of education. This includes the work of a technology assistant where he/she is required to assist the teacher in setting up equipment, instruct students in using equipment among others. The librarian is to be asked regarding their views on their role in the school and the manner it has evolved over the years.

Building drawings

As part of data collection, building drawings such as plans are necessary to understand the space. However, such drawings are not easily available, but egress plans are publicly available. From the pilot study, the egress plan is used to construct the plan of the facility. The plan is to depict the shape of the facility with the layout of its furniture and equipment.

Adjacency diagram (White, 1986) are used to visualize the relationships between the functional areas in a building. Here, it is to observe if the spaces within the library complement or clash with each other. The spaces of the facility are represented in terms of bubbles of varying color to indicate different spaces. The size of the bubble is proportionate to the relative size of the space. In the pilot study, it was observed that the projector screen hung above the desktops. So, the desktops could not be used by a group if another group is using the projector. The spaces in this context were rigidly defined, such as the placement of the book stacks, the librarian check-out counter and the reading area furniture. There was no scope to rearrange the furniture in this case.

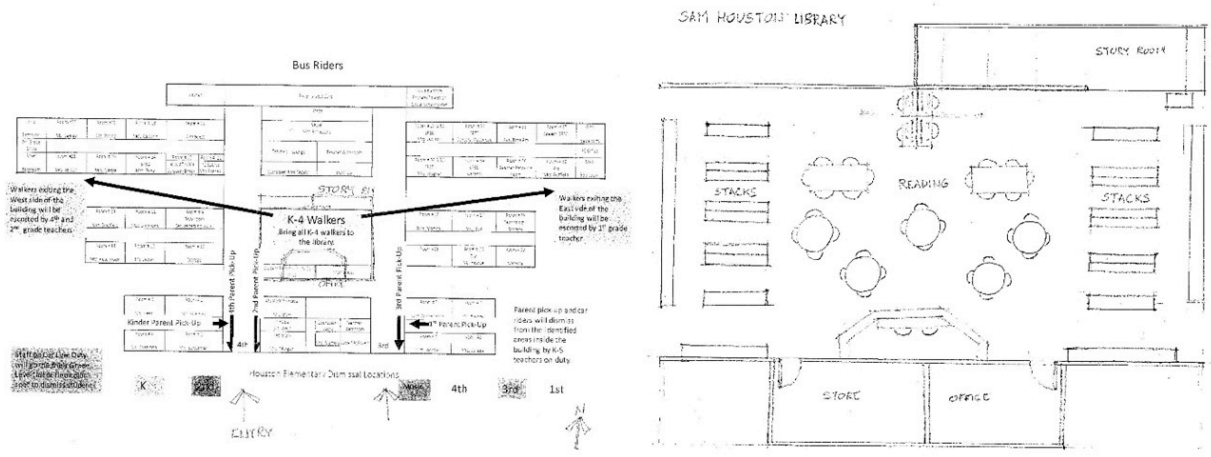

Figure 1 The plan of the library(right) constructed from the egress plan(left).

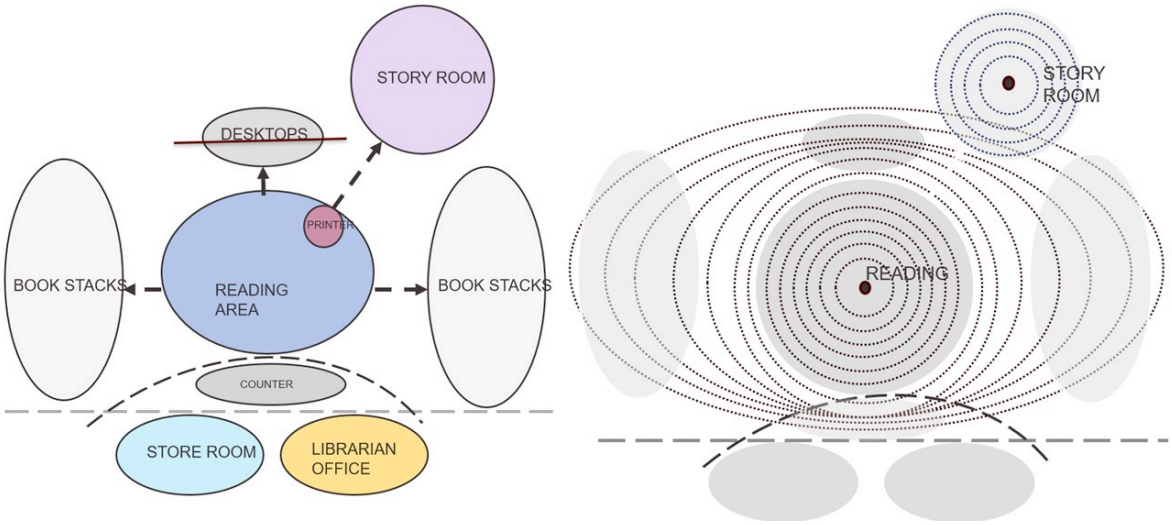

Figure 2 Adjacency diagram(left) and noise diagram(right) created from observations and building drawings.

Libraries today facilitate various activities which produce noise such as collaborative and presentation work (Maxwell and French, 2016). A diagram is therefore necessary to indicate the spaces which produce noise and if the noise spills out to other spaces. A noise level meter is used to measure the noise produced at different points in the library space. In the pilot study, it was observed that the noise produced from the reading area due to a presentation activity, was spilling out to the story-time room where silence is desirable. Such data would be instrumental in making design decisions regarding sound insulation.

People

The elementary school library is used by a range of users at different times of the day and is not limited to students (Gensler, 2016). From the pilot study, it was found out that the space is used by the faculty and the staff after school hours for meetings. The space is also used for Parent-Teacher Organization meetings. Many informal activities such as celebrations take place here. So, it is important that such data is captured by the instrument so that the design would be space keeping such users in mind. For this extent, the users of the space and their purpose are to be listed out, the total staff managing the space and the occupancy at the given hour. The occupancy would indicate how many users are in the space at the given hour and if multiple groups are using it.

Activity

This is the final section of the instrument where the objective is to observe the activities taking place. During the pilot study, it was realized that the researcher should spend one school day at the facility noting down all the activities taking place at different periods. This was to capture the spectrum of activities happening and to understand the dynamics of the space. From the observation and from literature, it was realized the activities taking place can be categorized into three classes, namely individual, collaborative and presentation (Fisher, 2007).

Here, individual activity is the type where a person is working on his own (Fisher, 2007). Here the activities could be reading, coloring, puzzle-solving, working on a desktop or even borrowing an item from the library. Items borrowed could either be taken home (such as a book) or is meant to be used only at the space itself (such as a laptop, tablet or a makerspace kit). For this end, a distinction must be made as this would determine the space needed for the usage of such equipment. During the pilot study, it was seen that the librarian did not spend any time within the check-out counter. If any student needed to borrow a book, the librarian would use the hand-held bar-code scanner standing outside the counter using only the table top. In this case the librarian had her own office, but she also had to perform duties other than being a keeper of books. This included being a technology assistant where she sets up equipment (such as laptops, desktops and projectors) and assist the teachers and students with such devices in the library as well as the class room. This required going around the facility and the school campus as well. This could be one possible explanation for the lack of usage of the check-out counter. Group activities (listed as collaboration activity) were also observed in the pilot study (Fisher, 2007). These included sharing of items such as colors and laptops, building, crafting, assembling and constructing. The space hosts extra-curricular activities of the school such as preparation for a celebration in which the students work in group. Other group activities are staff meetings and parent-teacher organization meetings which also take place here. All these data are to be collected from the librarian and observed if possible. The last type of activity is the presentation activity (Fisher, 2007). This is an instructional activity where the teacher or a student presents to a class using the projector in the library which may not be available in the classroom (Fisher, 2007).

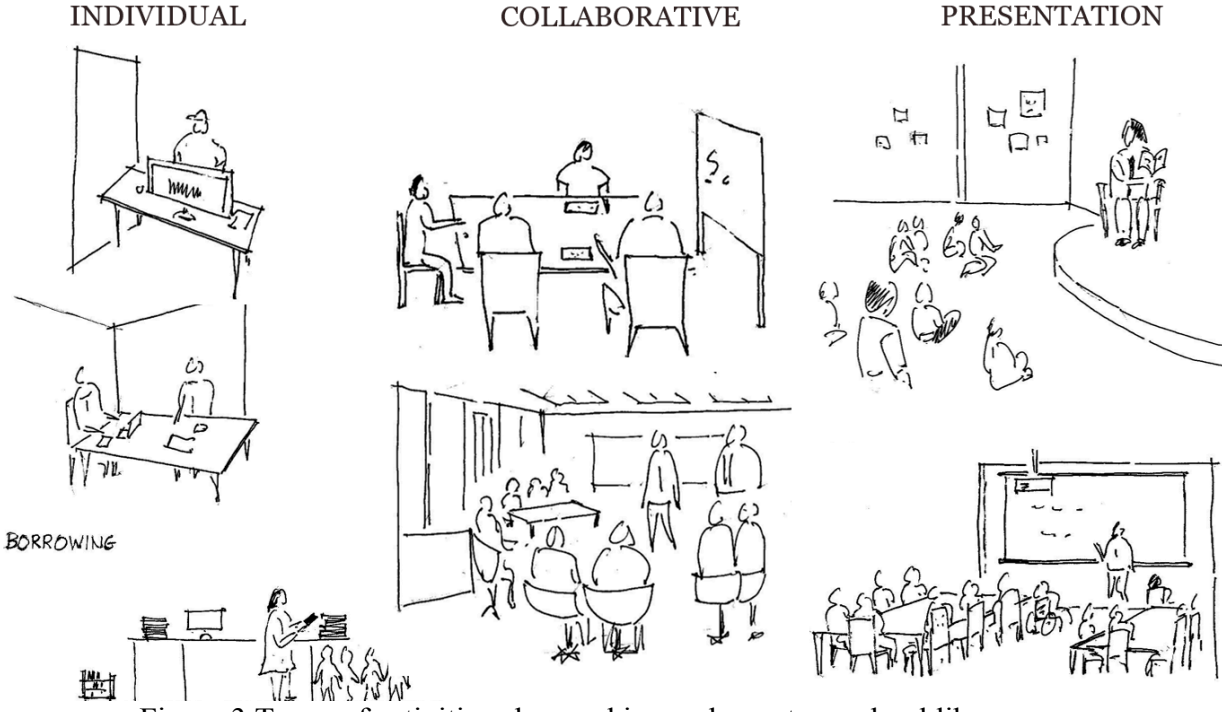

Figure 3 Types of activities observed in an elementary school library

The type of work observed can be classified as individual, group of two and group of three or more. At the same time, the items used by the students are to be recorded. This would indicate the way the facility is utilized. In the pilot study, it was observed that 75% of the users were using laptops at one time indicating the role of technology in such an environment.

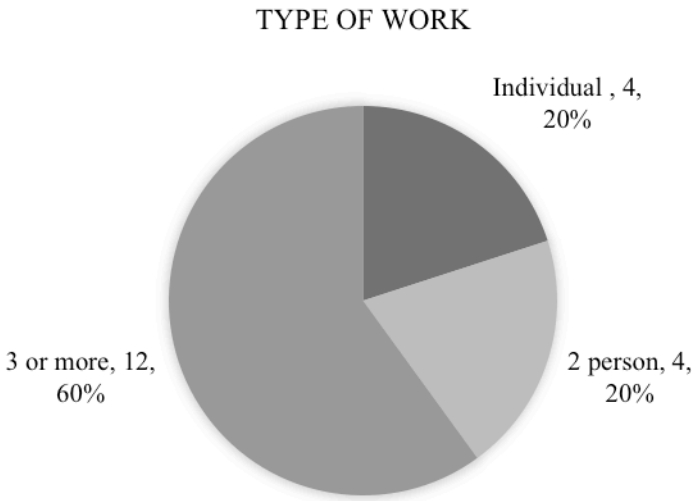

Figure 4 Type of work observed in a class period in the pilot study.

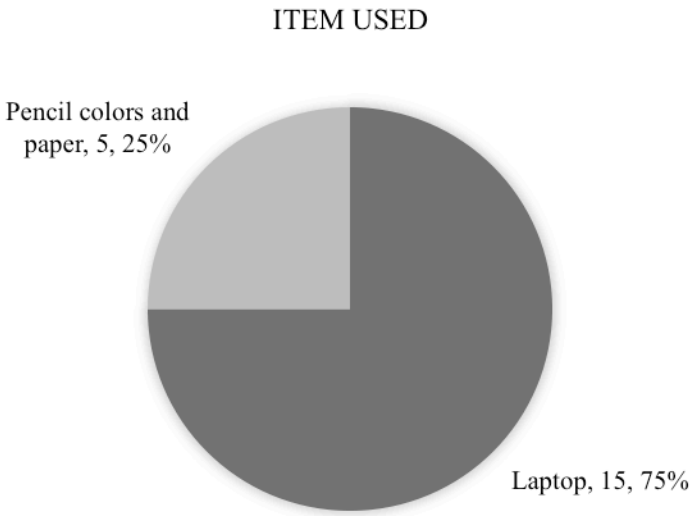

Figure 5 Items used by the students in the library in a typical class period.

The last part of the activity observation is to identify al the activities taking place and study the spatial characteristics of each activity. This begins with determining the approximate area required for the activity, followed by the geometry of the space. The data is to be indicated on the building drawings.

The next step is to collect the lighting data both in terms of quality and quantity (Boubekri, 2008). In this regard, both natural as well as artificial lighting is to be considered (Boubekri, 2008). It is to be seen if natural light through windows, clerestory light, skylights, glass walls or any other form of fenestration in used in the activity. Furthermore, glare from sunlight is to be accounted for. The fenestration details are to be recorded as in the number of openings, their sizes and location. For artificial lighting, the type of lighting fixture (troffer, strip light, track light, cove light, etc.) and the type of lamp (Light Emitting Diode, fluorescent, compact fluorescent, incandescent, etc.) are to be identified. The quantity, location, lamp

power and illuminance are to be noted. To record the illuminance, a photometer is to be used.

Apart from lighting, the noise is another important consideration in the activity. As libraries are no longer the quiet reading areas but are activity hubs (Maxwell and French, 2016), noise is inevitable. So, in this regard, the noise produced in an activity, such as a group work activity like presentation is to be recorded using a noise recorder. From this, it is to be seen if the noise produced by the activity is affecting any other activity in the proximity. For instance, it was seen in the pilot study that the noise produced during a faculty instruction spilled over to the story reading room where silence was desirable. However, in this particular case, only one classroom used the library at a time, so the noise produced was not disruptive.

Other spatial characteristics such as the enclosure characteristics are to be documented. The flooring pattern is to be indicated through floor plans if any space within the facility has such a distinct pattern to demarcate the space. The flooring materials such as carpet tiles, vinyl composition tiles, resilient rubber tiles, hardwood flooring or any other material is to be identified to see if any material is used for acoustic reasons. If the ceiling pattern is non-uniform, then it is to be depicted in a reflected ceiling plan. As for walls, it is to be identified if they serve any purpose in the form of a usable vertical surface such as displaying an item. The door material is to be identified (glass, steel, aluminum, etc.) and indicated if it is transparent to allow visibility. Furniture used in the activity is to be listed and described. The equipment used in the activity (such as projectors, laptops, tablets, etc.) are to be mentioned. These data relating to the activities taking place are therefore important.

Conclusion

Although other spatial data collection tools exist, they are generic in nature applicable to a variety of learning spaces. However, this instrument is devised to collect spatial data in the context of elementary school libraries in the United States. Specific qualitative as well as quantitative data is collected to gain a comprehensive understanding of the evolving purpose of such spaces. A pilot study was undertaken at a local elementary school to validate the instrument and the findings were incorporated in it. For instance, it was observed that although the school was the at center (literal and figurative) of curricular and extra-curricular activities. Although the facility was designed at a time when desktop computers were unavailable, today the school has bypassed the need for them due to laptops being cheaper and more convenient to use. Although the volume of books is decreasing over the years, the need for space in the library has not reduced as the library hosts multiple activities related to learning. The librarian checkout counter is a redundant space in the pilot study case due to the librarian's expanding role. However, this data cannot be generalized to all such libraries. For this end, this instrument is to be applied to multiple elementary school libraries built over the past three decades and the data is to be compared to understand the evolution of such spaces.

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Case Study: Creative Leadership and Diversity in a Manufacturing Technology Company

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Abstract
This qualitative case study explored the phenomenon of Creative Leadership, diversity and communication strategies to support creativity and innovation in a global technology manufacturing company. Visuals demonstrate various leadership traits and diversity connections within the context of innovation and creativity. The study found a clear definition of an organization's culture, effective communication, acceptance of unique skills and traits of co-workers and flexibility are building blocks for innovative processes. This exploration of leadership and diversity implementation integrates studies and practice through the discussion of a mid-size manufacturing company's practices and current literature. The study focuses on a global, innovative company in the technology field. The topics explored include leadership, diversity implementation, vision, culture and innovation, and leadership growth for the future.

Keywords: Creative leadership, innovation, diversity, inclusion, change management, organizational culture, leadership, communication, case study, career paths, collaboration, teams, implementation, vision, future

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Introduction

Companies of all sizes strive to implement creativity and innovation even as they manage the change that comes with disruptive technologies. Challenges that face industry include: the explosion in predictive-analytical tools, ever larger data pools, new materials, merging robotics and AI into workforces, retaining a skilled workforce, and creating an organizational culture supportive of innovation (Abecassis-Moedas & Gilson, 2018). Creative Leaders explore strategies of inclusion and diversity in support of creative thinking, multiple perspectives discovering multiple solutions, retention of skilled workers, managing change and chaos, and building team engagement. According to Taylor, Santiago, Hauer, Hynes, and Mickahail (2019) to understand how diversity works within an organization, leaders are challenged to ask:

1. What leadership changes are required to lead and perform with a diverse workforce?
2. What cultural knowledge is needed to communicate and operate with a diverse workforce?
3. What cultural attributes must one manage or address?
4. How are time and resources managed for diversity?

Figure 1 provides a visual overview of the challenges and interactions of diversity a leader will encounter.

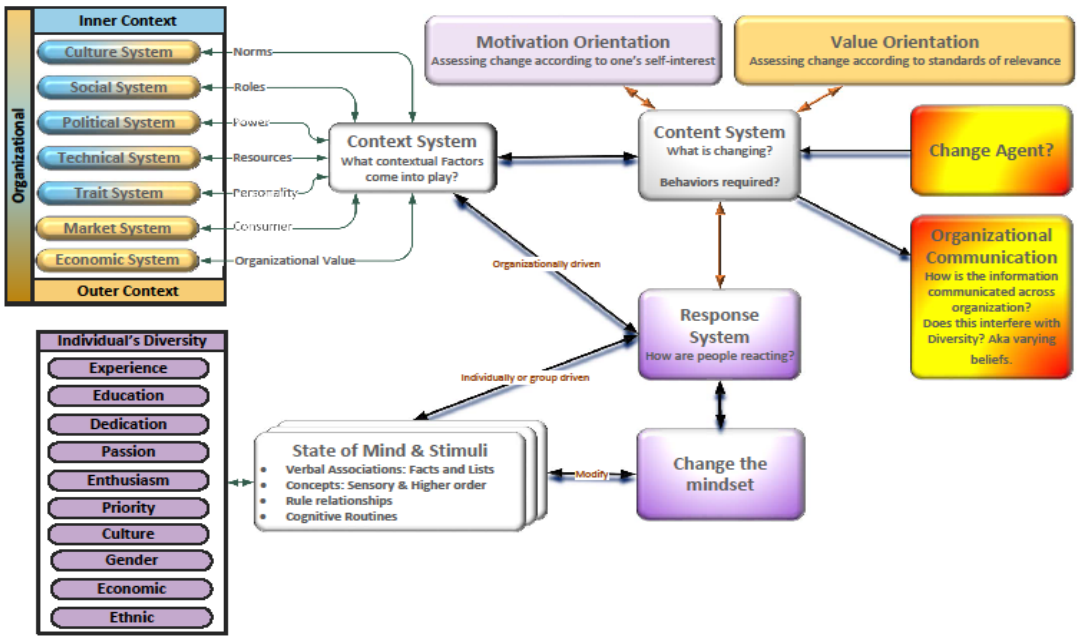

Figure 1: Concepts of Diversity and Communication
(Taylor, Santiago, Hauer, Hynes, & Mickahail, 2019)

This study explored the best practices of a mid-sized manufacturing company in the technology field, discovering best practices in innovation, diversity and inclusion.

Methodology

The exploratory case study focused on the phenomenon of an organization creating an innovative environment. Samtec, Inc. the organization used in the study, is a member of Fortune's 15 Best Workplaces in Manufacturing and Production, demonstrating diversity and innovation. The company is a global manufacturing organization in the technology industry, with sales of $100 million or more. The goal of the study was to identify best practices of a medium global operation demonstrating innovation in production, management, and R&D (Mickahail & de Aquino, 2019; Samtec, 2018). Narratives, interviews, and shared documentation were used to compile an overview of best practices of leadership for innovation and creativity. NVivo and Dedoose software were used in the analysis of the transcribed interview data, pulling out themes and organizing the data to share rich descriptions of leadership styles and practices.

Samtec, Inc.

Samtec, Inc. is a privately held $800 million global manufacturing company specializing in the largest variety of board-to-board interconnects in the industry. Headquartered in New Albany, Indiana, USA, Samtec evolved from a small chip manufacturer to an organization with a global reach with products sold in more than 125 countries, offices located in over 24 countries and approximately 6,000 associates worldwide. Samtec's business model is based on Sudden Service, providing products in a timely fashion, with a global infrastructure of sales, engineering, operations, quality, and IT (Mickahail & de Aquino, 2019; Samtec, 2018).

Samtec has a culture of learning, training, and personal growth. Customer service is a key part of their identity, with a flexible manufacturing process that grew from meeting customer needs. The organizational culture is formalized in Samtec DNA: Speed, Innovation, Flexibility, Win-Win. (Mickahail & de Aquino, 2019; Samtec, 2018).

Leadership

Samtec emphasizes the need for leadership demonstrating the core values and philosophies of the organization. Statements from interviewees reinforced this concept: "… the people that report to you care about what you care about. What does the leader care about? What does the CEO care about?" As an organization with a flat hierarchy, leaders at all levels support the culture of innovation and are accountable to other leaders, but also to all employees. Innovation is a core value of Samtec, reflected in leadership's support of experimentation, creating a safe environment to fail, with a common comment being "…let's try it and see what happens." The description of leadership at Samtec aligns with Creative Leadership traits.

Creative Leadership is defined as both a philosophy and an act (Mainemelis, Epitropaki, & Kark, 2018). Creative Leadership as a philosophy that embraces change while envisioning the positive future. Upon implementation, it builds toward those desirable futures through innovative strategies, unleashing the collaborative creativity of teams. According to Mainemelis et al. (2015) creative leadership in organizations

depends on creative and supportive contributions, operating in a collaborative context. Further explanation includes three main concepts: facilitating employee creativity; directing the materialization of a leader's creative vision; and integrating heterogeneous creative contributions (Mainemelis, Epitropaki, & Kark, 2018). To maximize creativity, an organizational culture encourages diversity, creates a safe environment, supports open collaboration, and employs Design Thinking or similar creation strategies.

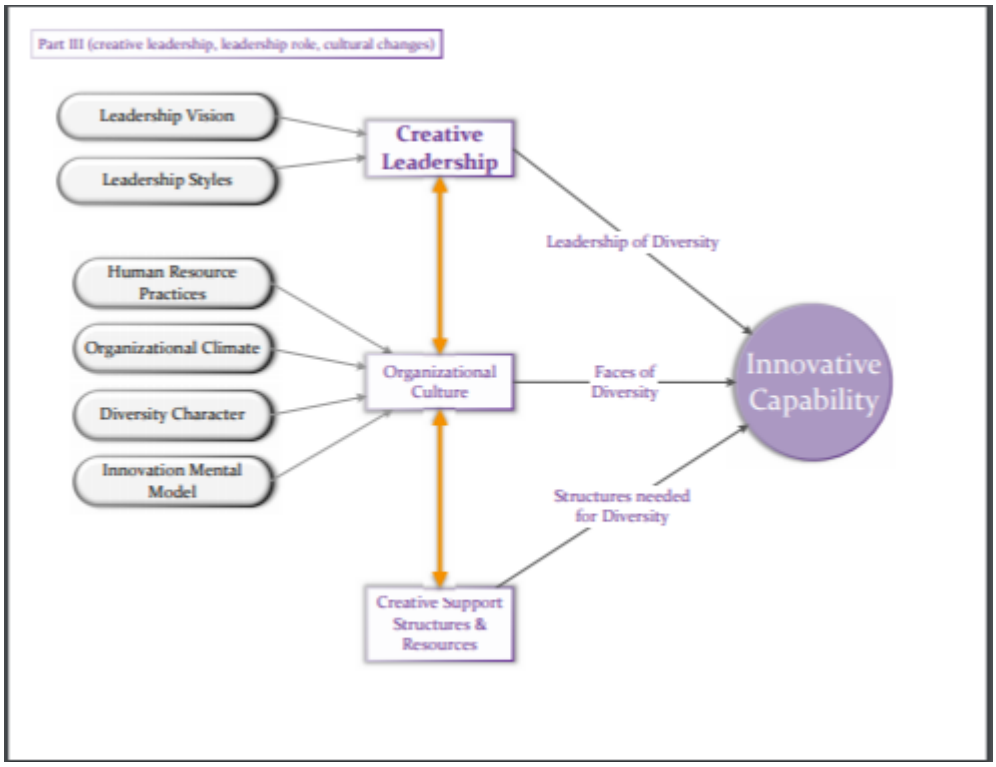

Figure 2: Creative Leadership
(Taylor, Santiago, Hauer, Hynes, & Mickahail, 2019)

Diversity and leadership challenges

To support creativity, diversity provides multiple perspectives and solutions. Diversity will not automatically create innovation, but diversity is supportive as a tool and resource. Leadership must be aware of communication strategies and share goals in a variety styles to engage a diverse workforce (Abdolmaleki et al., 2013). Complex leadership challenges include organizational as well as individual challenges. To address the multiple challenges of diversity and environment, a Creative Leader will assess and establish an appropriate hierarchy of communication and leadership. This organizational structure should support clear and transparent communication that flows throughout the organization, empower workers, support risk taking, encourage personal growth, create career pathways within the organization to retain skilled workers, allow agile responses to threats, and manage internal and external chaos effectively (Abdolmaleki et al., 2013; Abecassis-Moedas & Gilson, 2018; Bort, Bersch, Wagner, & Rueffer, 2017; Jin, Lee, & Lee, 2017).

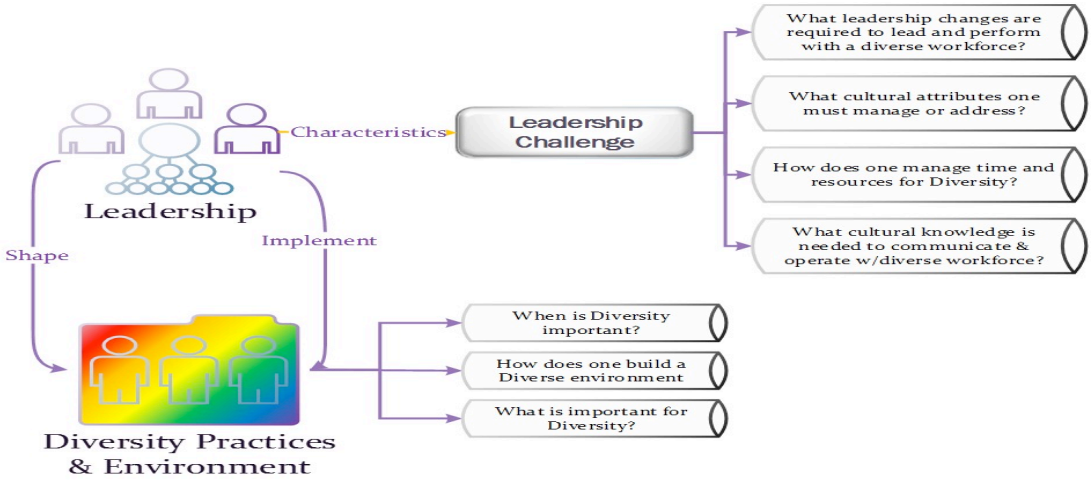

Figure 3: Diversity Practices and Environment
(Taylor, Santiago, Hauer, Hynes, & Mickahail, 2019).

Samtec has a cross-functional, flat, or horizontal, hierarchy. Narratives established that, while leaders establish core values, a true Open Door policy empowers all employees, with every individual able to "…ask about anything, anywhere, to anybody." Everyone is encouraged to weigh in about processes, sharing their unique perspective of ways to improve customer service. This culture evolved early on, as the 'organization as family' attitude of a small company allowed 'why' to be asked often. As the company grew, leadership understood the need for diverse input on processes, and the Open Door policy was implemented, supporting a horizontal hierarchy. Managers operate in open cubes mixed in with other departments and are expected to 'walk the floor' regularly during the day. Issues are often resolved on the spot, before they grow to be major problems.

The Samtec culture assumes everyone has worth. Diverse skills and talents are appreciated, sought after, and utilized. People are not 'boxed in' by standardized measurements, rather Kolbe assessments are used to discover skills and aptitudes, as well as resolve coaching and mentoring style conflicts. A saying used several times in interviews was "…round peg round hole, it is our responsibility to find the jobs to fit the skills. You don't throw the person out, you find where they fit." Workers are encouraged to 'try out' different jobs within the organization without fear of failure. The creation and encouragement of varied career pathways within the organization retains skilled workers while allowing them to grow. Samtec emphasizes accepting the unique qualities of individuals, defines diversity as multiple individual life experiences, and builds diversity through supporting personal growth and seeking out new employees based on accomplishments and skills, not standardized measurements.

Application of Creative Leadership

Innovation has increased the pace of change, demanding flexibility and agility from organizations (Zhu, Zou, & Zhang, 2019). Creativity has become a product, and companies are viewing leaders and processes from this new perspective. Creativity itself is not classified as useful innovation until the results from employing this product are able to be implemented in a useful, sustainable form. In business, creativity does not exist just to exist, but to contribute to the organization in a meaningful fashion. The definition of Creative Leadership encompasses this concept

by including the idea of Creative Leadership as an act, as well as a philosophy. According to Mainemelis, Epitropaki, & Kark (2018) builds a better future through supporting creative solutions and empowering both individuals and teams; leaders create the vision of the future and empower the individuals and teams in an organization to work toward the vision.

One aspect of empowerment is the creation of a safe environment that encourages employees to use the Design Thinking strategies to empathize, define, ideate, prototype, test, while imagining, failing safely, and applying feedback (Chasanidou, Gasparini, & Lee, 2015). Innovative companies such as Samtec create an environmental climate of experimentation and possibility thinking. Mantras such as 'fail fast & recover quickly', SOW (stuff on the wall), and 'Ready-Fire-Aim' allow associates the opportunity and freedom to unleash creative ideas and solutions to old or new challenges allowing products and services to positively impact the bottom line at a quicker pace. Transparent problem solving through high-intensity group brainstorming is intended to quickly combine diverse ideas and move to action. Virtual conference rooms allow 'standing meetings' to occur regularly across the globe, as well as encouraging 'on-the-spot' and short idea sessions to convene organically. Allowing all employees, no matter their 'rank', to participate in ideation is a proven success tool in innovative organizations (Dodge, Dwyer, Witzeman, Neylon, & Taylor, 2017). Moreover, organizations that support creativity through giving workers the most autonomy have the greatest success in innovative fields (Stachova, Stacho, & Vicen, 2017).

Leadership Challenge and Role

A leader establishes and shares the vision of the organization's desired future. The leadership role is to foster the innovative work environment through transparent communication, empower the individual through accepting diverse perspectives, while coaching toward the business drivers (Taylor, Santiago, & Hynes, 2019). The Creative Leader remains a champion of the organization's core values while communicating a clear vision of the desired future of the company, allowing the workers to engage, no matter their position.

Samtec encourages mentoring at all levels, assuring the clear communication of expectations. The establishment of teams that cross departments, inter-departmental trainings, and virtual teams meeting regularly and as needed across the globe, ensures there more people communicating and focused on solving a challenge. Complex challenges are addressed more effectively through diverse processes, intense communication, and diverse multicultural teams. These processes enable an organization to capture and exchange unique information while increasing the perspectives aimed at addressing issues (Hajro et al., 2017). Creative Leaders lend support with resources and a clear vision. Part of creating a clear vision is sharing a definition of the organizational culture.

Defining the Culture

Samtec's culture supports creativity, experimentation, and innovation. This culture led to the development of Sudden Service, a global infrastructure of engineering, sales, operations, quality, and IT that optimizes specialized technology centers to

provide a complete level of service and support for customers (Samtec, 2018). The culture of innovation is modeled by leadership through customer interactions and a strong work ethic. It is facilitated by the open floor concept of the organization, in all locations. Samtec's core values and goals are always on display, both through physical signage and employee attitudes. Sustaining a positive creative culture is a challenge which Samtec meets through clear communication of how their culture is defined.

Defining an organization's culture was listed as a key step to creating an innovative workplace in the case study interviews. The definition of an organization's culture is the structure that supports the company's philosophy. Samtec's culture evolved as the company grew from a small organization with 'we are all one family' values to a global presence that continues to keep caring for one another as a core value. The founder's emphasis on customer service led to the flexible manufacturing processes that serve the customer best. Decisions are based on what is best for the customer, not just the organization's bottom line. The culture supports the philosophy of customer service, because Samtec defines itself as a marketing organization first, and a manufacturing entity second. The emphasis on the customer drives the innovative culture that supports questioning all processes.

Part of the questioning culture is Samtec's ability to embrace a culture of 'why'. All employees are encouraged to ask why, as well as suggest 'how'. Every employee is empowered to act in the customer's best interest and suggest solutions as well as point out challenges. Every individual has worth, and his or her diverse experiences and skills are valued. Labels do not limit people and retention of workers is seen as a measurement of success.

However, communicating the definition of the culture in a memorable style that translates to a diverse group can be difficult. Samtec defines their culture through trainings sharing the 'Samtec DNA'. Visuals throughout the company headquarters remind workers of their 'DNA': Flexibility, Innovation, Speed, Win-win. The win-win is a reminder the customer and organization both win when the job is done correctly. Innovation and speedy delivery of unique products support the customer experience. Flexibility allows the organization to respond to the rapid changes organizations face in today's time of radical innovation and global competition. The core values are reflected in the practice that every worker is valued, expected to show respect to others and themselves, and to continue their personal growth.

With training, the phrase 'Samtec DNA' encompasses the flat but lean philosophy of operations that empowers all workers; the aptitude and appetite for innovation, collaboration, and keeping the vision of customer first. Mentoring and on-going trainings develop self-awareness, emotional intelligence, and job skills. 'Fast to Fail' processes establish a safe environment to experiment with prototypes and processes. Throughout the data gathering process, Samtec DNA was used to symbolize and convey an innovative attitude, self-worth, and diversity. This inclusive culture supports the sharing of cultural knowledge and diversity.

Cultural Knowledge and Diverse Innovation Group

The innovative group must desire, and feel empowered to solve a problem. Innovation is a voluntary act, one that cannot be dictated, but one that can be encouraged through a safe environment and open culture. Creative Leadership acts as a guide to coordinate decisions and support the collaboration that enables group members to communicate and create. According to Wartzman (2014) the leadership shares exiting knowledge and gives access to knowledge and power in support of the creative team.

Further, leadership helps shape and implement the building of internal and external relationships, developing trust among the culturally diverse members (Dodge, et al., 2017).

The environment and context that drives innovation is created and sustained by the leader (Stachova, Stacho, & Vicen, 2017). A core part of an innovative and diverse group is building trust across cultural, gender, educational, and multitude of other diversity factors. Trust is considered in a standalone construct isolated from culture, but culture is major effector. Taking these factors into consideration, then a primary challenge to developing a diverse innovative team is time and communications, as illustrated in Figure 4.

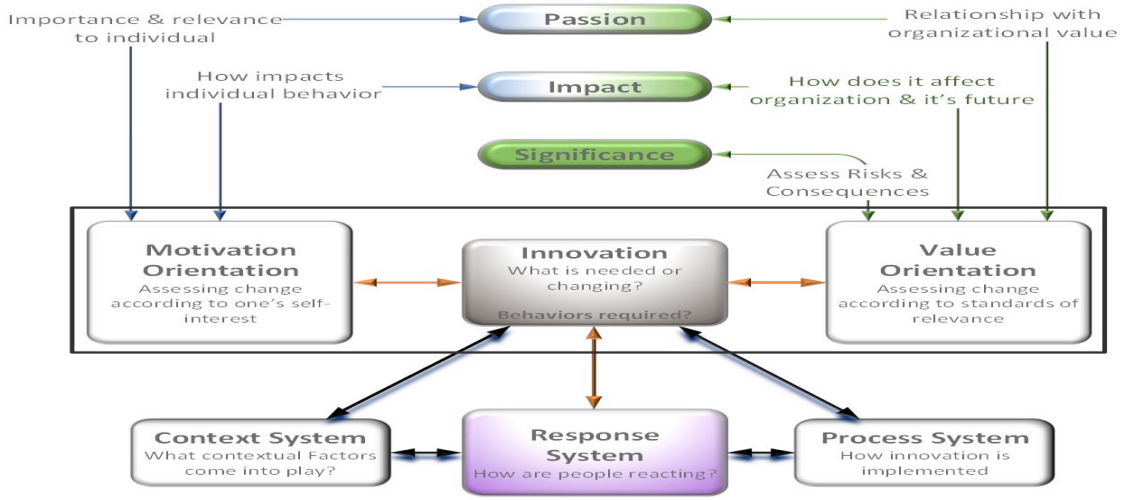

Figure 4: Leadership, Leverage, and Passion
(Taylor, Santiago, Hauer, Hynes, & Mickahail, 2019)

Leaders need to focus on and create an innovative environment through understanding what motivates the workers, the reward, and the underlying core behaviors. Harnessing and employing the knowledge and passion resident in the workers of the organization, to enable the decisions, culture, and unique characteristics of workers, is part of an organization's value (Maruta, 2014; Pontikes & Barnett, 2017; Wartzman, 2014). Diversity and collaboration support effective decisions with more creative options (Rock & Grant, 2016).

The process system analyzes how one encourages and implements innovation. The environment should reflect a supportive, innovative organizational culture, allowing the worker to realize their potential and follow their passion. A transactional, repetitive environment stifles empowerment and creativity, leading the worker to feel like a cog in the machine. The visual representation in Figure 4 includes the context system and interaction with motivation, orientation and value, drivers that influence

innovation. When creating an organizational culture, the needs of the entire organization should be considered, with a vision and philosophy that creates a positive value response from members and leadership across the organization (Taylor, Santiago, Hauer, Hynes, & Mickahail, 2019).

Conclusion

This study used a case study to explore the best practices of an innovative manufacturing company in the technology industry. Creative leadership practices, innovation strategies, and communication techniques used by the company demonstrate effective approaches to discovering and supporting creativity and innovation within an organization. The internal and external influences are mitigated or enhanced to align actions with the organizational vision through leadership practices and the organizational culture's impact. Consistent trainings are part of the communication plan to ensure core values are ingrained in the organizational culture. Mentoring and daily leadership interaction contribute to employee empowerment.

Samtec demonstrates Creative Leadership that supports innovation. From establishing a clear vision based on Core Values to defining the culture in the easily shared 'Samtec DNA' concept, Samtec has created an organizational culture supportive of innovation and creativity. Sustaining an innovative culture in a manufacturing company is a challenge that has been met through establishing clear expectations, internal communications, and creative tools that allow virtual teams to interact globally.

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A Method to Predict Students' Success in Distance Online Courses

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Abstract
Information technologies change the entire structure of the educational process. Its aspects – academic, administrative, technical, communicative, and personal – acquire specific traits in the framework of online education. Scholars and practitioners nowadays face the task of developing new methodologies of assessing and predicting online students' success. One of such methods is described in this work. Its development consisted of 3 stages: 1. Creating a brochure which contains important information about the educational process in the framework of distant online programs and requirements for successful studying in online courses; 2. Preparing a questionnaire based on the brochure, whose questions allow to determine if students successfully master many-sided knowledge needed for their online studying; 3. Conducting a computerized survey to a) verify the questionnaire's comprehensiveness and b) find quantitative criterion for identifying students at risk. 105 online graduate students participated in the survey. Mathematical analysis of their data was performed including Spearman's correlation method. The study results showed the following: 1) The questionnaire is clear and understandable; 2) A critical number of wrong answers to the questions which identifies the online students at risk of failure is "2"; 3) There exists a high positive correlation between the students' survey results and their academic achievement in the online course. The results allow to conclude that the tool created will make it possible to identify online students at risk already in the first days of the semester. So, a timely supportive training to incompetent online learners might be offered to prevent undesirable administrative consequences.

Keywords: distance online education, online learning, predicting online students' success, online students at risk, computer-based survey

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Introduction

Unsuccessful students are inevitable at any learning. They are present just as long as education itself. Although, this social problem was treated differently at different times. In traditional societies, physical punishment of underperforming learning was considered normal. The humanization of society led to the humanization of education, and educational institutions began to pay attention to the timely identification of academically problematic students, and their adaptation to school.

In modern societies, the rapid development of information technologies lead to the widespread incorporation them into education, specifically, the emergence of distance online programs. This has transformed the learning process and the very concept of the "at risk student". In today's online courses, this student is, above all, an illiterate computer user and incompetent information seeker. It is an individual unfamiliar with technological learning tools. Finally, it is a person unable to cope with her/his educational tasks due to lack of awareness about institutional rules and requirements accompanying distance education. Sometimes, these learners do not even understand that having of all these abilities and skills is an ultimate prerequisite for being successful in the new learning environments.

Information technologies change the entire structure of the educational process, and it acquires specific features. Nowadays, scholars and practitioners face the task of developing new methodologies of assessing and predicting success of the students receiving education in the new learning environments. Especial attention is paid to the methods of early diagnostics of online students at risk.

It should be noted that the idea of early identification of problem students is not new. Various experts have been trying to create of such methods for a long time. Already the most primary review of publications shows that research is developed in two main directions. In one of them, the instructional strategies for identifying at risk students are borrowed from those who teach in the classroom. Data collected by teachers working in the classroom and the reports summarizing their experience are invaluable (Hammond et al, 2007; Archambault et al., 2010; Hoffar & Fauer, 2011). In another direction of the search complementing the traditional approach, technology is utilized to accomplish the task (Toom, 2015).[1] This area of research and practice, called data analytics, develops intensively in the framework of education.

However, even today, data collection in many cases remains labor- and time-consuming task. But as experts mention, the matter does not tolerate delay because it relates to possible negative academic and administrative consequences. Experts warn that "early detection and taking appropriate measures is critical as most at risk students drop out of college within the first year" (Ed, 2014). Specialists point to behavioral and cognitive characteristics of at risk students and describe "warning signs to look for" for prevention of dropout tendency (Fusch, 2010; McDonald, 2017). What is also notable, in some American universities, "online courses lead to higher dropout risk than their traditional counterparts" (Gooray, 2017), and online students

[1] One of the most advanced learning environments, the Blackboard platform, on which online courses are developed at Touro College & University system, incorporates programs which carry out a multifaced analysis of students' learning activities. Students' work in the online courses is recorded and documented in detail.

"receive grades 0.44 points worse on a 4.0 grade point average scale compared to traditional students who took the same class in person" (Bettinger & Loeb, 2017). All these facts definitely deserve attention from online education practitioners.

In our work, an attempt has been made to create a methodological tool for identifying the students at risk of failure at the very early step of their studying in an online course — in the first days of the semester. This would allow instructors to early assist and support the incompetent learners, especially online novices, and to prevent negative consequences undesirable for both our educational institution and the students.

Theoretical approach

Education is the process by which society deliberately transmits its cultural heritage from one generation to another through schools and other social institutions. Traditionally, the process of learning, enlightenment, and transfer of knowledge from teacher to students, as well as the process of acquiring knowledge, takes place in classrooms. However, what occurs in a classroom is not limited to academic activities. The educational institutions and the educational process implemented by them follow certain administrative rules and regulations. In addition, the transfer of knowledge and its uptake are due to the constant communication between the participants. Also, technical tools widely used in today's education transfers teaching, learning, and communication between participants into an artificial cyber environment. Finally, certain personality traits are needed for successful adaptation to the new learning environments. So that, all these aspects – academic, administrative, communicative, information-technological, and personal – are important components of any educational process. In Figure 1, our vision of the educational process is exposed. It includes the five basic aspects mentioned above. As our experience shows, this model of education is embodied in the device of any online course.

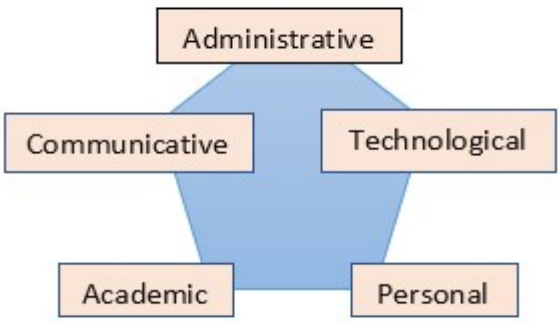

Figure 1. Major aspects of educational process

Methodology

Goal of the study

It is to develop and approbate a methodological tool for predicting students' success in online classes.

Hypotheses

1. Five areas of educational process – administrative, academic, communicative, technological, and personal – are necessary and sufficient for representation in the measuring tool;
2. A descriptive brochure with an accompanying and based on it questionnaire seems to be a quiet appropriate traditional measuring tool for testing people's knowledge of professional kind;
3. There exists a positive interconnection between the students' survey results and their academic achievement in the online class.

Tasks of the study

1. Creating a brochure which contains important information about a) the educational process in the framework of distant online programs and b) requirements for successful studying in online courses;
2. Developing a questionnaire, based on this brochure, whose questions allow to determine if students master multifaced knowledge needed for their successful online studying;
3. Conducting a computer-based survey which discovers if the questionnaire developed is clear and comprehensible for respondents;
4. Finding (based on the survey data) quantitative criteria of students' incompetence as online learners, particularly, students at risk of failure.

Participants

Participants of the study were 105 graduate students which took the same online psychology course *Child Development and Learning in Cultural Context* with the same instructor (the author) in the spring (60 students) and the fall (55 students) semesters of 2018.

The average age of participants was approximately 30 years. Forty-two students (40%) were online beginners; other 63 students (60%) had a previous experience in studying online. Twenty-two students (21%) students were males, while 83 (79 %) were females. Fifty-eight students (55%) were white, 21 students (20%) were black, 20 students (19%) identified themselves as Latinos (Hispanic), and six individuals (5.7%) – as Asian Americans. Three participants in whole investigated population were recent immigrants from Israel and Eastern European countries, and English was not a native language for them. The demographic and biographic data were collected from the students' postings and photos submitted to an "Introduce Yourself" forum at the Discussion Board of the course.

Instruments of the study

Brochure

The brochure *How to Succeed in an Online Course* was created by the author in accordance with the theoretical approach described above. The brochure consists of five sections corresponding to five aspects of the educational process: academic, administrative, communicative, technological, and personal. Each section contains a

set of learning situations with recommendations specific of one aspect of educational process; there are 22 situations/recommendations in total. The quality of the brochure was evaluated by four experts: a college administrator, an instructor of on-line courses, a technical support specialist, and a psychologist familiar with the specifics of work in distant online programs. Each of them made comments on the section of the brochure in which they were specialists. Their remarks and comments were considered by the author. Below, brief descriptions of all five sections of the brochure and examples of recommendations from each section are given.

Discovering administrative rules and regulations. In the *administrative section*, the students become familiar with: rules of online net etiquette, academic integrity standards concerning cheating, fabrication, and plagiarism, the college policy regarding various aspects of grading students' work, the college policy regarding dropping the course and getting incomplete grades, and requirements for course attendance and participation.

An example of the administrative recommendation whose knowledge prevents from loss of one's finances and academic status is present in Figure 2.

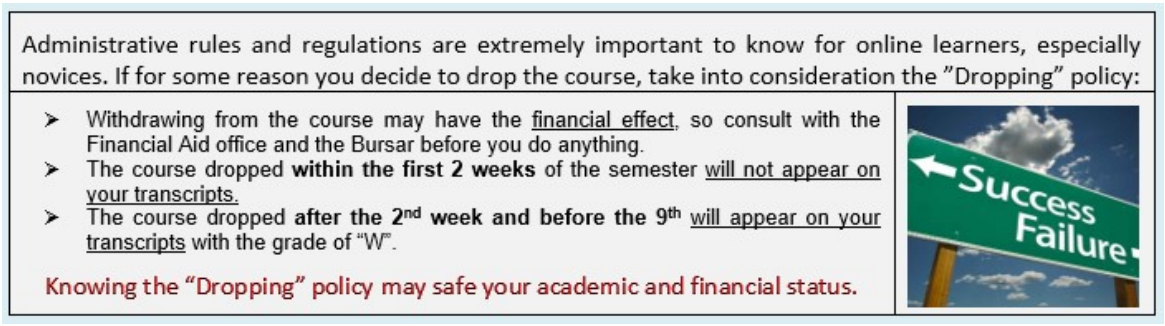

Figure 2. The recommendation representing the "Dropping policy"

Observing academic requirements. In the *academic section,* the students find out various aspects of academic discipline which they should observe to reach the main goal – successfully master both the subject (*Child Development and Learning*) and the information-technological tool (*Blackboard*) providing the study. Here students become familiar with requirements regarding optimal academic load in the online course, timeliness of the homework submissions, limits on the number of missed assignments, student's actions in case of illness, hospitalization, or delivery.

An example of the academic recommendation whose observation prevents one from getting a non-passing grade for the course is present in Figure 3.

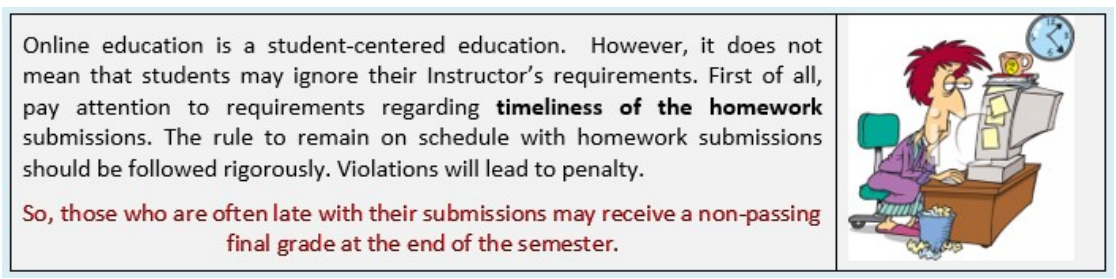

Figure 3. The recommendation containing the key-requirement for homework submissions

Following information-technological recommendations. The *information-technological section* includes requirements for both the students' computers and their computer and software management skills. It informs students about the college requirements for technical characteristics of students' computers (processor's power, memory capacity) and preferable browsers/mobile applications, their computer management skills needed for the start as well as new computer skills that should be learned in the course.

As a result, the students become also aware of the restrictions which their new learning environment (Blackboard platform) dictates. An example of technological recommendation specifying some computer skills without which one's study in the online classes would be impossible is demonstrated in Figure 4.

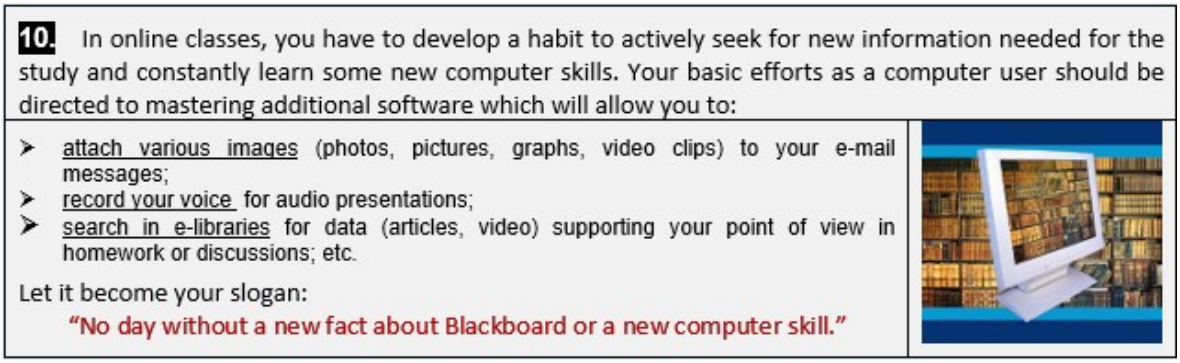

Figure 4. The recommendation to constant development of new computer skills

Accepting request for communication. In the *communicative section,* the students are exposed to the idea that a feeling of community is one of the most important for online learners. This feeling may appear only due to proper communication. Students find out a variety of online communication and its strict regulations in the framework of their online course. Here students are a) familiarized with the forms of communication specific for the online courses (visual, audio), b) instructed in implementing messages different in their goals (private, public, related to course, related to subject), c) familiarized with rules of formatting their messages, d) informed about the typical "formatting" errors which have a breaking effect on online communication, e) offered kinds of message exchange needed to be mastered for their successful online study (group and individual conferences, e-mail messages, postings on the Discussion Board), f) recommended the optimal regime of message exchange whose violation leads to a feeling of isolation.

An example of communicative recommendation is illustrated in Figure 5. Recommendation which is presented here provides a positive atmosphere on the Discussion Board and stimulates respectful relationships between classmates.

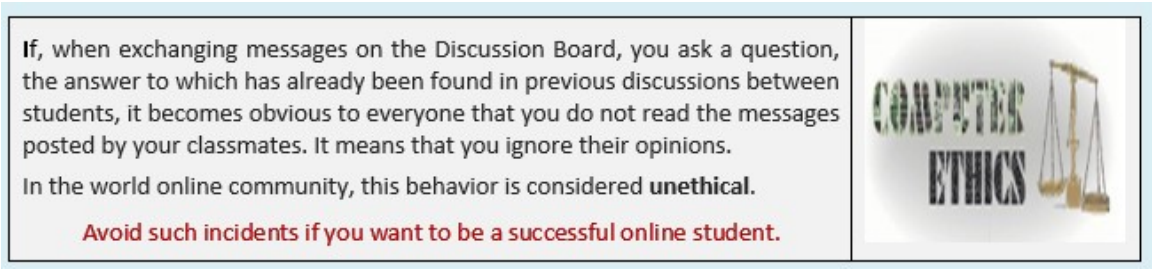

Figure 5. The recommendation for avoiding communication problems in the online class

Perfecting one's personality for online education. The *personal section* includes descriptions of the personality traits which the students should have or develop to become successful online learners. In this section the students find out which qualities they should cultivate in themselves to become successful online learners. That is, a) which psychological features they should develop (responsibility, self-discipline, goal-directedness, intellectual independence, and learning motivation), b) which social attitudes they should have (respectfulness, ability to promote positive relationships with others), c) which professional characteristics and qualities are preferable for studying online (abilities to actively seek for new information, to flexibly master knowledge, skills, forms of communication, to work in team).

An example of a personal recommendation emphasizing a constructive style of behavior which promotes effective online learning for everyone – a student him/herself as well as his/her classmates – is present in Figure 6.

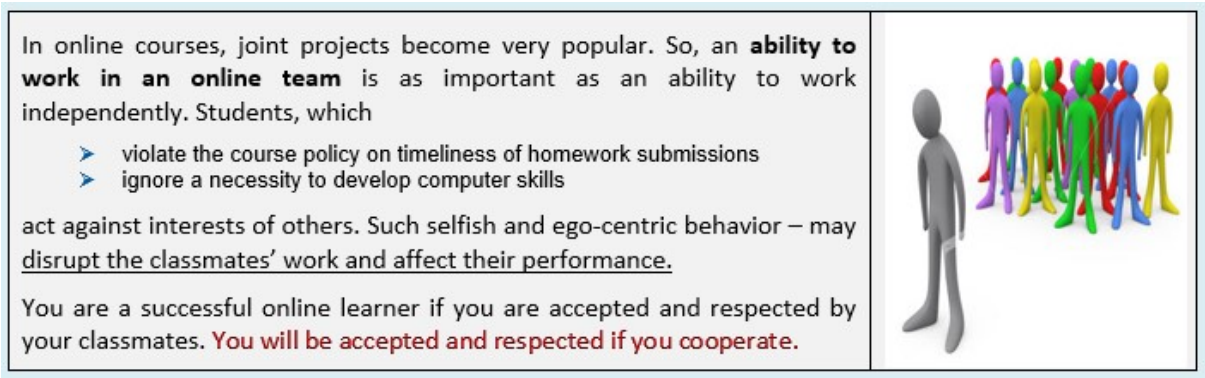

Figure 6. The recommendation having the key-requirement for online behavioral style

Questionnaire

This questionnaire is not intended to test the specific knowledge and skills of working with computer software. It does not test the students' knowledge of the specifics of a learning platform which is the basis for online courses. It is aimed at diagnosing a student's awareness of education as a social, legal, and administrative institution that is being restructured in connection with the incorporation of new information technology. It also analyses a student's awareness of what personality transformations are required for his/her successful adaptation to a new learning environment.

The questionnaire consisted of randomly arranged 20 questions which reflected 5 areas of educational process. Examples of the questions are presented in Table 1. The most questions were simple – the answers to each of such questions could be found in

one of the brochure's recommendations. In Table 1, the questions belonging to technological and communicative area are simple. Meanwhile, a few questions of the questionnaire were multiple, that's they required data from different recommendations of the brochure. In Table 1, the question located in the personal section is multiple.

The study

Survey

Approbation of the methodological tools was carried out in a computer-based survey. It was conducted to find out if the developed questionnaire was comprehensible, that is whether all questions are correctly understood by the questionnaire's respondents (Debois, S., 2019; Low, J., 2019). Another important task of the survey was to find the critical number of incorrect answers, which indicates the online student's incompetence or his/her risk of failure.

The study was conducted in two steps: one group (60 students) participated in survey in the spring semester of 2018; another group (55 students) – in the fall semester of 2018.

Computer-based survey was the first course work assigned in the online course. The students were recommended to carefully read the brochure before finding answers to the questions. They were instructed in giving brief, clear and to the point answers. Also, they were asked to specify the number of the brochure's recommendation associated with each question-answer.

Table 1. Typical questions testing students' competence in different areas of educational process

Section	Questions
Administrative	When is it appropriate to drop an on-line course during the semester to avoid a "W" in the transcripts and reduction of GPA?
Academic	What problem may students face at the end of the semester if they are often late with their homework submissions during the semester?
Technological	Which browser(s) match Touro technical requirements for online studying?
Communicative	How fast are online students recommended to respond to their Professor's and classmates' messages?"
Personal	What traits of personality should one have/develop to become a successful online learner?

Mathematical analysis

Clarity of the questionnaire. To find if all the questions were clear and understandable to students, the average value of the students' correct answers for all questions was computed according to the formula:

$$A = \frac{1}{n} * \sum_{i=1}^{n} x_i$$

where ***A*** is the arithmetic mean; ***n*** is the number of questions; x_i is the number of the students given correct answers for each question (Arithmetic Mean).

The average standard deviation was computed according to the formula:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

where ***σ*** is the standard deviation, ***μ*** is the arithmetic mean, and ***N*** is the number of questions (Standard Deviation Formulas).

According to the calculations, the average number of the students correctly answered questions (***A***) is 57.95 and average standard deviation (***σ)*** is 1.1. Confidence interval is [(A- σ); (A+ σ)] = [56.8; 59.0]. Five questions have been identified whose ***A*** values on the numerical axis are less than the lower boundary of the confidence interval. In other words, these five questions received the largest number of students' incorrect and incomplete answers. More details about these questions are given in Discussion.

Criterion of the students' incompetence. To find a critical number of incorrect answers manifesting online students' incompetence and risk of failure, the same type of analysis was conducted. The difference consisted in the following. In this case, ***n*** and ***N*** represented the number of students in the formulas, meanwhile x_i represented the number of the correct answers to the questionnaire for each student.

According to the calculations, the students' average correct answer (***A***) is 19.33 and average standard deviation (***σ)*** is 1.11. The confidence interval is [(A- σ); (A+ σ)] = [18.22; 20.4]. Seven students have been identified whose ***A*** values on the numerical axis were beyond the lower boundary of the confidence interval. These seven individuals gave the largest number of incorrect and incomplete answers to the questionnaire, and their results may be used to formulate the quantitative criterion for identifying "students at risk". More details about this issue is given in Discussion.

Validity of the results. It was suggested that there is a positive interconnection between success in taking the survey and successful learning in the online class. On our study, this hypothesis was tested with the use of the correlation analysis method. The correlation coefficient was calculated between the number of students' correct answers to the proposed questionnaire and their final grades for the online course taken.

In Table 2, students' data used for the calculation are illustrated in a sample-fragment. Data are encoded. Numbers of questions are presented in the upper horizontal row of the table. The left most vertical column represents participants of the study whose names are abbreviated. Table cells of different colors indicate the participants' responses of different value: white color means "correct answer", which is coded by "1" when calculating; light blue means "partly correct and incomplete" answer which is coded by "0.5"; light green means "partly correct and excessive" answer which is also coded by "0.5"; dark blue means "wrong answer" and is coded by "0". The data of some students which gave the greatest number of incorrect and incomplete answers to the questionnaire are highlighted in light orange.

Table 2. The Sample-Fragment Representing Students' Data

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	A_i	FCG
AS																					19	95
BC																					17.5	80
CC																					18.5	93
CJ																					20	98
RM																					20	100
RMa																					15.5	75
SD																					20	100
SN																					19.5	95
SNi																					19	93
SJ																					20	95
SJu																					19	92
YX																					19	90
WT																					20	100

In the two right most columns, the numbers of students' correct answers to the questionnaire (A_i), and their final course grades (***FCG***) are represented. To find how strong relationships were between the two, Spearman's correlation analysis was conducted with the use of the following formula:

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}.$$

where ***n*** is the number of paired observations; ***x*** = ($x_1 \ldots x_n$) and ***y*** = ($y_1 \ldots y_n$) are distributions of the chosen variables; ***d*** = $rg(x_i) - rg(y_i)$, is the difference between the two ranks of each observation (Spearman's rank correlation coefficient). The correlational analysis was done with the use of SPSS, a package of applied statistical programs for social sciences (Nie, N., Bent, D. & Hull, C., 1970).

The correlation analysis of data showed that there is a high interdependence between such variables as the number of correct answers to the questionnaire and the final grade for the course. According to the calculations, in a group of 60 students participated in the study in the spring of 2018, the correlation coefficient r_s *(A, FCG)* = 0.70, $p < 0.01$.

Reliability of the results. In a group of 55 students which participated in the study in the fall of 2018 was found the following:

1. The questions which received the largest number of incorrect and incomplete answers were different for different students. This result coincides with the result obtained in the spring group. This confirms our conclusion about the subjective difficulty of the questions for the students and the clarity of the questionnaire itself.
2. Interdependence between such variables as the number of correct answers to the questionnaire and the final grade for the course was as high in this group as it was in the spring group. The correlation coefficient r_s *(A, FCG)* = 0.66, $p < 0.01$.
3. The quantitative criterion for identifying students at risk was 2, which included both incorrect and incomplete answers. This result also coincides with the result obtained in the spring group of students.

Discussion

Since the results obtained in two different semesters of 2018 year are basically similar, we concentrate attention on the group of students which took the course in the spring semester.

Analysis of the questionnaire's quality – its clarity and comprehensiveness for students – showed that five questions "fell out" from the confidence interval, i.e. were beyond its lower boundary. In other words, these five questions received the greatest number of students' incorrect and incomplete answers. They are shown in Table 3.
One can see from Table 3 that all questions have the following common features: 1) belong to different aspects of educational process, 2) are related mostly to different students. This means that the problem which arose when the students answered these questions was not due to questions' quality; the problem was rather in the students themselves. Not questions are unclear, but the students' knowledge of the aspects of educational process reflected in these questions is insufficient.

Analysis of the students' answers showed that the average correct answers (***A***-s) for seven individuals were beyond of the confidence interval, i.e. the values of ***A***-s were smaller than the confidence interval's lower boundary. These students gave the greatest number of incorrect and incomplete answers to the questionnaire. Their data are illustrated in Table 4.

One can see from Table 4 that each of the students had his/her own set of incomplete and incorrect answers. This is one more confirmation of the fact that errors are not caused by an external, but an internal factor -- not by the shortcomings of the questionnaire, but by the subjective circumstances of each respondent.

Table 3. The Samples of the Most Subjectively Difficult Questions

I	II	III	IV
5	Communicative	What sequence of actions should students take to receive answers to their course-related questions?	AC, BC, CC, LF, NJ, JT, RR, UK, JA
10	Administrative	What is an objective predictable indicator of an online student's success, and how to find it in the course site?	AT, MR, SS
13	Academic	How many missing assignments in a row and without a valid excuse are permitted and do not lead to a failure in an online course?	HL, MM, MMi, MZ, MR, UK, WS
14	Technological	What kind of new computer skills and software management skills should students learn in their online classes?	GE, LF, SN, SNi, UK
17	Academic	What problem my students face at the end of the semester if they are often late with their homework submissions during the semester?	CJ, HL, UK RMa, YX,

Note: The "I" column represents numbers of the questions in the questionnaire; the number "II" column specifies aspects of educational process to which questions belong; the number "III" illustrates the questions' content; the number "IV" shows abbreviated names of the students which gave incorrect and incomplete answers to corresponding questions.

Table 4. The Results of the Incompetent Online Learners

I	II	III	IV	Adm.	Acad.	Tech.	Com.	Pers.
BC	2.5	2; 1	**80**					
RMa	4.5	4; 1	**75**					
MR	2	2; 0	**84**					
NJ	2	1; 2	**85**					
SS	2	2; 0	**81**					
UK	5	4; 2	**60**					
WS	2	2; 0	**82**					

Note: The "I" column presents abbreviated names of these less successful learners. In the "II" column, the total number of each student's incorrect and incomplete answers is shown, while the details of this information are presented in the "III" column: the first number indicates incorrect answers and the second one – incomplete answers. The "IV" shows the students' final course grades.[2] The five subsequent columns show shortened names for the five aspects of the educational process with respect to which students' competence was studied. In the part of the table below them, cells of different colors indicate students' degree of competence in these five areas. A white color means that no errors were made in questions related to a corresponding area; a pink color points to presence of incomplete answer; a coral color means that an error in a corresponding area was made; a purple color indicates a recurring error in a specific area.

[2] In American education, the 100-point system for evaluating students' knowledge with corresponding letters is commonly used. At Touro GSE, grades from 80 to 100 are considered passing. They include A+ (98-100), A (94-97), A- (90-93), B+ (87-89), B (83-86), and B- (80-82); grades below 80 are considered failing (F).

Indeed, the causes of online incompetence were different for these less successful learners. Everyone had their own areas of incompetence. And even in one area students differed in the degree of their incompetence – this is demonstrated by the different tones of red inherent to them.

Those who made 2 or 2.5 errors, passed, but most of them received final grades located on the boundary between "passed" and "not passed". Admittedly, this is a very low academic achievement. And even this turned out to be possible only due to the constant help and support of the instructor. The students who made 4.5 or 5 errors in answering the questionnaire failed the course.

The data of unsuccessful online students can be used to determine the quantitative criterion of the online incompetence. It is advisable to accept the smallest number of errors made by unsuccessful students as critical number. This number is "2" in this case. Thus, "2" can be used as a criterion for identifying students at risk. Two errors may relate to one area as well as different areas of the educational process. Anyway, an immediate training is required to make it possible for incompetent students to continue their studying in the online course.

In the second group of students which took the course in the fall semester of 2018, the quantitative criterion for identifying students at risk is also "2", which includes both incorrect and incomplete answers to the questionnaire. Such a coincidence serves an important proof of the reliability of the study results.

The correlation analysis conducted for the group studied in spring of 2018 showed a high positive relationship between the students' survey results and their academic achievement in the course. So, the more errors a student made while working with a brochure and questionnaire, the less successful s/he was in the online course, and the worse final grade s/he received. The result was confirmed for the group studied in fall semester of 2018. Therefore, it is possible to predict the learners' success in the online course already in the very beginning of the semester – based on their survey results.

Why is this conclusion well-founded? – When participating in the survey, the students have read the brochure, which was not too long – only 22 situations with recommendations were described in it. When answering 20 questions of the questionnaire, the students could use that brochure to find the correct answers. As the results of the mathematical analysis showed, questions were clear enough and well comprehensible for respondents. Since a good source of information was in their hands, they might be expected to answer correctly all the questions. However, some of them did not meet this expectation. Their errors indicate an inability to focus attention, poor reading skills, and/or lack of skills for the intellectual activity. These qualities were needed for both working with the questionnaire and doing their coursework online. Without them any learning is impossible. That's why the survey results may serve as a great indicator of learning success.

Conclusions

The following tasks are completed in the study:
1. A brochure is developed which includes information about the educational process at Touro College & University system and requirements for successful learning in online courses. It familiarizes the students with their duties, as well as the rules of behavior and activities in the virtual learning environment;
2. The questionnaire evaluates the students' mastery of the knowledge gained from the brochure;
3. The computerized survey verifies the questionnaire's clarity and comprehensiveness.

The following hypotheses are confirmed:
1) The brochure and the questionnaire based on it are appropriate tools for testing students' success in online classes;
2) Five aspects of the educational process, namely academic, administrative, communicative, technological, and personal, are all necessary and sufficient for representation in the tools for identifying the online students' incompetence;
3) There exists a positive correlation between the students' survey results and their academic achievement in the online course. $r_s = 0.70$, $p < 0.01$ for students participated in the study in the spring of 2018; $r_s = 0.66$, $p < 0.01$ for participants of the study conducted in the fall of 2018.

In the study, a quantitative criterion is found for identifying the online student's at risk of failure. The critical number of wrong answers to the questionnaire is "2". Those who made 2 and more errors when answering questions, should be considered at risk students.

The study's goal is achieved: a methodological tool for predicting the students' success in online classes is developed. The most important pedagogical function of this tool is its potential to identify online students at risk of failure already in the first days of the semester. It allows to introduce a timely supportive training to incompetent online learners and prevent them from unwanted administrative and academic consequences.

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Japanese and International Student Interaction in Group Based Classroom Activities

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Abstract
The birthrate in Japan is in decline, yet, in spite of this, the number of universities and technical colleges has continued to increase. To maintain current enrollment levels, Japanese universities have been looking to encourage students from other countries to undertake full degree programs in Japan, in English. However, little research has been conducted in relation to how Japanese students and international students interact when taking the same classes. This report will highlight the findings of a research project in which Japanese and international students were surveyed on their classroom interactions, including their perceptions of group dynamics and leadership roles. In addition, participants watched videos of their own and their classmates' course related presentations and provided feedback on these performances. The report will at first outline how international students took a leadership role in almost all of the presentation groups and why they did so. The report will then demonstrate the unique differences between Japanese and international students in relation to giving feedback to their own and their classmates presentations via the use of video recordings, using the university course management system forum page. Results of this research suggested that Japanese students were more likely than international students to give only positive feedback about their classmates' presentations, but also accounted for a greater percentage of the negative comments made regarding their own presentations.

Keywords: study abroad, video feedback, Japan, presentations

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Introduction

The birthrate in Japan is in a continual state of decline (Japan Times, 2019) with current predictions estimating that the population will fall from 127.09 million in 2015 to 88.08 million in 2053 (National Institute of Population and Social Security Research, 2016). In addition, the aging population of Japan means that number of university aged young adults will fall. To further add to this issue, the number of universities and higher education institutions continue to increase with over 4000 in total in 2013 (Niad-UE, 2014) meaning an oversupply of institutions in a decreasing market. To counter this issue some institutions are beginning to look abroad to increase their enrollments, and increasingly offering courses in English. Adding international students may seem like an easy solution, however, many issues such as the cultural differences between studying in the international student's home country and in Japan have not been addressed. This study followed the interactions of 34 Japanese and international students in relation to how they viewed participating in a mixed group presentation. This survey was divided into three areas, brainstorming and planning, presenting, and feedback, and aimed to get an understanding of the unique differences between how international students and domestic students think and conduct themselves in these areas. The results of this research demonstrated that international students entering university have more experience in giving presentations. In addition to this, they are more frequently designated as the leader of group presentations, they have less problems when giving presentations even when their native language is not English, and that they give more detailed feedback on presentations in both a positive and negative manner.

Literature Review

Japanese students. Students in Japan and many other parts of Asia have a reputation for being silent, and passive learners in the classroom (Cheng, 2000). The cause of this passiveness is often traced back to cultural attributes, which could have a negative impact when required to make and deliver presentations with international students. Japanese students, when studying in Western countries have been found to lack confidence and to be fearful of negative evaluations from peers and teachers a like (Ohata 2005). Although the current study is based in Japan, the fact that the classroom is mixed between international and Japanese students may mean that these issues could become prevalent in the classroom. Further to this, Banks (2016) found that Japanese students were fearful to show their English level to the teacher and would therefore remain quiet rather than try to communicate. This was due to the fact that the teacher was a native speaker, thus the same pattern may occur with other English-speaking students.

Feedback. Peer review is the process in which students give formative feedback on the work of other students. This is an alternative to teacher-based feedback and draws from the work of Vygotsky's (1978) social-constructive learning theory. In Japan, peer review has been used in many different contexts, however, a constant theme is the reluctance of Japanese students to give constructive criticism and to give authority to the feedback received from their peers (Morgan, Fuisting, and White, 2014). Using videos to give feedback on oral presentations has been used as far back as the early 1990s (Quigley & Nyquist 1992) as an alternative way for feedback to come not only from other students, but self-assessment. Self assessment is theorized that the student

will be able to be more critical and be open to learn from it. In addition, if peers provide the same or similar feedback, then this may give some authority to them as well.

Methodology

This study was conducted in a lecture class involving students from several faculties within a private university in Western Japan. Of the 43 students in the class, 20 would be classified as international or as a Japanese returnee. Returnee meaning that the students is a Japanese citizen, however they have spent a significant proportion of time receiving their education outside of Japan. A 36-statement survey was developed by the researcher, checked and edited by a senior researcher, and translated into Japanese for the purpose of this study. For the presentation, the students were required to make a Japanese/international student pairing to prepare and present a three-minute oral presentation on one of the lecture topics. The presentations were recorded by the instructor and posted on the learning management system (LMS) used by the university via unlisted YouTube videos. The students were requested to watch their own presentation and those of other groups and give written feedback via the LMS forum section of their class page. The survey was put into a Google Form and administered to the students in either Japanese or English after the conclusion of their mid semester group presentation. Students were instructed that participation in the survey was a voluntary activity and would have no bearing on their grade. Students were also advised that no identifying information would be collected beyond their nationality. Of the 43 students in the class, 34 students, 18 Japanese nationals and 16 international students, fully completed the survey. The results of the survey were analyzed using descriptive statistics in Microsoft Excel. In addition to the quantitative survey data, qualitative data was collected via open-ended questions in the survey.

Results and Discussion

The results of this research are divided into three sections: brainstorming and planning, presenting, and reviewing.

Demographics. Of the 34 students who took part in the survey 18 were Japanese nationals, four Chinese, four Indonesian, one Canadian, one Dutch, one Thai, one Korean, one Namibian, one Nepalese, and one Sir Lankan. Of the Japanese participants, 14 were male and four female, while nine of the international students were male and seven were female.

Brainstorming and Planning. As can be seen in table one, the majority of the leaders of the groups were international. The researcher hypothesizes from observations of the class during in-class discussion activities and general participation over the semester that the international students in general were more extroverted. Due to this, the international students quickly established themselves as more willing to undertake a leadership role within the group.

Table 1

Was the leader of your group a Japanese student or an international student?	
Japanese	11
International	23

In table two there is an interesting observation between the experiences of the domestic and international students. Almost all of the Japanese students (16) had experience giving individual class-fronted presentations, however, less than half (6) had experience with group class-fronted presentations. All but one of the international students (17) had experience with individual presentations and all (18) had group presentation experience. This gave further evidence as to why the international student in the group took more of a leadership role.

Table 2

	JPN		INT	
	Yes	No	Yes	No
I have made an individual class-fronted presentation in English before	16	2	17	1
I have made a group class-fronted presentation in English before	6	10	18	0

Table three contains 13 statements related to the planning and brainstorming stage of developing a presentation based on a five-point Likert scale from strongly agree (1) to strongly disagree (5). Statements one to six focus on the difficulty of developing individual or group presentations in either English or Japanese. The goal of these six questions was to get a better understanding of where, if any, the difference between the international and Japanese students were. The results of these questions show that were differences in each of the nine statements between the groups, and that in some cases the differences were significant. For example, statement three *It is difficult to plan and develop an individual class-fronted presentation in English* and statement four *It is difficult to plan and develop a group class-fronted presentation in English,* saw a significant difference between the two groups in both statements. In both statements the international students slightly disagreed with the statement (m = 3.54 and m = 3.4) more than there were neutral about it. Whereas the Japanese students agreed more than they were neutral (m = 2.22 and m = 2). Furthermore, we can see that the Japanese students believed making an individual presentation was slightly more difficult than making a group presentation. The result for the international students indicated that they did not have difficulty with either method of presentation, with a marginal favoritism towards individual presentations. The fact that both the international and Japanese students found making an individual presentation less difficult than a group presentation suggests that working in a group is perceived as more difficult by both groups regardless of who the group members are. Reasons for this were not investigated in this survey. However, the researcher theorized that these difficulties could have included having to make a presentation with individuals who do not know each other, differences in work ethic outside of the classroom, the fact that they may have different preparation standards, and possibly social interaction insecurities.

Statements six to nine enquired about the stress of making an individual and group presentation in English and Japanese. As can be seen in the table, the majority of the statements saw both Japanese and international participants indicate between being neutral and disagreeing. The exception to this was the statement *It is stressful to plan and develop a group class-fronted presentation in Japanese* in which both the Japanese (m = 2.89) were on the agree side of neutral and the international students (m = 1.83) indicated between agree to strongly agree. This result could be expected from the international students, as many of them have limited Japanese ability. However, for the Japanese students the result suggests the stress lies not as a language issue, but with the need to communicate with other students to plan and develop a presentation.

Statements ten to thirteen asked specifically about the difficulty and stress experienced when brainstorming and preparing a presentation with students of different nationalities. In these statements the answers for both the Japanese and international students were mainly neutral. However, statement thirteen *The international student in my group made most of the slides in my group* identified a difference in which the Japanese students (m = 3.39) were between neutral to disagree, and the international students (m =2.87) were between neutral to agree. This suggests that the Japanese participants believed the division of labor to make the slide for the presentation was either equal or they were doing slightly more than their international partner, where the international students believed they did slightly more than their Japanese partner. The presentation itself required an even division of slides between the two participants, thus the difference may come down to such factors as who put the presentation together, the design, and who the leader was.

Table 3

	JPN				INT			
	Mean	Median	Mode	SD	Mean	Median	Mode	SD
1. It is difficult to plan and develop an individual class-fronted presentation in Japanese	2.78	2.5	4	1.26	2.4	3	3	1.06
2. It is difficult to plan and develop a group class-fronted presentation in Japanese	2.5	2	2	1.2	2.6	2	2	1.2
3. It is difficult to plan and develop an individual class-fronted presentation in English	2.22	2	2	1.22	3.53	4	4	1.06
4. It is difficult to plan and develop a group class-fronted presentation in English	2	2	2	1.03	3.4	3	3	1.12
5. It is difficult to plan and develop a class-fronted presentation with students from other nationalities in Japanese	2	2	2	1.14	2.8	3	2	1.21
6. It is stressful to plan and develop an individual class-fronted presentation in Japanese.	3.39	4	4	1.29	2.67	3	2	0.9
7.It is stressful to plan and develop an individual class-fronted presentation in English	3.22	4	4	1.26	3.47	3	3	0.92
8. It is stressful to plan and develop a group class-fronted presentation in English	3.11	3	4	1.28	3	3	2	1.2
9. It is stressful to plan and develop a group class-fronted presentation in Japanese	2.89	3	4	1.23	2.27	3	3	0.88
10. It is stressful to plan and develop a class-fronted presentation with students from other nationalities in English	2.94	3	4	1.16	2.73	3	2	1.16
11. It is stressful to plan and develop a class-fronted presentation with students from other	3.17	3	4	1.1	2.33	2	3	0.71

nationalities in Japanese								
12. The international student in my group was responsible for most of the ideas in my group	3	3	4	1.19	2.87	3	3	0.86
13. The international student in my group made most of the slides in my group	3.39	3.5	4	1.14	2.87	3	3	1.25

Presenting. Table four shows 12 statement that refer to presenting. In this section, the greatest number of differences between Japanese and international students can be observed. Statement one to six enquired about the difficulty of presenting a class-fronted presentation in English and Japanese, individually or as part of a group. As can be seen in the table, in all six statements the Japanese participants were between neutral and agreeing. This suggests that the Japanese participants found slight difficulties in giving presentations regardless of the format of the presentation. In contrast, the international participants produced a variety of responses. For individual presentations in English, the participants were between neutral to disagreeing (3.4), however for both individual (m = 2.47) and group presentations (m = 2.33) in Japanese the international students were between neutral and agreeing with the statement. As previously stated, such results are not surprising given the variety of Japanese proficiency within the international student cohort.

Statements seven to twelve related to stress when presenting a class-fronted presentation in English and Japanese, individually or as part of a group. Here again we can see some differences between the perceived stress level of the Japanese and international students. When the statement referred to presenting in English the Japanese participants (m = 2.83 and m = 2.89) were between neutral and agreeing with the statement while the international students (m = 3.13 and m = 3.2) were between neutral to disagreeing. In contrast, when the statement referred to presenting in Japanese the international participants (m = 2.53 and m = 2.27) were between neutral to agree and the Japanese students (m = 3.28 and m = 3.22) were between neutral to disagreeing. This again demonstrates a simple division between the two based on language spoken.

Table 4

	JPN Mean	Median	Mode	SD	INT Mean	Median	Mode	SD
1. It is difficult to present an individual class-fronted presentation in English.	2.67	2	2	1.2	3.4	3	3	0.91
2. It is difficult to present an individual class-fronted presentation in Japanese.	2.78	2	2	1.4	2.47	3	3	0.84
3. It is difficult to present a group class-fronted presentation in English.	2.44	2	2	1	3.07	3	32	1.16
4. It is difficult to present a group class-fronted presentation in Japanese	2.83	3	2	1.2	2.33	2	3	0.9
5. It is difficult to present a group class-fronted presentation in English with students from other countries	2.39	2	3	1.1	3.13	3	3	0.92
6. It is difficult to present a group class-fronted presentation in Japanese with students from other countries.	2.5	2	2	1.2	2.47	3	3	0.99
7. It is stressful to present an individual class-fronted presentation in English	2.83	2.5	2	1.3	3.27	3	3	1.03
8. It is stressful to present an individual class-fronted presentation in Japanese	3.28	3.5	4	1.2	2.53	2	2	0.99
9. It is stressful to present a group class-fronted presentation in English.	2.89	3	4	1.2	3.13	3	2	1.06
10. It is stressful to present a group class-fronted presentation in Japanese	3.22	3	4	1.2	2.27	2	2	0.8
11. It is stressful to present a group class-fronted presentation in	2.72	2.5	4	1.3	3.2	3	2	1.15

English with students from other countries.								
12. It is stressful to present a group class-fronted presentation in Japanese with students from other countries.	2.83	3	4	1.3	2.2	2	2	0.86

Feedback. Table five presents the results of the feedback section of the survey. This section shows that there is little difference Japanese and international student perception of feedback. This suggests that once the language aspect of conducting a presentation between Japanese and international students is removed that students have a similar way of thinking. In relation to feedback, it is clear that the process of students re-watching their presentation again via YouTube was a worthwhile experience for both the international and Japanese students. For example, for the statements *I noticed many presentation issues by watching my presentation again on my device* and *By watching my presentation again on my device my future presentation performances will improve* both the Japanese (m = 1.83 and m = 2.11) and international students (m = 2.13 and m = 2.07) were in agreement that this was a beneficial activity. In addition, both groups were between neutral to disagree when asked if they *enjoyed watching my presentation on YouTube.* These results suggest that by the instructor recording the presentations of students and publishing to enable them to review and give feedback, that there is a benefit for students' future presentations.

Table 5

	JPN Mean	Median	Mode	SD	INT Mean	Median	Mode	SD
1. A class-fronted PowerPoint presentation in English can help me improve my English communication skills.	2	2	2	0.69	2.13	2	2	1.06
2. I noticed many presentation issues by watching my presentation again on my device.	1.83	2	2	0.79	2.13	2	2	0.99
3. By watching my presentation again on my device my future presentation performances will improve	2.11	2	2	0.68	2.07	2	2	0.96
4. I enjoyed watching my presentation on YouTube.	3.28	3	4	0.96	3.13	3	3	0.99
5. I was nervous to let my group members watch my presentation video.	3.33	3	3	1.08	2.87	3	2	1.3

6. It was helpful to watch and to have my group members watch my presentation video.	2.44	2.5	3	0.62	2.73	3	3	0.8
7. My group members gave me helpful oral feedback after watching the presentation video	3.06	3	3	0.78	2.93	3	2	1.1
8. My group members gave me helpful written feedback on Manaba+R after watching the presentation video.	2.72	3	3	0.75	2.93	3	2	1.1
9. Other class members not in my group gave me helpful oral feedback after watching my groups presentation video.	3.28	3	3	1.02	3.07	3	3	0.96
10. Other class members gave me helpful written feedback on Manaba+R after watching my groups presentation video	3.44	3	3	0.92	3.27	3	3	1.03
11. I was comfortable with the teacher posting my presentation video on Manaba+R	2.28	2	3	0.89	2.87	3	4	1.06
12. I was comfortable with the teacher posting my presentation video on YouTube	2.33	2	2	0.69	2.93	3	3	0.88

Tables six and seven illustrate how Japanese and international students complete the statements: *The advantages of using video recordings for feedback in a presentation are*, and *The disadvantages of using video recordings for feedback in a presentation are.* Both the Japanese and international students generally completed these statements in a positive way when talking about the advantages for their own presentations. The most beneficial aspect to this video review for Japanese students was being able to discover their own mistakes through repeated viewings. However, there was no mention of the advantages of having other class members watch and give feedback to their presentation. This could suggest that the students did not receive adequate feedback from other group members, or that they do not take into consideration the feedback received from class members. A deeper understanding of this lies in the responses to the disadvantages statement. Here, several students' responses related to being embarrassed, and not wanting others to watch their presentation online.

Table 6

Japanese

The advantages of using video recordings for feedback in a presentation are …	The disadvantages of using video recordings for feedback in a presentation are …
I can review it again	Nothing
I can see my good and bad things	I was embarrassed
I can see it many times later	It was nervousness.
You actually see what happens	Awkward
Easy to understand	There may be privacy issues
I can check it again later	I was embarrassed
I could see my presentation objectively	Some people find it embarrassing to watch their videos
I can see feedback	I'm worried about my personal information
We can see it many times.	It is uncomfortable to watch my own bad presentation.
Can find the things that I should improve while presenting	Many people can see the video even though some people do not want anyone to see it
We can notice both good points and bad points by ourselves	My presentation was worse and more embarrassing than I thought.
You can find exactly where you need to correct your presentation	I cannot prevent my presentation from being watched by other people
I can see my presentation objectively	
I can see my presentation later	
I can find problems of my own presentation	
That enables me to see my presentation objectively	

The international students answered in a similar way to the Japanese students in relation to the advantages. The majority of the responses referred to being able to improve their presentation skills though watching their presentations again. Like the Japanese students, the international students also did not mention any advantages of peers being able to give feedback on presentations. In relation to the disadvantages there were some similar responses regarding being shy and embarrassed with other students watching their presentations. In addition to this, the international students demonstrated more concerns about privacy of their videos. This could indicate that international students have more knowledge of privacy issues than Japanese students or a greater willingness to challenge something within the class that they do not like. It also gives the researcher something to consider when conducting similar feedback activities in the future.

Table 7

International

The advantages of using video recordings for feedback in a presentation are …	The disadvantages of using video recordings for feedback in a presentation are …
We are able to find the points to improve	As long as the video is public, some people might find it and make fun of it
We can grow up	It must be shyly
Nothing	Nothing
Can see any timeline	No
I can know my bad points after watching videos.	I am shy to watch own face.
Able to self-reflect	Embarrassing and hard to watch
Can watch our mistakes	I don't know
Realizing my mistake when doing presentation	Nothing in my opinion
I can know how I perform	It is awkward to watch my own presentation.
To improve	Hmmm not sure
That the student could tell for themselves why they got the marks they got	In can be distrusting to the class
We can watch our presentation later and learn from mistakes	I don't think there are any
You can watch it later and improve what you missed during the presentation	Some students don't feel comfortable with it
It's helpful in a way since people can go back to look at their performances and look for points to improve	Some people might get nervous when it comes to video taking
You can improve your presentation skills	Some may feel nervous

Conclusion

With the inclusion of more international students in Japanese higher education there is a need to understand how Japanese and international students interact together. This research has shown that when doing presentations there are some differences between the two groups. The results of this research suggest that the differences could be related to the educational upbringing of the students. As expected, the international students are more comfortable doing presentations in English, whereas the Japanese students are more comfortable in Japanese. The Japanese group, possibly with less exposure to other nationalities, find it more stressful and difficult to do a group presentation with someone from a different country than an international student does, which is something that may change as more international students enter the Japanese education sector. For giving feedback, both groups can see the benefits of recording the presentations to watch them again. In addition, the Japanese students are more concerned with showing their presentation to others than the international students. Whereas the international students are more concerned about privacy issues. It is clear that teachers need to invest time in creating meaningful ways Japanese students and

international students can engage within the class to reduce the stress and difficulty experienced and to make interactions between the norm in Japanese institutions.

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Interaction between Changes of Higher-Order Thinking Skills and Changes of Academic Interest and Self-efficacy in Problem-Based Learning

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Abstract
This study examined whether problem-based learning (PBL) contributes to development of students' higher-order thinking (HOT), and the development depends on levels of students' motivation (i.e., interest and self-efficacy). Using 89 college students enrolled in Educational Psychology classes from South Korea, we conducted a t-test and repeated measure analysis to see their changes in HOT, interest, and self-efficacy and the interaction between the variables. We found students' HOT scores increased significantly after PBL than before. Further, a repeated measure ANOVA showed students belonged to HOT or lower-order thinking (LOT) groups at both the times increased their level of motivation steadily. However, the level of motivation of the students who belonged to HOT at the beginning but LOT at the end increased much more than the other three groups. On the other hand, the level of motivation of the students who belonged to the group which changed from HOT before PBL to LOT after PBL decreased after PBL. This suggests that use of PBL class should be carefully considered according to the students' HOT types and motivational changes.

Keywords: Interest; self-efficacy; Problem-Based Learning; Higher-Order Thinking

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Introduction

The way how students think becomes complicated by the gap between the teacher who judges it and the students. It is necessary to judge the thinking activity first when dividing the thinking of students into Higher-Order Thinking (HOT) or Lower-Order Thinking (LOT), and usually the judgment is made from teachers' viewpoints. In fact, Bloom (1956), Resnick (1987) and others who led the discussions about the existing higher-order thinking skills divided the thinking activity of students on the basis of their teaching experiences. However, according to Schrag (1989), it is not enough to judge higher-order thinking only in the viewpoint of teachers for objective understanding of higher-order thinking skills. It is necessary to consider how and why students think in a way of HOT or LOT from the viewpoint of students based on the activity and report of students.

Schrag (1989) argued that it is required to know the circumstances and materials given to students before dividing the levels of the thinking skills of students. This argument began from a criticism of the existing scholars including Bloom and his colleagues who simply focused on dividing the levels of thinking skills of students. Even if the thinking skills of students are judged relatively objectively from the viewpoints of both the students and the teachers, a thinking activity may seem like HOT or LOT skills depending on the environment of the students who use HOT skills. One should be able to answer such questions if he/she is to obtain the fundamental ideas of students' actual usage of HOT skills that: what kinds of materials are students reading? What are they being taught?

Active learning including problem-based learning (PBL) has become a popular teaching method at universities expecting that the PBL would improve the academic achievement and develop interdisciplinary thinking of college students (Stentoft, 2017). The PBL appeals to modern university students because students have been expected to able to perform more critical and self-directed thinking through the active learning method (i.e., PBL). Indeed, it has been found that development of HOT accompanied use of PBL (e.g., Barrows, 1996). However, the co-occurrence of HOT and PBL in the field does not seem to warrant their positive relationship according to the previous studies. On one side, scholars insist PBL encourages college students' higher-order thinking skills. Scholars in this group have paid attention to scientific thinking processes such as questioning and inquiry (Alexander et al., 2011; Lewis & Smith, 1993) which appears during PBL. Thus, PBL was viewed as a good way of developing HOT. On the other side, researchers argued there is something more to consider for appropriate development of HOT rather than simply providing problems to classes. Based on an in-depth observation of students in scientific inquiry classes, Marshall and Horton (2011) found that the level of students' intellectual ability (or higher thinking skills) was negatively associated with the time spent exploring problems. College students with less developed intellectual skills spent more time exploring than managing or solving problems. The researchers concluded that instructors should provide suitable steps for each student depending on their cognitive levels rather than simply providing them with problem-based instructions.

The current study considered the discrepancy of the arguments on relationship between PBL and HOT and the early concerns of Schrag (1989), that is, the assertion that the problems of the existing education raised by Bloom, etc. cannot be solved by

simple division of HOT and LOT skills. Therefore, we sought to explore predictors potentially influence to development of HOT such as PBL.

In addition to consideration of PBL as a potential contributor to development of HOT, we sought to find students' psychological assets determining development of their HOT. Considering both the psychological and physical determinants is necessary to see how HOT develop from the viewpoint of students rather than that of teachers. In this study, PBL was meant to be the physical environment, and self-efficacy (SE) and interest (INT) were referred to the students' psychological environment. The physical and mental learning environment of students was expected to ultimately make the difference in their level of thinking skills.

In this regard, the hypotheses of this study are set up as follows.

1. If college students take PBL classes (physical learning environment), they will tend to use thinking skills more in general (improvement in higher-order thinking skills).

2. After taking PBL classes, the degree of changes of academic interest and self-efficacy of college students (mental environment) will differ by the degree of use of thinking skills (occurrence of interaction between changes of level of motivation and changes of level of thinking skills).

Literature Review

Higher-Order Thinking Skills

Higher-order thinking skills were introduced by Bloom (1956) in his taxonomy as a tool to help systematic presentation of the goal of education in the U.S. (Krathwohl, 2002). To date, the term HOT has been often used as a term opposed to low-order thinking (LOT). However, when Bloom suggested the taxonomy, it meant cognitive skills presented on a continuum (e.g., from lower-order thinking skills to higher-order thinking). He put evaluation as highest cognitive function, which was followed by synthesis, analysis, application and comprehension, and finally knowledge as lowest level on the continuum. Lori Anderson, who was a student of Bloom, later changed Bloom's taxonomy in the 1990's. The biggest change between the old taxonomy and the new one was that the form of the cognitive skills was originally in noun but changed into verb. The continuum, then, became (higher skills of) creating, evaluating, analyzing, applying, understanding and remembering (lower skills). In addition, sub thinking skills were added to the underlying large category of thinking skills. Though some scholars (Schrag, 1989) argued against the Bloom and his colleagues' ideas regarding hierarchy of thinking skills, the existence of a certain order in using thinking skills based upon Bloom's taxonomy has been widely used in construction or understanding of educational courses to date.

The idea of hierarchy of thinking skills by Bloom's taxonomy is particularly important in the field because ones need to decide which cognitive function should be trained first and next in developing students' thinking skills. It does not mean that 'remembering' or 'understanding' in the lower ranks of the hierarchy are less important than 'evaluating' or 'creating'. Rather, activities in the lower ranks of the hierarchy that are basic learning ability need more time and long devotion. Thus, the

fact that a person has HOT skills means that the person uses all the activities in the hierarchy more frequently than a person with LOT skills.

According to Krathwohl (2002) who improved Bloom's taxonomy furthermore, the six verbs in the new Bloom's taxonomy are categorized down into sub-verbs underlying the six upper-level verbs. More recently, they have introduced another new form of taxonomy, so-called Bloom's digital taxonomy (Churches, 2009). The digital taxonomy incorporated new verb forms and sub verbs reflecting changes in educational circumstances (e.g., frequent usage of the Internet). The sub verbs newly included in Bloom's digital taxonomy are the verbs such as social networking, social blogging, programming and filming.

Much empirical research evidenced that the difference between higher-order thinkers and lower-order thinkers does not occur simply by the level of thinking activity as appear in Bloom's taxonomy. According to a research which analyzed the profiles of students according to use of thinking skills (Authors, 2018), the types of thinkers among Korean college students were largely divided into a group of higher-order thinkers and a group of lower-order thinkers, but their thinking activities are not divisible in each group. The group of HOT tends to use the HOT skills such as 'evaluating' or 'creating' as well as LOT skills of 'remembering' or 'understanding' more frequently than lower-order thinkers did. That means that higher-order thinkers tended to use all of various thinking skills actively as opposed to their counterparts (Authors, 2018). As recognized by Schrag (1989), it seems hard to dichotomize LOT skills and HOT skills, but the category of thinking activities need to be understood on a continuum.

Problem-Based Learning, Higher-Order Thinking skills and academic motivation

Problem-based learning (PBL) has been conducted with the purpose to improve HOT skills. Since it had been activated in the late 1960's by Barrows, a medical school professor at McMaster University in Canada (Barrows, 1996), PBL was developed to improve students' skills to solve their real-life problems, rather than to gain knowledge by simple memorization. Such a type of learning activities are known effective for academic achievement for medical students who require hands-on experiences to solve problems such as diagnosing symptoms of patients (Schmidt, 1983; Srinivasan, Wilkes, Stevenson, Nguyen, & Slavin, 2007). Centering on real-life problems, students do not need to learn all the knowledge necessary for diagnosis in PBL but diagnose the patients first and learn knowledge necessary for the diagnosis. That way, students can find out adequate treatments and prescriptions (Choi, 2004). That is, PBL is a form of learner-driven class in which students solve a given unstructured and complicated problem existing in real life by self-directed individual learning and cooperative learning with the help of teacher (Shin, 2003).

PBL provides the situation-based educational environment emphasized in Bloom's hierarchy of thinking skills in that PBL encourages students to think analyze, evaluate and create solutions for problems (Kong, Qin, Zhou, Mou, & Gao, 2014). PBL is a type of learning helpful to the contemporary education, which desperately needs practical field-oriented knowledge as it has exceedingly influenced by information literacy and retention, and enables flexible thinking (Yeo, 2005). PBL is a class

platform frequently used in the modern college education as it improve self-regulatory ability and class satisfaction (Kang & Kim, 1998). While solving a problem, students can stimulate their metacognition and control the learning process by themselves.

PBL is also highlighted as it motivates students easily. For example, the MUSIC motivation model (empowerment, usefulness, success, situational and individual interest, and academic and personal caring) (Jones, 2009) has been use to analyze the learning process in a PBL for engineering students. The results showed that the project design activity, the group activity and the assistance of teachers experienced by the engineering students were significantly related with the five motivation factors (Jones, Epler, Mokri, Bryant, & Paretti, 2013). The participants in the study chose a project according to their personal interest or the usefulness of the project in relation to their future career. As a result, the program increased students' personal interests. The experiences of success in solving a problem are known to increase students' interests, which leads to the academic achievement of students in a virtuous cycle (Rotgans & Schmidt, 2011). According to a more recent analysis of the motivation-learning achievement in the PBL of Dutch and German college students (Geitz, Brinke, & Kirschner, 2016), self-efficacy, a sense of goal and deep learning had mutually significant relationship of each other.

However, a closer investigation is called for the expectation that PBL would improve the level of motivation and HOT skills. In addition to relation between the level of motivation and HOT, prior knowledge seems to have some contribution to the relationship (Busato, Prins, Elshout, & Hamaker, 2000). In fact, in the case of the engineering students examined by Marshall and Horton (2011), the students with little HOT skills, such as showing somewhat lower intellectual capacity at the beginning, spent much time exploring and managing skills and showed relatively lower achievement. Also, according to the guidelines for the design and operation of PBL at college level (Na & Chung, 2012), it is desirable to judge whether PBL class is suitable to the students before designing PBL and then to develop appropriate environments for each student. For example, when designing the situation of the problem, it is recommended to select a type of problems appropriate for the area of students' interest out of various problem types: explanation problem, decision-making problem, diagnosis and solution problem, situated cases, policy problem, design problem and dilemma.

In sum, PBL seems to be influenced by individual variables such as interest, self-efficacy, self-control and deep learning (Geitz et al., 2016; Gurpinar, Alimoglu, Mamakli, & Aktekin, 2010; Raiyn & Tilchin, 2015). However, little was known about difference by time in such variables. Studies barely analyzed how the changes of determinants are related with the improvement of HOT skills. In the current study, PBL is hypothesized to improve HOT skills of college students. Further, the amount of change of self-efficacy and academic interest were hypothesized to differ respectively by changes of HOT levels.

Methods

Participants

This study used a hundred students enrolled in four Educational Psychology classes in the first semester of 2017 at a university located in South Korea. Of them, eighty-two students performed both the pretest and the posttest and consisted of the final dataset. All the participants took classes conducted by the same instructor. Of the participants, 49 students (59.8%) belonged to the colleges of art, music and physical education (see Table 1); 13 students (15.9%) belonged to the colleges of humanities and social sciences; and 11 students (13.4%) belonged to the college of education. Seven students (8.5%) were majoring in science and engineering, and one student was majoring in medicine and life sciences taking 1.2% respectively. There were 36 female students (43.9%) and 46 male students (56.1%). The classes were designed to train pre-service teachers. The participants were composed of one freshman (1.2%), 72 sophomores (87.8%), two juniors (2.4%) and seven seniors (8.5%). Thus, the majority of the students were sophomores. No prerequisite subjects were required for the Educational Psychology classes, and most participants had little prior knowledge of education. No students had an experience of taking a PBL class before.

Table 1
Descriptive Statistics of The PBL Participants

Group		N (%)	Group		N (%)
Gender	Male	46 (56.1)	Age	20s	80 (97.6)
	Female	36 (43.9)		30s	2 (2.4)
School year	Freshman	1 (1.2)	College	Humanities and social sciences	20 (24.4)
	Sophomore	72 (87.8)		Science and engineering	12 (14.6)
	Junior	2 (2.4)		Art, music and physical education	49 (59.8)
	Senior	7 (8.5)		College of education	1 (1.2)

The PBL program

The Educational Psychology classes were subject to develop pre-service teachers' fundamental understanding of teaching. The PBL classes were conducted in the 12th, 13th, 14th and 15th week during the 15 weeks in total. The PBL classes regarded counseling and school-life guidance. The problem below is used in the study and regards a problematic counseling situation at schools. The problem was developed by a researcher who has consulted and operated PBL classes for several years and had expertise in PBL.

The problem used in the research

[General condition]
You are the homeroom teacher in charge of Class No. 2 in Grade 12 at a High School. In this school, homeroom teachers have a regular meeting at the beginning of each

semester to share their plans for teaching, career counseling and life guidance of the students.
You are to prepare materials that you will present in the meeting considering the characteristics of the students in your class. Please present your plan in accordance with the following directions.
[Format requirement of your presentation]
- Describe a systematic evaluation method for grasping the student characteristics and validate the method.
- Present plans for counseling and life guidance with the materials for grasping the student characteristics.
[Information of the high school students]
- 15 students hoping to enter college (including 1 special student with visual impairment)
- 7 students who are seeking jobs after graduation
- 22 students in total

Measures

The participants performed a pretest in April before the PBL classes began, and a posttest in June, immediately after the completion of the PBL classes. The questionnaires used in the pretest and the posttest follow.

Higher-Order Thinking skills scale for college students

We used the questionnaires developed by Author (2016) for the examination of the higher-order thinking skills of Korean university students (HOTUS). The questionnaire was developed based upon the survey results of Korean college students with the consultation of educational psychology experts incorporating the concepts of HOT skills that had been suggested by such educational psychologists as Bloom, Lipman and Resnick. The HOTUS was composed of 25 items under five sub-scales of creativity, analysis, argument, demonstration and consideration. The participants marked the degree of their agreement to the sentence proposed like “I review what I learned during the class to solve the task.” The internal consistency of the HOTUS was 0.74 for four items of the analysis factors; 0.76 for four questions of creativity factors; 0.79 for the five questions of argument factors; and 0.78 for the five questions of demonstration factors showing appropriate reliability. The internal consistency among the seven questions of consideration factor was 0.83 showing superior reliability.

Academic interest

Sixteen self-report question items were used to examine students’ subject interests. The questionnaire was reproduced by Yoon (2003) based on Schiefele’s (1991) interest theory. The subject interest in this measure was categorized into cognitive interest and emotional interest. The cognitive interest was subdivided into interest in subject contents, value of the subject and effort. The emotional interest was subdivided into efficacy about the subject and preference for the instructor. The students marked their degree of agreement to each question like “I want to be a teacher like this professor when I become a teacher” on a 5-point scale (1=not at all, 5=very much so). The internal consistency of interest in subject contents was 0.79,

and those of value of the subject and the effort were 0.73 respectively showing appropriate reliability. The internal consistency of efficacy about subject, a sub factor of emotional interest, was 0.83, and that of preference of the instructor was 0.85 showing superior reliability.

Academic self-efficacy

We used the scale of academic self-efficacy developed by Kim and Park (2001). Self-confidence, self-control efficacy and preference for difficult tasks underlie the scale with 28 items. The participants reported their agreement of the pertinent statements for each types of efficacy on a Likert-type scale. The internal reliability of preference for difficult tasks (10 items) was 0.89, and that of self-control efficacy questions (10 items) was 0.90. The internal consistency of self-confidence (8 items) was 0.86 indicating good reliability.

Analysis

The current study aimed to examine the interaction between changes of HOT skills and changes of academic interest and self-efficacy of the participants before and after implementation of PBL classes. First, we examined levels of student HOT before and after PBL, and the interaction of INT and SE with the HOT difference between the two measurements time points. We particularly paid attention to the students whose pre-post HOT value changed positively (i.e., hanged from the LOT group to the HOT group) with regard to their motivation changes (pretest-posttest difference of interest and self-efficacy). Several analysis phases were incorporated for the purpose.

First, the average change of students' overall HOT before and after the PBL program were analyzed using t-test. With a significant overall difference for change (i.e., difference between pretest and posttest), the students were grouped to the HOT group and the LOT group at each time point (pretest and posttest) according to the latent profile analysis of their HOT. This initial grouping was further divided into four groups along with the time points: 1) consistent HOT group (those grouped in HOT both before and after PBL), 2) consistent LOT group (those grouped in LOT both before and after PBL), 3) LOT -> HOT group (those grouped in LOT at pretest but in HOT at posttest) and 4) HOT -> LOT group (those grouped in HOT at pretest but in LOT at posttest).

Second, the repeated measure ANOVA was conducted to examine whether the grouping (consistent HOT, consistent LOT, LOT -> HOT, HOT -> LOT) was related with degrees of changes in the students' interest (INT) and self-efficacy(SE).

Results

Descriptive statistics and latent profile analysis

Descriptive statistics of pre-post test scores for HOT, INT and SE are as follows. According to the results of a paired t-test, the mean scores of all three variables at the end were significantly higher than those at the beginning (see Table 2).

Table 2
Descriptive Statistics of Pre-Post Test For HOT, INT and SE

Source	Pretest	Posttest	*t*	*p*
HOT	3.7±0.4	3.9±0.5	-4.672**	.00
INT	3.7±0.4	3.9±0.5	-4.914**	.00
SE	3.2±0.4	3.4±0.4	-4.263**	.00

Note. Values are presented as Mean±SD; HOT=Higher-Order-Thinking; INT=interest; SE=self-efficacy.

The latent profile analysis for grouping the changes of students' HOT skills showed that two latent groups are present both before and after PBL. Table 3 shows the model with two latent profile groups are appropriate for this data.

Table 3
Model-Data Fit Indices for the Latent Profile Analysis of HOT

	AIC	BIC	SABIC	Entropy	LMRLRT	BLRT
Pre HOT(2)	4322.092	4505.002	4265.302	0.927	0.0680	0.0000
Post HOT(2)	4549.083	4731.993	4492.293	0.972	0.1841	0.0000

Note. HOT=Higher-Order-Thinking
Based on the above grouping, 29 students (35.4%) belonged to the consistent HOT group; 24 students (29.3%) to the consistent LOT group; 27 students (32.9%) to the LOT -> HOT group; and 2 students (2.4%) to the HOT -> LOT group.

Repeated Measure ANOVA for INT

A repeated measure ANOVA displayed whether changes of INT depend on the change of HOT skills (Table 4). The results captured significant interaction effect between INT and the HOT changing groups. In other words, INT significantly changed as HOT group changes (F=4.360, p=0.007).

Table 4
Repeated Measure ANOVA for INT

Source	Sum Square	*df*	Mean Square	F	p
INT(pre-post)	.101	1	.101	1.246	.268
INT*HOT change	1.060	3	.353	4.360	.007
Error	6.324	78	.081		

Regarding INT change in each group, the consistent HOT group answered 3.91(SD=0.38) out of 5 on average before PBL class, which meant slightly lower level of interest than the medium value (3). However, it was 4.12(SD=0.52) on average after PBL class, which meant slightly higher level of interest. The consistent LOT group scored 3.34(SD=0.37) on average before PBL class and 3.44(SD=0.35) on average after PBL class without much difference. In fact, Figure 1 shows that INT of the consistent HOT group and that of the consistent LOT group slightly rose. On the other hand, the average INT in the LOT -> HOT group at the posttest (M=4.05, SD=0.44) was increased significantly from the pretest (M=3.63, SD=0.37). Such a

difference is apparent in the graph. The slope of the LOT -> HOT group is higher than that of the consistent HOT group and the consistent LOT group. Interestingly, INT of the HOT -> LOT group fell considerably over time. The HOT -> LOT group answered 3.93(SD=0.44) on average at the beginning but the average score fell into 3.56(SD=0.44) at the end of the semester. The decreasing INT score in HOT -> LOT group contrasts with the increasing scores in other groups.

Table 5
Changes of INT by Group Changes between Pretest and Posttest

Group	INT-pretest	INT-posttest
Consist. HOT (N=29)	3.91±0.38	4.12±0.52
Consist. LOT (N=24)	3.34±0.37	3.44±0.35
LOT -> HOT (N=27)	3.63±0.37	4.05±0.44
HOT -> LOT (N=2)	3.94±0.44	3.56±0.44
Total (N=8)	3.65±0.43	3.88±0.53

Note. Values are presented as Mean±SD

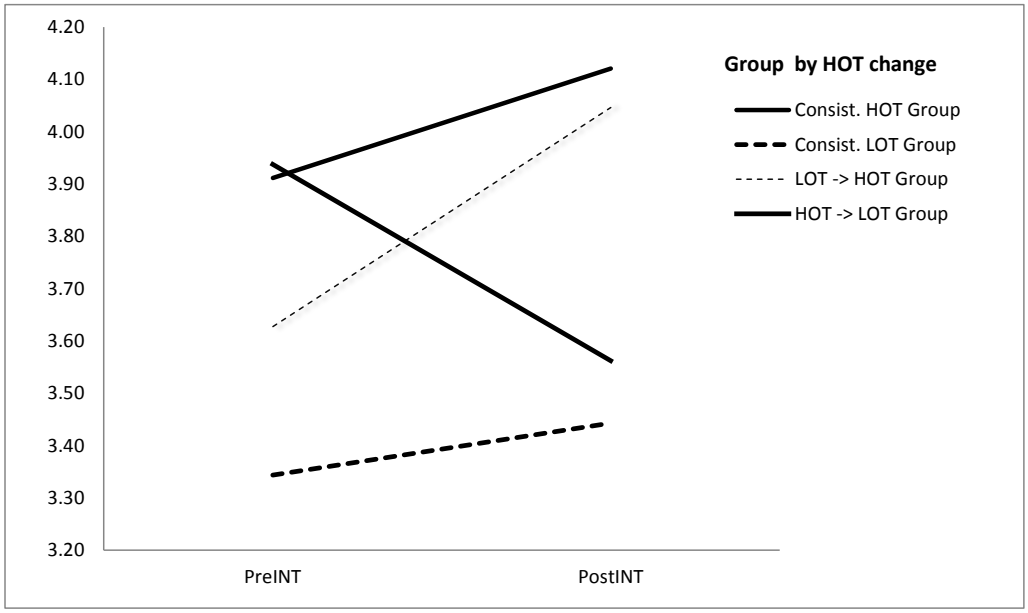

Figure 1. Changes of INT by group changes between pretest and posttest

Repeated Measure ANOVA for SE

The following are the results of the repeated measure ANOVA conducted to examine changes of SE by the HOT change groups. The examination of the change of INT between the pretest and the posttest with the covariate of the HOT change groups showed that statistically significant SE*HOT change group effect. However, there was no significant SE *HOT change interaction effect (F=2.27, p=0.09).

Table 6
Repeated Measure ANOVA for SE

Source	Sum Square	*df*	Mean Square	F	p
SE(pre-post)	.184	1	.184	2.700	.104
SE*HOT change	.463	3	.154	2.270	.087
Error	5.307	78	.068		

SE *HOT change effect also appeared. The consistent HOT group and the consistent LOT group increased from 3.39(SD=0.39) to 3.52(SD=0.46) and from 3.04(SD=0.25) to 3.14(SD=0.24) on average showing slight growth from pretest to posttest. Interestingly, the LOT -> HOT group increased from 3.23(SD=0.33) to 3.55(SD=0.23) on average and the average score in the posttest recorded the highest among the four types of group changes. On the other hand, the HOT -> LOT group showed much lower scores after PBL than before PBL (M=3.30 and SD=0.48 before PBL; M=3.23 and SD=0.43 after PBL). Difference across groups are notable in the graph. The slope of change in the LOT -> HOT group was higher than that of the consistent HOT group and the consistent LOT group and the slope of the HOT -> LOT group was negative between the two time points.

Table 7
Changes of INT by Group Changes between Pretest and Posttest
Note. Values are presented as Mean±SD

Group	SE-pretest	SE-posttest
Consist. HOT (n=29)	3.39±0.39	3.52±0.46
Consist. LOT (n=24)	3.04±0.25	3.14±0.24
LOT -> HOT (n=27)	3.23±0.33	3.55±0.23
HOT -> LOT (n=2)	3.30±0.48	3.23±0.43
Total (n=8)	3.23±0.36	3.41±0.38

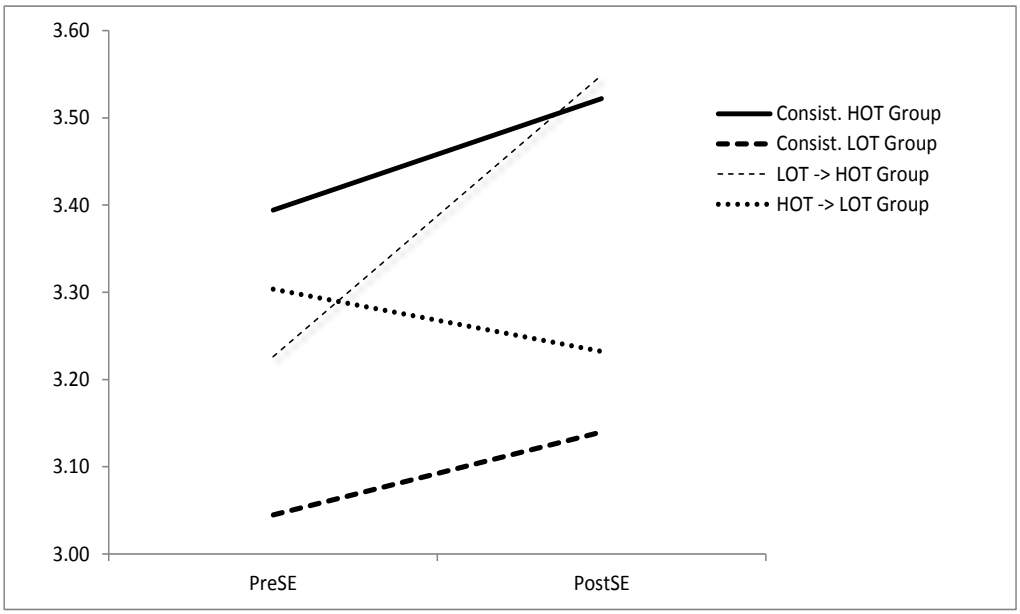

Figure 2. Changes of SE by group changes between pretest and posttest

Summary and Discussions

This study showed that PBL contributes to development of students' HOT, and the development depends on levels of students' motivation (i.e., INT and SE). Regarding the first hypothesis of this study, students' HOT scores increased significantly after PBL than before. The second hypothesis, that is, the difference in students' HOT changes by the motivation changes was supported as well. The repeated measure ANOVA showed the levels of INT or SE in the consistent HOT group or the

consistent LOT group maintained before and after PBL. In other words, students belonged to HOT or LOT groups at both the times increased their level of motivation steadily.

Notable was the change of the level of motivation in the LOT-> HOT group and the HOT -> LOT group. The level of motivation of the students who belonged to HOT at the beginning but LOT at the end increased much more than the other three groups. On the other hand, the level of motivation of the students who belonged to the group which changed from HOT before PBL to LOT after PBL decreased after PBL. Such a result supports that the change of HOT level among students has some kind relationship with motivation.

As Schrag (1989) noted, ones' HOT development should be investigated with respect to conditions surrounding the ones and their characteristics (Busato et al., 2000; Yoon, 2003). This study compared the difference made by the physical circumstance variable represented by the PBL and the psychological circumstance represented by INT and SE. Those circumstances appeared to determine development of HOT skills. First, PBL contributed to developing the overall levels of HOT. Simply speaking, it seemed that PBL contributes to developing the HOT skills of students. In addition, interestingly, motivational changes represented by INT and SE had static interaction with the development of HOT. Such results are similar to the findings from the previous studies supporting the static interaction between academic achievement and the level of motivation (Lee et al., 2014; Tella, 2007). However, such a difference was not made simply by including PBL, but related with the change in students' motivation levels. The level of motivation increased remarkably in the group which had much effect of PBL, that is, the LOT-> HOT group. The SE level of the students in the LOT-> HOT group became higher than that in the consistent HOT group. It means that SE of the students increases rapidly by thinking more deeply, broadly, creatively and critically. On the contrary, the level of students' SE in the HOT -> LOT group rather decreased over time. Such a difference in the research results needs further investigation to uncover whether the level of students' HOT skills may differ by the intensity of investigation of a problem with the level of students' intellectual ability (or higher thinking skills) as proposed by Marshall & Horton (2011). The further research seems particularly necessary for the HOT -> LOT group, who are less likely to investigate problems as noted by Marshall & Horton (2011). Differently from other groups, the level of motivation in the HOT -> LOT group rather decreased after PBL.

This study showed that students' HOT skills improved after taking PBL and at the same time the level of the change of HOT skills differed by level of the students' motivational changes. This suggests that use of PBL class should be carefully considered according to the students' HOT types and motivational changes. In particular, the instructors are called for asking following question: Do the students maintain their level of motivation sufficiently? Do the students with lower INT or SE appear in the PBL class? If students show any such conditions, the students should be given enough time to investigate the problem. Teachers or instructors will become able to predict the increase or decrease of students' HOT skills by observing the changing levels of their motivation as well as their initial level of motivation. In addition, the change of motivation can be used as a clue for the decision to provide students with more time for investigation.

This study is significant in that it has elucidated the interaction between the change of the level of motivation and the change of HOT skills in PBL classes at college. However, it is necessary to make careful interpretation for the following several reasons. First, the number of the students who belonged to the HOT -> LOT group was only two, which is too few though they were paid much attention in this study. Therefore, it is difficult to conclude the results due to the small number of students in the case though the level of their motivation has decreased noticeably. It is desirable to conduct quantitative research with a greater number of students in the future. It will be also helpful to conduct qualitative examination of the reason why and how they changed so rather than simple quantification of the change in students' motivation levels. Second, application of the study result to students in various races and conditions is cautious as the result regards students only within South Korea. It is necessary to study with data from more varied and comprehensive conditions for further generalization. Third, it should be helpful to diversify research models for obtaining clearer research results. Due to the limited number of study participants, we could not make refined analysis. To overcome this limitation, we first grouped the participants according to the participants' HOT levels using latent profile analysis, and changes of the level of motivation was analyzed according to the change of their belonging to the groups. With enough cases, we might have been able to obtain more meaningful results than the current study through analyses adequate for longitudinal data, such as latent growth modeling or hierarchical analysis. Further research is necessary to compensate these limitations.

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Systematic Design to Enhance Learning: Multimedia Resources in Online Learning

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Abstract
The study investigated whether spatial ability would be a predictor of learning outcome when using different types of multimedia resources. Specifically, this study hypothesized that individuals with lower spatial ability would experience greater learning benefits from dynamic resources (e.g., animation with narration) as opposed to non-dynamic learning resources (e.g., static visuals with narration), based on the ability-as-compensator hypothesis. The independent variables for the current, experimental study were type of multimedia resources and spatial ability. The dependent variables were learning outcomes in two, procedural knowledge learning tasks. A total of 246 participants were solicited on a voluntary basis from the undergraduate student population at a mid-size university in the Northeastern USA. All participants were directed to an online site offering a timed spatial ability test and two, time-limited learning tasks. Participants were randomly assigned to one of two multimedia resource groups (animation or static). The study found that spatial ability was an acceptable predictor of learning outcomes in both learning tasks. Contrary to the study hypothesis, however, individuals with higher spatial ability, not lower spatial ability, experienced greater learning benefits in the animation group. This finding would then correspond the ability-as-enhancer hypothesis, which suggests that higher spatial ability individuals have a greater cognitive capacity to deal with dynamic learning resources.

Keywords: Animation versus static visuals, spatial ability, learning outcomes, ability-as-compensator hypothesis, ability-as-enhancer hypothesis

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Introduction

With current technological advancements, designing a variety of multimedia instructional resources such as animations and simulations has become increasingly feasible. Animations can solicit learner attention, clarify abstract concepts, and provide procedural information more efficiently (Berney & Bétrancourt, 2016). Considerable research has thus been devoted to the examination of animations and their influence on learning outcomes in recent years. While meta-analyses report greater learning gains with animated learning resources as opposed to static learning resources in general, discrepancies exist as to the effect size of learning outcomes with animations, specifically with procedural knowledge (Berney & Bétrancourt, 2016; Höffler & Leutner, 2011). Furthermore, the focus of many past studies has been on learning outcomes only, not particularly on the relationship between learner characteristics and learning outcomes.

Procedural information often requires learners to engage in the mental manipulation of visual objects. Spatial ability allows individuals to mentally manipulate objects effectively, which in turn enables better understanding of spatial relationships between objects (Lohman, 1996; Massa, Mayer, & Bohon, 2005). It is therefore a reasonable assumption that spatial ability plays an important role in the acquisition of procedural information offered by dynamic and static learning resources. This study thus examined the relationship between spatial ability and learning outcomes with static versus animated learning resources.

Literature Review

Spatial Ability and Visual Learning Resources

Spatial ability plays an important role in learning with multimedia resources (Höffler, 2010; Höffler & Leutner, 2011; Yilmaz, 2009). In fact, individuals with higher and lower spatial ability show differences in performance when learning with visual resources (Berney, Bétrancourt, Molinari, & Hoyek, 2015; Höffler, 2010). As individuals with lower spatial ability have more difficulty dealing with visual resources, efforts are often made to better aid their understanding. Such strategies include explicitly drawing attention to key components of images (Roach, Fraser, Kryklywy, Mitchell, & Wilson, 2019) or using different types of visual resources, such as dynamic images (Hegarty & Kriz, 2008). The latter strategy is based on the ability-as-compensator hypothesis (Mayer & Sims, 1994).

According to the current interpretation of the ability-as-compensator hypothesis, optimal instructional design (e.g., with dynamic images) can reduce the need for mental manipulation of visual resources by offering an explicit representation of relationships among components of the visual resource (Berney et al., 2015; Höffler, 2010; Höffler & Leutner, 2011). Dynamic learning resources can accordingly mitigate differences in learning outcomes between individuals with higher and lower spatial ability by aiding those with lower spatial ability to efficiently build accurate mental models (Hegarty & Kriz, 2008), thus enhancing learning outcomes (Höffler, 2010; Höffler & Leutner, 2011). Many research studies provide empirical evidence

supporting learning differences based on spatial ability when dealing with images, as summarized in Höffler (2010), with an overall medium effect size.

An alternative view regarding spatial ability in dealing with visual resources is the ability-as-enhancer hypothesis. This hypothesis asserts that individuals with higher spatial ability possess greater cognitive capacity and thus are better able to deal with dynamic visuals containing additional procedural information (Mayer & Sims, 1994). Empirical support for the ability-as-enhance hypothesis, however, is less abundant, compared with the ability-as-compensator hypothesis (e.g., Mayer & Sims, 1994; Huk, 2006). Regardless of which perspective is adopted, it is clear that interactions between spatial ability and learning outcomes exist, particularly when processing learning resources containing dynamic visualizations.

Research Question and Hypothesis

The purpose of the study was to investigate whether spatial ability would be an adequate predictor of leaning outcomes and how learning outcomes would differ based on multimedia learning resource type. Referencing the ability-as-compensator hypothesis as the research framework, this study hypothesized that the predictive power of spatial ability on learning outcomes would be stronger when using static learning resources than when using animation, as animations would mitigate spatial ability differences by reducing the need for mental manipulation of visual objects.

Methodology

Variables

The independent variables for this experimental study were spatial ability and type of multimedia resources (two-levels: animation and static). The dependent variables were learning outcome as measured by the number of correct responses in two, procedural knowledge learning tasks.

Participants

A total of 245 participants were solicited on a voluntary basis from the undergraduate student population at a mid-size university in the Northeastern USA. The majority of the participants were female (N=193, 78.8%) and between the ages of 18 and 22 (N=236, 96.3%).

Instruments

This study used a spatial ability test and two learning tasks. The spatial ability test was to assess learner's ability to apprehend, encode, and manipulate spatial objects mentally (Lohman, 1988). A timed, paper-folding test from French, Ekstrom and Price (1963), which asks learners to imagine the folding and unfolding of pieces of paper, was adopted. Each of the learning tasks covered a unique, procedural knowledge topic, which could be encountered in an informal learning setting: 1) the functioning of a toilet cistern and 2) the functioning of a car brake system. The toilet cistern task was adapted from Höffler et al. (2017) with permission. The brake system

task was created for the study, inspired by the work of Mayer, Mathias, and Wetzell (2002).

Each learning task contained three, time-limited multimedia resources presented as either static images or animations. The multimedia resources were designed and developed with consideration of multiple, multimedia related principles. For example, in an effort to balance visual and auditory working memory capacity, the multimedia resources included simultaneously narrated explanation, thus employing both the modality principle (Low & Sweller, 2014) and the temporal contiguity principle (Mayer & Fiorella, 2014). Following the pre-training principle (Mayer & Pilegard, 2014), participants were first offered pre-training resources (e.g., labeled images of a toilet cistern and a car brake system), with the goal of familiarizing learners with each task topic prior to engaging in the main tasks. These pre-training resources further adopted the spatial contiguity principle and the signaling principle in order to reduce extraneous cognitive load and manage essential processing (Mayer & Fiorella, 2014; Mayer & Pilegard, 2014). Finally, the main tasks were each divided into three segments, following along with the segmenting principle in an effort to manage essential cognitive processing (Mayer & Pilegard, 2014).

The multimedia resources in both learning tasks were each followed by questions related to the concepts covered. The learning questions adopted Bloom's taxonomy and included progressive levels of complexity through knowledge, comprehension, analysis, synthesis, evaluation, and transfer. Each learning task contained a total of ten questions.

Procedure

Participants were recruited via on-campus flyers containing the URL and a QR code for online participation. After responding to basic demographic questions, participants were randomly assigned to one of the two, multimedia resource groups (animation or static). Upon completion, participants were provided with a compensation code, which they could use to collect a twenty-dollar gift card.

Data Analysis

For the data analyses, simple linear regression for each learning task was conducted using the R statistical computing environment, version 3.5.3. Assumptions for regression analysis were examined, including independence, homoscedasticity, linearity, and normality. As participants were randomly assigned to groups, independence was assumed. Both visual inspection and non-constant variance score test (ncvTest) revealed no significant deviation from homoscedasticity. Linearity was found between the independent variables (spatial ability and multimedia resource type) and the dependent variables (task scores) following examination of correlations; there was a significant, moderate to strong positive correlation between spatial ability and learning outcomes in the toilet cistern learning task (r=0.504, N = 245, p = 0.000, one-tailed) and brake system learning task (r=0.465, N = 245, p = 0.000, one-tailed). This finding was similarly found for both the animation and static groups: toilet cistern learning task (r=0.595 and r=0.413, respectively) and brake system learning task (r=0.516 and r=0.420, respectively). While the data for spatial ability and the brake task score did not meet the assumption of normality, both these variables were

fairly symmetric (skewness) and had light tails (kurtosis), showing values that fell within the acceptable range of |1.96|. Overall, it was thus judged that the assumptions to proceed with simple linear regression were met. Descriptive statistics are provided in Table 1.

Table 1: Descriptive statistics

		Mean	*SD*	Skew	Kurtosis
Total	Spatial ability	9.38	4.01	-0.04	-0.86
(N=245)	Learning outcome - toilet cistern	4.38	1.44	-0.25	-0.41
	Learning outcome - car brake system	5.51	1.79	-0.06	-0.79
Animation	Spatial ability	9.31	4.03	-0.03	-0.93
(N=121)	Learning outcome - toilet cistern	4.40	1.47	-0.21	-0.50
	Learning outcome - car brake system	5.47	1.71	-0.04	-0.61
Static	Spatial ability	9.45	4.00	-0.05	-0.82
(N=124)	Learning outcome - toilet cistern	4.36	1.41	-0.29	-0.38
	Learning outcome - car brake system	5.56	1.86	-0.08	-0.97

Findings

Regressions

The regression analyses, conducted to investigate the predictive power of spatial ability on learning outcomes, revealed a statistical significance for both learning tasks: the toilet cistern learning task (p=0.000, r^2=0.251) and the car brake system learning task (p=0.000, r^2=0.213) regardless of multimedia type. Additional regression analyses, which examined the static and animation groups separately, showed a very strong statistical significance in the animation group: the toilet cistern learning task (p=0.000, r^2=0.348) and the car brake system learning task (p=0.000, r^2=0.260). For the static group, although statistical significance was found, the total variance explained by the regression model was smaller: the toilet cistern learning task (p=0.000, r^2=0.164) and the car brake system learning task (p=0.000, r^2=0.169). Table 2 summarizes the results of the regressions analyses. As the animation group model explained a greater amount of variance than the static group model, the study hypothesis was rejected.

Table 2: Simple linear regression analyses of spatial ability and learning outcomes

	Intercept	*B (SE)*	*t*	*p*	CI Lower	CI Upper
All cases						
Toilet cistern	2.683	0.181 (0.020)	9.103	0.000	0.142	0.220
Car brake system	3.571	0.207 (0.025)	8.191	0.000	0.157	0.257
Animation						
Toilet cistern	2.389	0.216 (0.027)	8.067	0.000	0.163	0.269
Car brake system	3.433	0.219 (0.033)	6.571	0.000	0.153	0.285
Static						
Toilet cistern	2.977	0.146 (0.029)	5.009	0.000	0.088	0.204
Car brake system	3.711	0.196 (0.038)	5.108	0.000	0.120	0.271

Discussions

The findings of the current study provide empirical evidence that spatial ability is an adequate predictor of learning outcome regardless of whether animated or static learning resources are used. However, more variance was explained (i.e., greater differences in learning outcomes between individuals with higher and lower spatial ability) when animated learning resources were used, contradicting the ability-as-compensator hypothesis. If animated learning resources did reduce the need for mental manipulation of visual objects, the differences in scores between individuals with lower and higher spatial ability should have been smaller in this group.

Animated learning resources did not close the learning gap between individuals with lower and higher spatial ability, implying that a greater cognitive capacity was needed to deal with this type of learning resources. A potential reason for this unexpected finding could be that animated learning resources are transient, limiting the opportunity for re-inspection of visual information (Tversky & Morrison, 2002). While individuals with higher spatial ability may have greater working memory capacity to process transient visual information, individuals with lower spatial ability may require more time process the same information. Another potential reason could be that animated learning resources provide additional visual information not present in static learning resources such as the movements of the system (Tversky & Morrison, 2002). This added information again requires greater cognitive capacity to process. From these perspectives, namely that individuals need spatial ability to retain transient information and to process added visual information, the findings of the current study are better aligned with the ability-as-enhancer hypothesis (see Mayer & Sims, 1994), implying that spatial ability is more critical for learning from animated learning resources.

Conclusion

This study examined the potential of spatial ability as a predictor of leaning outcomes and how learning outcomes would differ based on multimedia learning resource type. The study contributes to the literature by providing empirical evidence of the ability-as-enhancer hypothesis, which thus far has had limited support (Höffler, Schmeck, & Opfermann, 2013; Huk, 2006; Nguyen, Nelson, & Wilson, 2012). It also adds to the limited examination of the influence of static versus animated learning resources on learning outcomes (Höffler et al., 2013). This study may further illuminate the relationship between individuals' choices in academic major and occupation, especially STEM fields where spatial ability demands are high (Blazhenkova & Kozhenikov, 2009). Finally, this study contributes to practice by suggesting the need for strategic design and implementation of multimedia learning resources to elicit better learning outcomes for diverse learners.

The readers, however, are cautioned given the following limitations: Learners' prior knowledge can play a role in processing new information. The study, however, did not ascertain learner's prior knowledge as a potentially confounding variable. Future study may benefit by controlling for participants' prior knowledge. Additionally, the study participants were recruited from one research site and were disproportionally female. It is recommended that future study employ a more diverse and purposeful sampling strategy. Overall, the field would benefit from additional studies examining

the relationship between the spatial ability and different types of multimedia resources. Finally, it is worth noting that participants had to complete all learning tasks to be compensated. This participation setting might have implicitly emphasized a performance goal approach, rather than a mastery goal approach. Future researchers may consider the potential impact of different goal orientations when designing studies.

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