A Measure of Mobile Technology Familiarity

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Utilizing personal computer technology in the classrooms has been shown to have a positive impact on student classroom achievement (Butzin, 2001). Despite known gains, incorporation of technology into the classrooms is a slow process that not all educators perform. This reluctance to utilize technology in the classroom tends to stem from a lack of acceptance of these devices, due typically to a lack of information about what benefits can be offered (Ifenthaler & Schweinbenz, 2013). The current study is designed to assess how familiar school personnel are with handheld technology applications that can be useful in the classroom setting, and whether awareness of practical applications for technology increase with access to handheld devices.

Technology Acceptance Model

Research into how individuals come to accept technology as a valuable tool for their personal lives and professions has developed into four different yet similar theoretical models. Each theoretical model assesses factors that determine whether an individual will develop a positive attitude toward the use of technology, and ultimately whether they will adopt the devices for use in their everyday lives. These models are the Theory of Reasoned Action, the Theory of Planned Behavior, the Technology Acceptance Model, and the Unified Theory of Acceptance and Use of Technology (Teo, 2013).

The first model that was developed was the Theory of Reasoned Action (TRA) (Teo, 2013). This model posits that the individual's attitude toward using the technology and the subjective norm will determine whether the individual begins using the technology. For this model, the individual's attitude toward technology is considered from the broad perspective of technology use not on a device-by-device basis, but as a concept of including any electronics at all. An individual who believes that technology is largely redundant because the work can be done with paper, for instance, would have a negative attitude toward technology, and would be unlikely to adopt any device for use. The second factor, subjective norms, refers to the individual's assessment of whether others would want them to perform the action. If a school system believes that electronics in the classroom isn't useful, there will be no expectation to utilize the devices, and the individual will be unlikely to adopt the technology. According to the TRA, these two factors alone will determine an individual's use of technology.

The second theoretical model developed is the Theory of Planned Behavior (TPB) (Teo, 2013). This model sought to expand on the TRA by including the individual's perceived behavioral control as a factor influencing the adoption of technology. Perceived behavioral control is defined by the extent to which personal and environmental factors influence performance of the behavior. This begins to incorporate concepts like availability and funding for the technology, as well as individual perceptions of a specific device.

The Technology Acceptance Model (TAM) was later developed, and was based heavily upon the TRA model (Lee & Ryu, 2013). The TAM outlines three factors influencing technology use and acceptance: attitude, perceived usefulness, and perceived ease of use. This model defines perceived usefulness in terms of whether the technology can improve the individual's productivity. If the technology can improve their productivity, then there is a purpose to using it, and the individual will see the value in making the transition. Perceived ease of use is defined by the level of effort the individual needs to exert in order to learn and use the technology. If the device takes considerable effort to use, the individual's productivity will suffer due to difficulties in getting the technology to work. Due to this reduction in efficiency, ease of use can directly impact perceived usefulness. Both perceived ease of use and perceived usefulness will develop the individual's attitudes toward the technology, which in turn determines their likeliness to use the device in their everyday lives.

A final model was constructed incorporating facets of all three of the previous models, known as the Unified Theory of Acceptance and Use of Technology (UTAUT) (Teo, 2013). This model includes perceived usefulness, perceived ease of use, subjective social norms, and facilitating conditions within the environment as factors that determine whether a piece of technology will be utilized by an individual. Due to the current study's focus on an individual's perceived skill with mobile technology and their perceived usefulness of these devices, while little attention is given to social influence or facilitating conditions in the environment, the TAM is used as the theoretical framework.

While the three facets of the TAM can be used to broadly describe the model, ease of use can be broken down into five sub-categories to better understand what helps an individual determine if a system is simple to learn. First among them is a subjectively pleasing aesthetic. If an individual likes the look and layout of a system's interface, they're more likely to be open to the idea of using it. This can influence their perceived ease of use not because of anything the system is capable of doing differently, but because of a sense that it functions smoothly (Barnard, Bradley, Hodgson & Lloyd, 2013). This category has been so influential that some theorists have called for its inclusion as a separate factor in the model called Perceived Richness of Presentation. Perceived richness of presentation refers to how engaging the system is, how it can be presented, and whether it utilizes multiple modalities and an integration of auditory and visual stimuli. This richness of presentation can impact the individual's perceived ease of use through distractibility and engagement, as an engaging system can overshadow potential difficulties in its use (Lee & Ryu, 2013).

This cognitive engagement can likewise be broken into three intertwining facets: curiosity, interest, and attention focus. Curiosity is defined as a desire for new information and experiences. Interest is defined as an arousal and sustaining of curiosity. Attention focus is defined by sustained curiosity to develop interest. Each of these factors plays off of one another, such that an individual's triggered curiosity will maintain interest in the system through sustained effort attention, which leads to engagement with the system. To put this in reductionist terms, if interest is sparked, the individual will attend to it and try to learn the system, which potentially leads to an interest in learning more. If that interest is sparked, the cycle begins over until they lose interest, or have learned the system (Lee & Ryu, 2013).

The next factor that determines a person's perceived ease of use is efficiency, or how fast users can accomplish a task using this system. If the system is efficient, it means the individual is able to quickly and easily use it, which gives them a positive sense of the system's accessibility and ease of use (Lin, 2013). This in turn will impact the individual's perceived usefulness of the system, as a technology that can improve efficiency has a clearly defined use – more expedient results (Teo, 2013).

Ease of initially learning to perform the task – or Learnability – is another integral factor that impacts perceived ease of use. If the individual has a negative first experience with a system, they are less likely to want to utilize it in the future due to a sense that it is too difficult to operate. This is impacted in two ways – perceived learner control, and the individual's self-efficacy. Learner control refers to the individual's ability to construct their own knowledge. If the system is learnable, then the individual is able to construct their knowledge of the system as they explore and experiment with it. Self-efficacy refers to the individual's perceived ability to learn from media at all. If the individual has low self-efficacy for media-based learning, they are unlikely to make the attempt, or to perceive noticeable gains in terms of their learning (Lee & Ryu, 2013).

Memorability refers to the individual's ability to recall how to use an application over time, and is impacted by how many steps are required to perform an action. If the task is streamlined and simplified, it is more likely to be easily remembered, and the individual will not have to spend time repeatedly looking up information (Lin, 2013).

The number of errors that occur while users are engaged with a task also has an impact on perceived ease of use. The higher the number of errors, the more frustrated an individual will become with the system, and the more difficult they will think it is to use (Lin, 2013). These errors can be mitigated by system responsiveness, or the amount of feedback the system will offer as it's being used. If a system is designed to offer corrections and give helpful feedback to the user, the difficulty of operating the system alone is nullified (Lee & Ryu, 2013).

User errors as a whole can be reduced in several ways based on the system's interface. System interface can reduce errors and improve learning through four constructs: transparency, affordance, feedback, and error recovery. Transparency refers to showing users what they need to do and demonstrating the effects of their actions. Transparency can be best established through the use of a trial or introductory lessons on how to perform basic tasks. Affordance refers to the system's intuitiveness, and whether or not the correct actions are easily identifiable among all other options. Readily accessible options for a task improve affordance, and reduce the possibility of user errors. Feedback pertains to system responsiveness to an error once it's made. If a system identifies an error when it's made, it should also be able to identify a solution to the user. This feedback is necessary for individuals to learn how to operate the system, and to avoid continuous errors. The system may also have a build in error recovery function, where the system naturally recovers from an error. The most common form of error recovery is auto-correct, where an error in typing is automatically corrected by the system. This function is beneficial, as it enables the user to make mistakes without fear of consequence. Each of these functions can prevent errors for individuals, and impact their perceived ease of use (Barnard, Bradley, Hodgson & Lloyd, 2013).

The facets of TAM do not occur all at once, nor are they constructs that are set in stone. An individual's perceptions of a system's utility and ease of use can be impacted through trial runs and direct instruction. Due to the ability of people to change an opinion based on exposure, there tends to be a three-phase method to the acceptance of technology. At first, individuals enter the Objectification Phase, where the intent to use the system begins based on perceived usefulness, environmental factors, or a combination of the two. After an individual perceives the utility of a new system, they move into the Incorporation Phase, where they begin to experiment with and explore the new device. This is where the bulk of learning about the system occurs, and where the individual can develop a sense of the system's ease of use. Should the system prove useful and easy to use to them, they arrive in the Acceptance Phase, where the use of the technology becomes commonplace. Once in the acceptance phase, the individual is more likely to utilize the technology for day-to-day tasks, and establishes a routine in its use (Barnard, Bradley, Hodgson & Lloyd, 2013).

This three-step process outlines an initial introduction to a new technology, but does not account for the inevitable upgrades and system transfers that can and will occur over time. Instead, a different model must be employed for encouraging the use of a new technology in a setting where an outdated system already exists. This model comes in five stages. Individuals will start in the Knowledge Phase, where they get to know the new product. It's here that they will be introduced to factors such as system complexity, similarities to the old system, and potential advantages of the new system over the old one. The knowledge phase simply outlines the product, but the persuasion phase is when the individual can be convinced that the new device is necessary. This can be done best through a trial period where the individual can use the program and see for themselves what the benefits are. Following this trial period comes the decision phase, where they determine whether or not to purchase the new product over the old one. If it is decided in favor of the new product, the implementation phase begins, and the product is incorporated into their daily lives. As the device is being used, they begin the confirmation phase, where they decide whether or not the full package was a relative benefit or detriment compared to the old system (Barnard, Bradley, Hodgson & Lloyd, 2013).

Impacts of Technology on the Classroom

Technology-integrated classrooms have been shown to have beneficial effects for students, including increased test scores and behavioral improvements (Butzin, 2001). Students show positive achievement in all subject areas when personal computer technology is utilized in classrooms, and some studies suggest that students learn more in less time when receiving computer-based instruction (Butzin, 2001). These improvements in academics are not only seen from technology implementation in the classroom, but from use outside of the classroom as well. Out-of school literacy practices involving technology, such as instant messengers and social media sites like Facebook, seem to improve traditional in-school literacy practices (Huntington & Worrell, 2013). Additionally, students report that they use the internet to complete homework assignments at a much higher rate than they do textbooks or the library, due to the efficiency with which they can search and the greater fund of knowledge available (Butzin, 2001).

In current classrooms, technology is available, but is not being utilized to its fullest potential. The most common uses of technology are entertainment through video clips, and presentations on PowerPoint. Most teaching and learning is still conducted through traditional pencil-and-paper (Butzin, 2001). This implementation is a start, but largely has little to do with increasing academic performance of students. To increase student achievement, technology needs to be made interactive. If students are passively taking in information through a presentation or video, they are not actively constructing their own knowledge, and are less likely to retain information. Interaction with the technology is important to develop skills for how to learn and find information (Lin, Chen, Sun, Wible & Kuo, 2010). Interaction with the system is best facilitated through stimulating visuals and multiple media modalities to capture and sustain attention (Lee & Ryu, 2013). If students are allowed to directly work with a technological device that is stimulating and engaging, they are more likely to perceive it as a useful tool for constructing knowledge, and will continue to learn through the device.

To demonstrate this, there are school-based projects that have been developed to integrate classrooms with technology. One such project is known as the Apple Classrooms of Tomorrow, which was utilized in a ten-year study on the effects of technology-rich classrooms on student learning. Over the ten years, student test scores did not show significant gains, but students' attitudes toward school and academic motivation increased, while behavioral problems decreased (Butzin, 2001).

Another program developed to incorporate technology into the classroom is Project CHILD, which incorporates computers into each classroom. In this project model, three teachers work in teams to teach across three grade levels (K-2; 3-5) for three years. These teachers run three different cluster classrooms for reading, writing, or math. Work in these cluster classrooms is done in three separate stations: a station for computers and online work, a station for textbooks and written work, and a station for exploration and hands-on work. A fourth station is created for students to speak with teachers if they require help. Children spend one hour per day in each cluster classroom, and the rest of their day with their individual teacher. A study was conducted to compare test scores of students in Project CHILD with test scores from non-technology based classrooms. Test scores from second grade and fifth grades were compared for reading, language arts, and math. Additional measures were taken for student behavior, engagement, and attitude toward schools. Results of the study showed that, at the fifth grade level, students in Project CHILD showed significant gains over the non-technology enriched classrooms for reading, language arts, math applications and computations, and reading comprehension. At the second grade level, students in Project CHILD scored higher for reading and language arts. For both grade levels, students enrolled in Project CHILD showed fewer behavior problems, better attitudes toward school, and more engaged learning (Butzin, 2001).

Barriers to Technology Implementation

With documented benefits to implementing technology in the classroom, it can be hard to understand why so few schools utilize the options available. The most immediate concern to consider is cost, as most technology that is available can cost a significant amount. Concerns over damages, replacements, and future required updates also factor heavily in many schools' aversion to technology integration (Ifenthaler & Schweinbenz, 2013). However, there are many other reasons that school staff may have for not incorporating technology into the classrooms.

A study by Ifenthaler and Schweinbenz (2013) was conducted to examine teacher attitudes toward technology after exposure. Eighteen teachers from schools using tablet-PCs in their classrooms were interviewed about their experiences, perceptions, and attitudes toward technology. The goal of this study was to determine what teachers felt they needed in order to appropriately utilize technology.

The most common statement given was that teachers felt they needed to learn what was available first. When handed technology and told to experiment, many did not know what to do, and wound up using it infrequently, if at all. Individuals with family or friends who were familiar with the devices tended to request help to learn, while those without such connections often felt frustrated and did not like using the devices. Simply giving a basic outline of what the device can do is insufficient, as this will not tell them how it can specifically benefit them. In order for others to see the value of a piece of equipment, they need to be shown the value of individual features, not the entire product. All facets will not be equal in the individual's eyes, and unless the device can demonstrate how it will impact their job directly, they will not see the benefit. Specification of available features is therefore a key factor in helping others learn what is available (Lin & Chen, 2013). Highlighting strategies for use is also helpful, as some options may not be obviously beneficial until its practical use has been demonstrated.

When personally asked what would help teachers learn to use their tablet-PCs, a frequent request was training. They were unfamiliar not only with the tablet, but with most technology in general. This lack of experience was cited as a common barrier. Additionally, concerns about now knowing how to operate the device during a class seemed to sway teachers away from its use. Due to lack of familiarity, they were uncertain if they could properly utilize it, which in turn led to concerns about losing class time simply to figure out the device.

Interestingly, teachers do claim they see the benefit in these devices, but they do not see them as beneficial for all students. Many claimed that while the students who performed well in classes would likely be able to figure out and use the devices to their benefit, they did not believe that students with limited academic performance would make significant gains simply by using technology. This mentality creates a unique barrier, as technology is unlikely to be utilized if there is no perceived use for it. Fortunately, as demonstrated through programs like Project CHILD, noticeable gains have been made for students on all academic levels when technology is incorporated (Butzin, 2001).

These concerns link into a common theme of limited self-efficacy regarding the use of such devices. In the case of technology, self-efficacy can be broken down into three facets – magnitude, or the individual's believed capabilities with a particular device; strength, of their confidence in their abilities; and generalizability, or their belief that their skill with a particular device would transfer to other devices as well (Nam, Bahn & Lee, 2013). Low self-efficacy then results in unpleasant feelings and anxiety toward using a particular device, which causes the individual to avoid using it altogether (Lee & Ryu, 2013). On an individual basis, this is a matter of preference, but within the classroom is can create a dangerous cycle.

Acceptance of technology in the classroom by students is influenced highly by instructional strategies used by teachers. If technology is never used at all, students will see no benefit to the technology available, and will in turn have little to no self-efficacy regarding the use of these devices for purposes beyond entertainment. If teachers have low self-efficacy and avoid using technology in their classrooms, this directly impacts student perceptions (Nam, Bahn & Lee, 2013). It is estimated that roughly 50% of primary school educators self-identify as novices, indicating a wide-spread sense of low self-efficacy regarding technology and its use among educators. To curtail this trend, self-efficacy among educators needs to be improved, and to do this, exposure and training seem to be the preferred way to go.

The current study has developed a questionnaire to assess familiarity with mobile technology through three key areas: frequency of use, skill in operating the device, and ability to teach others how to use the device. All three categories measure how well the individual can operate handheld devices, and whether they know about the options that are available. This questionnaire can be used to identify features educators are not aware of, and help develop training on how to implement the technology. The objective of this study is to determine if access and experimentation with handheld devices increases an individual's ability to utilize the technology.

Methods

Participants

Seventy-two students at the State University of New York at Plattsburgh were administered the questionnaire developed by the researchers. Twelve participants were male, and fifty-nine participants were female. Ages ranged from twenty to forty-four years. To target individuals in an education setting, students were selected based upon enrollment in the graduate program for school psychology, undergraduates enrolled in an education course, and undergraduates enrolled in a psychology course. Of the total participants, six were in their second year of study in the school psychology program, nine were in their first year of the school psychology program, thirty-three were attending an education course, and twenty-three were attending and undergraduate psychology course. During collection of post-test data, the 22 participants enrolled in an undergraduate education course were dismissed for the semester before questionnaires were distributed. Due to this,

Materials

A questionnaire to assess mobile technology familiarity was developed by the researcher in conjunction with Dr. Dale Phillips, a professor of psychology at SUNY Plattsburgh, and the graduate school psychology class of 2015. The questionnaire was developed by utilizing an article outlining fifteen essential iPad skills necessary for teachers and students to know (Kharbach, 2013). Each of the fifteen domains was included in the development of the questionnaire – creation of presentations, creation of digital stories, creation of e-books, printing documents, creating videos, improving reading skills, taking notes, creating written content, using WhiteBoard applications, recording audio, screen sharing, completing homework, creating MindMaps, doing research, and creating digital portfolios. An additional domain was added to assess communication skills with handheld devices for a total of sixteen domains.

Each domain was developed with a four-part heuristic designed to assess the individual's frequency of use of the technology's function, the skill with which the individual could utilize the function, how well the individual believed that they could teach another to use the function, and a validity question to ensure the individual knows what the construct is.

The questionnaire was developed by the examiner and the 2015 cohort in the school psychology program at SUNY Plattsburgh, under supervision of Dr. Dale Phillips. The questionnaire's total length is seventy-four questions, with ten demographic questions and four questions for each of the sixteen essential skills assessed. The four questions for each skill examine the individual's frequency of use for the skill, their perceived skillfulness in using the application, their perceived ability to teach the skill to others, and a validity question to ensure accuracy of the self-report.

Content validity for the questionnaire was established using thirty-two participants selected by the eight students who developed the questions. Each participant in this phase was asked to look at a scrambled list of the questions, and determine which of the sixteen essential mobile technology skills the question belonged to. Results of these statistics showed that participants were able to correctly identify which domain each question belonged to.

Internal consistency for the questionnaire was then established using a different pool of thirty-two participants selected again by the eight students who developed the questions. Data were recorded using the Qualtrics survey program to reduce potential error in recording. Once the thirty-two participants had responded, an item analysis was conducted for each question against all subscales in order to establish that it was properly measuring the construct in question. Results showed that while all questions assessing frequency of use, skillfulness of use, and ability to teach others were correlated with the subscale they were a part of, the validity questions tended to be unrelated. As a result, all validity questions were re-written for a second draft of the questionnaire.

An assessment of internal consistency was then conducted for the second draft of the questionnaire using eighty participants selected by convenience sampling. Data were recorded using the Qualtrics survey program. Once all participants had completed the questionnaire, an item analysis was conducted to correlate each item against all subscales. Results showed that all questions were correlated to the subscale they were measuring, and had lower correlation with other subscales. Each subscale was somewhat correlated, with certain similar subscales being highly correlated, such as the Research and Completing Homework scales. Additionally, some of the subscales correlated highly due to none of the eighty participants rating themselves as having any knowledge about the skill in question and therefore having no variance (MindMaps and White Board).

Descriptive Statistics of these results showed that data were highly skewed for most items. For the Communication domain, data were skewed highly toward all participants frequently using this function, knowing all about how to use it, and being able to teach others how to use it. For all other domains, data were skewed toward never using the function, knowing nothing about the function, and being unable to teach anything.

A Cronbach's Alpha was conducted to determine internal consistency. Results of this analysis showed that all domains were internally consistent. Exact values can be seen in Figure A.

A Principle Components Analysis was conducted to verify the validity of the measure. Factors were rotated using a Verimix Rotation. Results of this analysis showed that eighty percent of variance within the measure was explained through seventeen factors. Ten of these factors consisted of a single composite the questionnaire is attempting to measure, while three of the factors were composed of two composites. This is likely due to the high correlation between scores on these composites, as nearly all respondents answered the same way to questions on these composites, be it that they knew almost nothing about the construct, or they were all highly familiar with the construct. The remaining four factors were related to certain outliers within composites. These outliers were typically validity questions, as respondents sometimes indicated some familiarity with the composite, but were not familiar with it enough to correctly answer questions about it.

Table A.

Domain	Cronback's Alpha Score
Create Presentation	.819
Create Digital Stories	.831
Create E-books	.777
Print Documents	.830
Create Videos	.809
Improve Reading Skills	.815
Take Notes	.811
Create Written Documents	.817
Use Whiteboard	.816
Create Audio Clips	.812
Screen Share	.830
Do Homework	.797
Create Mind Maps	.816
Do Research	.821
Create Digital Portfolio	.819
Communication	.788

Procedure

Participants will be asked to complete the questionnaire developed for this study to determine their level of familiarity with technology. A sample of seventy-two students was used to gather pre-test data on familiarity with iPad applications as they apply to the school environment. Once complete, pre-test data will be examined to determine a baseline of student familiarity with these applications. Following pre-test data, the sixteen participants enrolled in the school psychology graduate program will be given iPads to utilize for four months. At the end of the four months, post-test data will be gathered to determine if access to iPads will improve familiarity with the applications available. This post-test data will be compared to the baseline pre-test data using an ANOVA test.

Results

Descriptive statistics were run for data along the pre-post testing and assigned group. Participants in the experimental groups showed considerable improvement in average performance on the questionnaire (pre-data mean=119.9, SD=22.4; post-data mean=168.8, SD=17.8). Participants in the control group showed little difference in their total understanding of concepts measured by the questionnaire (pre-data mean=98.3, SD=30.25; post-data mean=104.5, SD=19.96). Kurtosis and skewness were within acceptable limits for all groups in both phases of the experiment. The complete results for all composites in both pre- and post-test trials for all groups can be seen in Table B-E.

Table B. – Pre-test data for experimental groups

Composite	**N**	**Minimum Score**	**Maximum Score**	**Mean**	**Standard Deviation**
Presentation	16	3	11	7.25	2.11
Digital Story	16	3	7	4.44	1.46
E-book	16	3	9	4.88	1.54
Print Documents	16	3	10	5.69	2.41
Create Video	16	3	12	8.25	2.72
Improve Reading	16	3	13	6.38	2.60
Notes	16	8	15	11.44	1.75
Written Documents	16	3	15	8.13	3.69
WhiteBoard	16	3	10	4.56	2.03
Audio Clips	16	4	11	7.88	2.45
Screen Share	16	3	7	4.69	1.35
Homework	16	4	15	10.75	2.74
Mind Maps	16	3	11	5.00	2.56
Research	16	9	15	12.56	1.67
Digital Portfolio	16	3	14	5.25	3.13
Communication	16	11	15	12.81	1.11
Total	16	87	152	119.94	22.40
Validity	16	8	15	11.81	2.29

Table C. – Pre-test data for control group

Composite	**N**	**Minimum Score**	**Maximum Score**	**Mean**	**Standard Deviation**

Presentation	55	2	13	4.91	2.58
Digital Story	55	2	9	4.24	1.69
E-book	55	2	9	4.20	1.61
Print Documents	55	2	14	5.18	3.06
Create Video	55	3	14	7.00	2.80
Improve Reading	55	2	13	5.98	3.05
Notes	55	3	15	7.31	2.88
Written Documents	55	2	14	5.64	2.74
WhiteBoard	55	3	10	4.18	1.70
Audio Clips	55	3	15	6.75	2.83
Screen Share	55	2	12	5.56	2.24
Homework	55	3	15	7.56	3.51
Mind Maps	55	2	10	3.78	1.36
Research	55	3	15	9.93	3.05
Digital Portfolio	55	2	12	4.53	2.11
Communication	55	7	15	11.53	1.91
Total	55	53	189	98.27	30.25
Validity	55	0	14	7.84	3.10

Table D. – Post-test data for experimental groups

Composite	**N**	**Minimum Score**	**Maximum Score**	**Mean**	**Standard Deviation**
Presentation	16	7	12	10.38	1.31
Digital Story	16	7	13	8.94	1.73
E-book	16	7	14	9.13	1.86
Print Documents	16	7	14	9.69	2.21
Create Video	16	8	14	10.56	1.55
Improve Reading	16	7	14	9.19	1.80
Notes	16	11	15	13.69	1.25
Written Documents	16	7	15	11.44	2.13
WhiteBoard	16	7	13	9.69	2.02
Audio Clips	16	7	15	11.13	1.82
Screen Share	16	4	12	8.19	2.07
Homework	16	10	15	12.63	1.41
Mind Maps	16	7	13	9.25	1.61
Research	16	12	15	13.81	1.11
Digital Portfolio	16	3	13	7.31	2.57
Communication	16	12	15	13.81	0.66
Total	16	145	216	168.81	17.81
Validity	16	12	16	14.06	1.12

Table E. – Post-test data for control group

Composite	**N**	**Minimum**	**Maximum**	**Mean**	**Standard**

		Score	Score		Deviation
Presentation	33	3	10	5.33	2.03
Digital Story	33	3	10	4.61	1.85
E-book	33	3	11	4.33	1.73
Print Documents	33	3	13	5.36	2.80
Create Video	33	4	13	7.91	2.13
Improve Reading	33	3	12	6.00	2.03
Notes	33	4	13	7.61	2.65
Written Documents	33	3	12	6.36	2.52
WhiteBoard	33	3	8	4.30	1.21
Audio Clips	33	3	12	6.55	2.31
Screen Share	33	3	10	5.61	1.71
Homework	33	3	13	8.85	2.67
Mind Maps	33	3	9	3.85	1.52
Research	33	3	15	10.91	2.66
Digital Portfolio	33	3	14	4.85	2.40
Communication	33	9	14	12.06	1.43
Total	33	73	156	104.48	19.96
Validity	33	2	12	8.21	2.82

Data were then analyzed using a repeated measures ANOVA test to determine the effect that iPad use had on knowledge of mobile technology skills. All composites analyzed showed significant improvement from baseline to the end of intervention, with the exception of Improving Reading [$F(1,119)=3.59$; $p=0.060$] and Creating Audio Clips [$F(1,119)=3.77$; $p=0.055$]. Results of the ANOVA are charted in Table F below.

Table F. – Effect sizes for experimental group

Domain	Effect Size (*r*)	F-value	df	P-value
Presentation	0.83	8.79	119	0.004
Digital Story	0.77	19.03	119	0.001
E Books	0.80	14.18	119	0.001
Print Docs	0.65	6.68	119	0.011
Create Video	0.58	9.44	119	0.003
Improve Reading	0.64	3.59	119	0.060
Notes	0.83	4.63	119	0.033
Written Docs	0.74	9.20	119	0.003
White Board	0.85	17.18	119	0.001
Audio Clips	0.73	3.77	119	0.055

Screen Share	0.56	7.45	119	0.007
Homework	0.66	8.44	119	0.004
Mind Maps	0.87	12.87	119	0.001
Research	0.58	6.32	119	0.013
Digital Portfolio	0.44	4.27	119	0.041
Communication	0.62	6.66	119	0.011
Total	0.86	13.67	119	0.001

Discussion

The current study is consistent with many of the theoretical views regarding technology use and acceptance. The results of this experiment indicate that, with sufficient exposure to mobile technology, individuals will come to find uses for these devices within the classroom. Participants with this exposure showed dramatic improvement in their use and understanding of how mobile devices can be used in education, while those without such exposure showed little change. Additionally, results seem to indicate that the questionnaire was able to accurately reflect gains in each participant's knowledge regarding the use of mobile technology in the classroom. These results are most consistent with the Technology Acceptance Model (TAM), in which improving the perceived ease of use and perceived usefulness of a new technology will increase the likelihood of individuals utilizing and becoming proficient with the devices.

This study is currently one of the first of its kind to have a working metric for examining participants' level of familiarity and ability to use mobile technology. To date, no other research seems to have developed such a measure, making this questionnaire difficult to compare to other studies. However, the results do find a link between the participants' familiarity and level of use and the participants' perceived ease of use, which is consistent with theoretical models of technology acceptance. It can therefore be concluded that this questionnaire can be used as a measure for gauging how familiar an individual is with mobile technology, and that the measure can track changes in the individual's perceptions regarding these devices.

It was informally noted that some participants showed a strong aversion to completing the questionnaire. Most complaints issued by participants were in regards to the length of the measure. At seventy-four questions, the questionnaire can be time-consuming to complete, and requesting that participants complete the same questionnaire twice throughout the study may have been draining. Additionally, all questions were formatted with a similar template along the four question types: how often is this skill used, how skilled participants feel they are at using it, how well could participants teach these skills, and a general validity question regarding use of the applications. These question types were utilized for each of sixteen domains, meaning similar questions were repeated sixteen times for each skill measured. This repetition may also have impacted participants' willingness to complete the measure. However, the current format of the questions was shown to most accurately measure changes in skills that participants had. Due to this, the current form of the questionnaire is considered the most effective, though participants' fatigue at repeated exposure should be kept in mind.

An unexpected finding of the study was in regards to how participants learned these skills through different applications. Through informal observations of the experimental group during the study, it was noted that participants would seek out the best application to suit their needs, and would discuss preferences and findings with other participants regarding which had greater efficacy. Participants would also demonstrate how to operate the applications to one another. This reciprocal teaching was likely to impact their perceived ability to understand and teach use of skills, as they had already familiarized themselves with what was available, and how to showcase the skills to others.

While the study yielded significant results, the control group is hindered by its reliance on convenience sampling to find participants. While the experimental groups were able to be brought back for the end of the experiment, the control group was from a class no longer in session, and thus a new control group needed to be brought in for the second half of the study. In an ideal experiment, using the same participants for the control group would be necessary. Additionally, sampling was performed based on convenience. Thus, all participants involved were college students enrolled in psychology courses. Random sampling would have been a more effective sampling method to demonstrate universality of these results.

Future studies could focus on the efficacy of these skills within the classroom. While the current study examined participants' familiarity and comfort in using these devices, it does not check for their effectiveness at utilizing them within the classroom. Additional research into whether exposure to these devices will improve an individual's ability to use them effectively in the classroom would be valuable.

Additional areas for further research would be the impact these skills have on the students in the classroom. While the current study examines the effectiveness of the staff at using these skills, no research so far has examined how effective these skills are at improving student learning. The current study also examines only college-age students, and therefore results may not generalize to younger children. Future studies may benefit from examining if these results generalize to children as well as adults.

Lastly, research into the effects of these applications would better demonstrate the utility of mobile technology in education. To date, there is little research on any mobile technology applications that suggest effectiveness. While all applications used in this study were based on sound theoretical models, there is no research showing that they are effective in practice. Having studies examine these applications for practical utility in the classroom would demonstrate their benefits for educators and school staff.

This research shows positive effects on participants' understanding and skilled use of mobile technology applications designed for the classroom. Additionally, the measure designed to examine in participants' skill and ability to teach skills has been shown to be accurate at detecting changes in participants' skill levels. While further research is needed to generalize findings to other populations, and to determine how well mobile technology applications can improve student learning, the current study demonstrates that exposure to mobile technology can increase educators' proficiency with these devices, and that improvements in educators' skills can be measured via the developed questionnaire. These results show a method of increasing educator familiarity, and improving the ease of integration of mobile technology in the classroom to enhance student learning.

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