Student perceptions on using cell phones as learning tools

Implications for mobile technology usage in Caribbean higher education institutions

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Abstract

Purpose – This paper aims to examine students' perception, views and opinions about the usage of mobile phones in an educational setting in a higher education institution located in Jamaica. The results of these findings were used to gain insights and to assist education policymakers in adopting most suitable approaches to integrating mobile technology in learning.

Design/methodology/approach – A survey approach was used for this study. A total of 145 students participated in the study using structured questionnaire design containing 14 questions.

Findings – The results indicated an overall positive student perception toward cell phones usage as a learning tool and integrating cell phones into learning activities. Students were keen on its usage as a social connectivity and collaborative tool, which they can use for flexible and personalized learning activities.

Originality/value – Less research has been done in Caribbean and developing countries in analyzing student perception toward using cell phones for learning purposes. This research provides insights in developing policies to assist with the integration of mobile phone technology in learning and how institutions can respond to the advent of advancing mobile technology.

Keywords Jamaica, Learning, Mobile technology, Student perception, Cell phone, Pedagogies, Caribbean, Developing countries

Paper type Research paper

Introduction

Mobile devices connected to the internet such as smartphones and tablets have become the choice platform for the millennial generation engaged in various internet activities. There has been spectacular growth in the global mobile market with projection of increases in ownership and penetration rates (GSMA Intelligence Report, 2016). The estimate is to be at 5.8 billion subscribers and 71 per cent penetration rate by the year 2025.

Advances in technologies and ICTs have led to greater use of mobile technology in the education sector, and particularly at the university level. Many institutions worldwide have started to experiment with various learning methods and integrating mobile phone use to facilitate students' learning. The higher education sector has become increasingly

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technology-driven. More developed countries are using modern advances in educational technologies and instructional design. These range from e-learning, distance education, Bring Your Own Devices (BYOD), use of online and social media, student response systems in classrooms, to now game-based learning, Web 2.0, simulation technology, three-dimensional apps and virtual classroom environments. These advances in conjunction with newer pedagogies such as adaptive, collaborative and hybrid learning styles are being used to enhance students' learning experiences. This has created disruption in pedagogical structure and framework of learning institutions resulting in noticeable shifts from instructor led to more student-learner centered, self-lifelong modes of learning. Universities in Jamaica and the Anglophone Caribbean have also embarked on initiatives to increase the use of technologies in their institutions in response to the emergence of these educational technologies.

For instance, University of the West Indies, the region's premier higher education institution in the English speaking Caribbean, with campuses located in Jamaica, Trinidad and Barbados, through their Centre for Excellence in Teaching and Learning have accelerated ongoing drive to sensitize and train lecturers in how to use mobile and other ICT technologies in the class setting. Recent developments such as the "Inaugural Teaching with Technology Showcase" (2014), e-book access for incoming graduate students allow for real time, interactive online and group study, and support services provided by MITS, the university's information technology services leverage technology use to drive students' IT requirements during their course of study, via the UWI Triple A Strategy (2017-2022).

Mobile and ICTs, therefore, provide many opportunities to create, deliver and support innovative methods of learning. Research points to the use of such technologies in facilitating collaboration and communication, enhancing creative and interactive learning styles and the development of tools, applications to aid in the delivery of educational content. Institutions, therefore, have to carefully weigh investments made in technology against the benefits realized by students and administration in adopting such technologies in learning environment. Technology implementation can create its own set of challenges and issues specific to each institution. This can represent substantial costs and resources expended to acquire potential benefits.

Hence, a study of students' perception, views and opinions about the use of cell phones as a learning tool in class setting is an important consideration for university administration decision-makers for mobile technology adoption. Students' user acceptance of mobile devices in the learning environment is even more critical for Caribbean and developing world institutions in the context of significant infrastructural, institutional, socio-economic and financial resource constraints.

The purpose of this paper is to examine students' perception about the use of mobile phones in an educational setting in a higher education institution located in Jamaica. Research indicates that the study of various user acceptance models in developed countries is a useful technique in predicting successful adoption of technology in learning. Given our unique challenges and constraints, such studies on student receptiveness to mobile technology use in classroom scenario may better inform institutions how to integrate mobile phone usage into pedagogies and delivery modes to enhance student performance and learning outcomes.

This research embarked on an empirical approach by collecting data on a sample of undergraduate students and soliciting their perception about using cell phones in a class setting via survey instrument. To elaborate and investigate our main objective, we explored in further depth two areas:

(1) How do students perceive/rate their own use of mobile phone technology use and impact on their learning and academic performance?

(2) How do students perceive/rate their lecturers' use of mobile phone technology use and impact on their learning and academic performance?

It is hoped that the results of this survey will provide useful insights of students' views about mobile phone use in learning and benefit lecturers, facilitators and university administrators to craft suitable strategies for better implementation in the context of Caribbean challenges, with the ultimate objective of enhancing academic performance and ensuring region's higher education standards are on par with developed countries. The ensuing sections contain the research methodology, analysis and discussion of the results along with recommendations for the future.

Literature review

Technology's disruptive force has forced higher education institutions to rethink current cell phone policies and to spur innovative approaches to enhance student participation and involvement in the learning process. While much of contemporary literature seem fixated with the wide range of features and capabilities of these devices, others rightly focus on identifying those key properties and attributes, which can be incorporated and employed to learning delivery methods.

University students are especially heavy users of cell phones and this has implications for learning outcomes at the tertiary level. Institutions will have to place greater importance on using mobile technology resources efficiently to support learning. Research cites a number of common recurring themes regarding students' positive perception of their devices' capabilities in their educational pursuits. They offer more appeal to students with respect to the ease of access to search for information.

Internet connection enables students to use mobile phones as modern tools to collect and acquire knowledge, which creates further opportunities for learning while attending lectures. Primary benefits are enhanced communication and collaboration, along with greater interaction and increased learning irrespective of time or location.

Mobile devices belong to six categories such as smartwatches, mobile phones, PDAs, web pads, tablets and laptops (Sharples and Beale, 2003). Others classify mobile phones as one variant of portable digital assistants (PDAs), which is defined as any handheld device equipped with computer capabilities, which can be used to support educational objectives (Churchill and Churchill, 2008). These mobile devices facilitate students' ability to communicate, interact, engage in discussions, store and record material for later use, give lecturers affordances to use mind mapping tools to better gauge how students think and process information. More importantly, they also facilitate higher-level thinking and computational skills.

In terms of pedagogical frameworks, there is the view that mobile phone features and attributes can be of significant value in helping to create new learning styles and methods. For instance, such devices can be used to design "collaborative, contextual and constructionist" (Patten *et al.*, 2006) forms of learning.

The increasing use of mobile phone technology within the higher education context represents a paradigm shift in thinking about teaching and learning strategies. Existing pedagogical frameworks tend to assume that learning occurs largely in the context of a classroom setting. Many contend that mobile technology integration in learning upsets this notion and is spawning new pedagogies integrating its use inside and outside the university

environment (Martin and Ertzberger, 2013; Wong and Looi, 2011; Patten *et al.*, 2006; Attewell, 2005; Sharples, 2000).

Mobile phones are enabling the "here and now" of mobile learning, i.e. the ability to practice authentic learning instantly irrespective of time or location. This type of ubiquitous learning has been shown to produce significant improvements in student performance, specifically with respect to higher enjoyment levels, greater "engagement, motivation, focus and enthusiasm" (Martin and Ertzberger, 2013). Others conceive its use in assisting with "seamless" learning styles, i.e. a type of smooth, unified integration of learning experiences spanning across many dimensions of the education experience, such as students' exposure to formal/informal, social, physical and virtual learning context. Otherwise referred to as mobile-assisted seamless learning (MSL), it can be considered to an "all-in-one" approach, which produces benefits of context-based, personalized, socially engaged and multidisciplinary approaches to learning. In addition, with continued advances in technology, such methods are considered especially relevant for applications in virtual learning environments with the growing use of digital tools.

The literature also indicates the use of mobile phone device features to support more popular learning approaches in higher education, namely, lifelong learning and mobile learning (m-learning). The pedagogy of lifelong learning focuses on providing students with higher-order skills and competencies (i.e. critical thinking, adaptability, self-directed reflection, meta-learning, creativity and problemsolving), which are required over a lifetime to succeed in a dynamic changing world (Bolhuis, 2003; Fischer, 2001).

Supporting mobile technology tools ideally suited to the advancement of lifelong learning strategies as enunciated by Sharples (2000) include students' ability to engage in collaborative and situated type learning as a response mechanism to adapting to changing environment, immediate accessibility to information, portability and personalized features to react instantaneously anytime, anywhere.

Directly emerging from mobile technology advancements, mobile learning (m-learning) is viewed as perhaps offering potentially the most exciting, futuristic and technologically advanced possibilities in revolutionizing the delivery of higher education in the immediate future. This is because mobile phones are exceptional learning tools in various educational settings (Ahmad, 2015, 2018a, 2018b, 2019a, 2019b). The ubiquitous nature of mobile technology combined with advances in ICT and wireless internet technology is considered to be the future of education technology and learning (Moreira *et al.*, 2018; Peng *et al.*, 2009).

Early development of mobile learning frameworks

Mobile tools have become important factors contributing to the "social, collaborative and situated elements of human learning" (Roschelle and Pea, 2002). Mobile phone, in particular, smartphones are particularly suited for collaborative and augmented learning styles (Martín-Gutiérrez *et al.*, 2015). Such devices are regarded as vital technology support tools, which facilitate rather than replace normal methods of communication and interaction during the learning process, and hence, are essential in the creation of innovative learning strategies for university students (Naismith *et al.*, 2004).

Others view the return on investment, cost-benefit analysis and cost-effectiveness approaches as more important determining factors in developing strategies around appropriate pedagogical approaches to mobile phone technology integration. It provides for "flexible pedagogies" (Gordon, 2014) by supporting and enhancing personalized, and blended learning methods. In terms of cost savings and long term benefits, it can also enable real value for all education stakeholders via mechanism such as virtual learning environments, peer and assessment tools without the requirement for additional amounts of

resource outlays. Mobile phone technology carries with it certain unique technical features, which present real cost savings for existing educational models. In evaluating the pedagogical impacts, both "technical and non-technical factors" (Sarrab *et al.*, 2016) needs to be incorporated in measuring the quality impact. The entire gamut of quality performance (QUPER) factors including "flexibility, scalability, usability, maintainability, functionality, reliability, connectivity, performance, user interface, security, flexibility, scalability, usability and maintainability" (Svensson *et al.*, 2008) will affect mobile phone adoption rates and more importantly, the receptiveness of education stakeholders to integrate it into learning. Mobile technology advances also increase students' expectations about the delivery and access to quality education. Given the level of technology with advances in networking, internet and digitalization, students have higher expectations regarding access to lower cost and just in time modes of learning. Mobile phone technology offers this extra value from a pedagogical perspective in terms of organizing teaching and learning "on the go", providing instant communication, collaboration, knowledge and assessment support. It is considered by some as a means of better satisfying the demands of learners while balancing the needs of institutions to provide cost-efficient quality learning outcomes in "supporting existing self-directed, interactive and constructivist pedagogical frameworks" (Rajasingham, 2011).

Alternative pedagogical frameworks

Given the ubiquitous nature of mobile phones and continued advances in technology, we have witnessed a gradual shift in thinking about the creation of new approaches to teaching and learning. Much of the discussion centers on the role of mobile phones in developing personalized, collaborative and authentic forms of learning to generate rather than enhance student learning experiences and raise higher education outcomes. The literature indicates a revolutionized approach to m-learning methodologies. There is increased recognition that mobile technology's ubiquitous nature has led to learning inside and outside the class context, which has led to new learning opportunities. Some assert that both students and lecturers need to be receptive, aware and ready to adapt to this new dispensation to successfully implement new pedagogies surrounding mobile phone technology (Moreira *et al.*, 2018).

Earlier applications of m-learning, drawn from a sample of research studies during the 2010-2015 period in US and developing world institutions, examined frameworks using cell phone integration in creating innovative learning styles, which facilitate individualized learning, anytime, anywhere, but which also allow for "unstructured" and "customizable" styles suitable to the learner's need in any "situated and context aware" learning atmosphere (Gikas and Grant, 2013; Compton, 2013).

More recent developments have seen the creation of alternative pedagogical frameworks such as technological pedagogical content knowledge (TPACK), technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) models of mobile technology integration (Scherer *et al.*, 2019).

The TPACK framework uses supporting mobile features together with three important knowledge domains, namely, technology (supporting tools), content (educational subject matter or materials) and knowledge pedagogies (best fit education methods) to deliver the desired learning outcomes. It is referred to as the three important knowledge domains, which requires teachers to be competent in all three areas in conjunction with the supporting tools to produce the best learning outcomes.

TAM attempt to explain factors, which account for acceptance and adoption of digital and mobile technologies in education. It examines such factors as perceived usefulness, ease

of use and attitudes as powerful influences for comparison with other models of technology integration.

One study conducted in a South African higher education institution applied this framework with the use of the popular mobile instant messenger (MIM) app, Whatsapp, in a learning context. This application affirmed a positive relationship between these factors and perceived usefulness of mobile learning. More importantly, the use of MIM enabled efficiencies with respect to accessibility, timeliness, quality and relevance of data, which are regarded as key factors in perceived usefulness and enhancement of flexible, collaborative learning environments (Bere and Rambe, 2016).

The UTAT framework are essentially theoretical models, which try to explain the mechanism behind determining the factors contributing to technology adoption, i.e. users intentions. These factors are heavily influenced by social, psychological and behavioral factors such as performance and effort expectations, social influence and facilitating factors, which, in turn, can also be affecting age, gender and experience levels (Taherdoost, 2018; Williams *et al.*, 2015).

The literature points to the wide differences among institutions within regions and countries with respect to these acceptance factors. These may be impacted by technology factors (e.g. security, privacy, compatibility, etc.), institutional and organizational issues (e.g. readiness, resistance to change) and quality issues in institutions located in the Middle East, Asia and Latin America (Almaiah and Al Mulhem, 2019), to developing countries in the Caribbean (English speaking Guyana, Trinidad, Jamaica, Barbados), which identify specific cultural, social and country-level differences "moderating UTAT effects" (Thomas *et al.*, 2014, 2013).

Use of Smart Mobile Pedagogies in *response to latest technology advances*

Rapid and dynamic evolution of technology, particularly in the mobile space will continue to generate new theoretical frameworks and experimentation about integrating mobile technology in higher education. Latest literature attempts to predict how higher education institutions will respond in the near future with the advent of higher-level: "smart technologies" such as the pending implementation of 5 G wireless mobile internet services, edge computing, the internet of things, mobile cloud computing services, and the use of mobile support tools, such as wearables for application in augmented and virtual reality learning environments (Khan *et al.*, 2019; Sergio For tes *et al.*, 2019).

The result is a paradigm shift in thinking and approach to learning from prior traditional, lower technology integrated, teacher led models to use of more "highly adaptive, customizable ubiquitous, mobile learning technology supported tools and devices," which empowers and affords learners to adapt their learning experiences to suit inside and outside the classroom environment.

This would need teachers to keep current with emerging mobile and digital technologies, but also to have the needed institutional and infrastructural support to enable adequate preparation and adjustment of pedagogical approach to support learner-centered styles.

From a practical perspective, educational researchers are beginning to see glimpses of hands-on application of these smart pedagogical approaches with the development of "smart campuses" (Fortes *et al.*, 2019) and "smart teaching platforms" (Xu *et al.*, 2019) based on 5 G Mobile technology and other tech advances in Chinese and Spanish education systems.

Experimentation with 5 G in the Chinese university and college system has seen an explosion of mobile and online teaching network models heavily supported by government and university administration. Such testing in Chinese higher education are producing benefits in terms of students' ability to access to materials and instructions via mobile

distance teaching, real-time impact monitoring and adjustment of teaching approaches, emergency communications and real-time access and navigation of learning databases (Xu *et al.*, 2019).

Caribbean and developing world response to technology advances

The big question is how will Caribbean and developing world HE systems respond to this new wave of tech advances? How will they adjust or revamp pedagogical approaches to teaching and learning with continuous tech disruptions in a dynamic twenty-first-century learning environment? Much has already been written about the constraints to technology adoption in higher education and the factors contributing the digital divide between developed and developed countries (Nye, 2015; West, 2015; Thomas *et al.*, 2013).

Latest research work conducted by International Telecommunications Union (ITU) and the GSMA *Digital Inclusion in Latin America and The Caribbean Report, 2016*, speaks to the concerns about "digital inclusion" for developing country institutions with the incorporation of 5 G, IOT, cloud and edge computing in learning and other spheres of life (ITU Report, 2019; GSMA Intelligence Report, 2016).

Digital inclusion is especially important for developing economies to meet vital sustainable development goals (SDGs) pertaining to the attainment of basic health, educational, social and economic objectives of lesser developed states. Concerns about access, affordability, pricing of more sophisticated and higher quality technology brings into sharper focus the challenges faced by developing states (Noll *et al.*, 2018).

Over the past five years, a number of innovative initiatives have been implemented by regional institutions to integrate mobile technologies at tertiary level. Many of these spearheaded by the UWI's Centre for Excellence in Teaching and Learning, which have deployed deliberate strategies to continually sensitize teachers to new "innovative pedagogical strategies incorporating twenty-first-century technology." Recent focus has been on the use of collaborative and cooperative learning approaches to achieve higher learning outcomes.

Examples of specific approaches to introducing technology tools include workshops, presentations, and round table discussions on the use of Skype and Google apps in teaching and group work monitoring, using Web 2.0 technologies (e.g. blogs, wikis, podcasts, social networking) and mobile learning techniques in classroom setting. In addition, there has been much sensitization by the university's information technology services department (MITS) about the impact of new media technologies in higher education (UWI, Centre for Excellence T&L, 2014).

Research method and design

A survey approach was used for this study. A 12-item survey covering three constructs was used. Four survey questions comprised each of the following constructs: perception of fairness of university cell phone policy, perception of lecturer initiated educational cell phone applications and perception of student initiated cell phone educational applications. Responses were based on a six-point Likert-type scale with the neutral response omitted. Respondents selected one of the following responses for each question: strongly disagree: 1; disagree: 2; slightly disagree: 3; slightly agree: 4; agree: 5; strongly agree: 6.

The data was collected from a group of students attending The University of the West Indies in Jamaica. A total of 145 surveys were distributed of which 144 participants responded. This comprised of 71 males and 73 females ranging in ages 19-22 years. All were enrolled in an undergraduate degree program with 63 (44 per cent) being 1st-year students, 13 (9 per cent) 2nd year and 68 (47 per cent) 3rd year students.

All the information gathered was at the convenience of the researcher. Participation was voluntary and no personal or identifying information was gathered to ensure confidentiality and high participation rate. The demographic statistics of the respondents are summarized in Figures 1-3 below.

Procedure

The survey questionnaire was used to gather participants' perception of cellphone use as a learning tool in the classroom setting. The survey instrument was divided into two main sections.

Section I

The first section was used to obtain information relating to cellphone use and access, ownership and demographic facts.

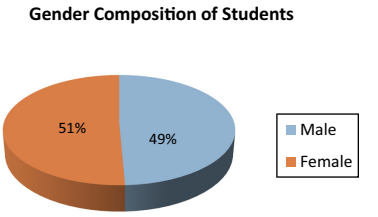

Figure 1.
Gender composition of students

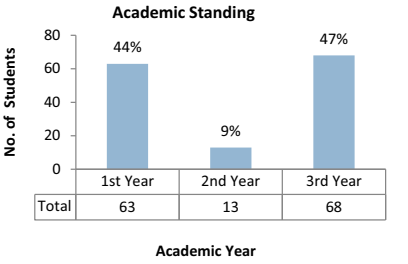

Figure 2.
Academic standing

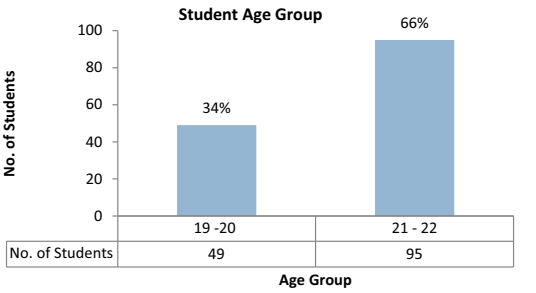

Figure 3.
Student age group

Section II

The second section sought to enlist specific student perceptions and views on cellphone use in education by posing 12 questions. These questions were divided into three subsections of four questions each which focused on themes regarding students' perception of the usefulness of cellphones in learning and educational activities.

The three subsections questions centered on the following topics:

(1) Satisfaction with School Policy.

(2) Perception as Teacher Initiated Learning Tool.

(3) Perception as Student Initiated Learning Tool.

The results were then presented in a number of tables along with important calculated indicators. The analysis was used to gain important insights into response trends and patterns within the data.

Specifically we looked at the following indicators:

- The highest average/percentage form of agreement (all categories).
- The highest average/percentage form of agreement (within category).
- The highest average/percentage form of disagreement (all categories).
- The highest average/percentage form of agreement (within category).
- The ratio of unfavorable vs favorable (of 12 questions).

The results were then used to discuss the findings in a number of ways:

- Firstly and most importantly we used it to find out the possible factors, which influence student perceptions about cellphone use as an educational learning tool.
- How these perceptions differed from the researchers "anticipated" perceptions.
- How these findings could be incorporated into policy and implemented for mobile usage in the classroom.
- Finally, we compared to what extent our results concurred or diverged from other research findings in other countries.

Results

The findings for the first section of the survey instrument are presented in the following Figures 4 and 5.

Section I

The overwhelming majority of students (97 per cent), own a cellphone and indicates the high mobile penetration rates in Jamaica and other developing countries in Latin America, Caribbean, (West, 2015). The results show that cellphone usage, access and ownership patterns are generally consistent with those in other countries.

Figure 4, shows that the largest numbers (132 and 128), use cellphones for calling and texting and reinforces its importance as a vital connectivity and socialization tool. What is interesting is the large numbers (101, 93 and 52) who utilize it as a clock, an important time management and emergency back- up tool.

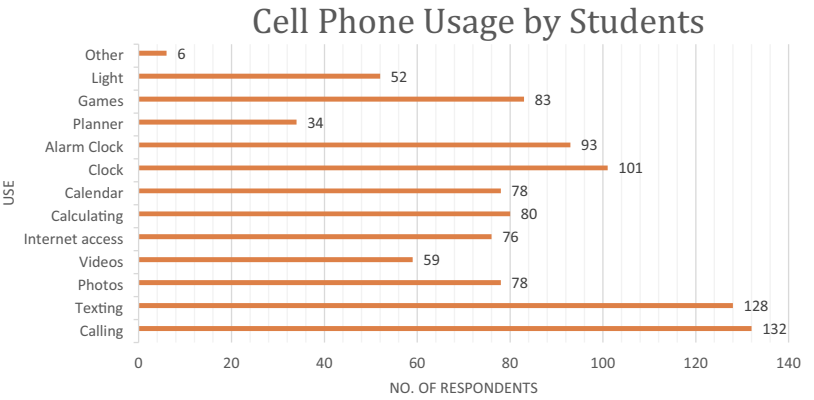

Figure 4.
Cell phone usage by students

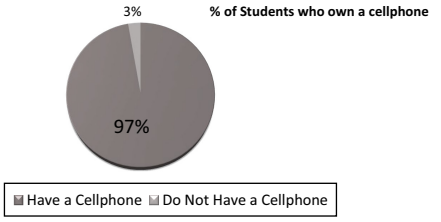

Figure 5.
Percentage of students who own a cellphone

Section II

The results are summarized in the following figures and tables. It shows the results per category with responses to each of the four questions posed.

For the first category pertaining to school policy with cellphone, we found a strong awareness of the rules and guidelines, which stood at 90 per cent. With regards to the fairness of the policy and fairness of the sanctions for breach of policy, a majority of 58 per cent in both cases indicating a favorable response.

However, the greatest negative response was for the freedom to use cellphones anytime, which recorded a 76 per cent unfavorable response. It is interesting to note that notwithstanding a strong awareness of the policy (55 per cent), a high 32 per cent registered strong disapproval with not being allowed to use it at any time (Figures 6 and 7, Table I).

With regards to using the cellphone as student-initiated tool of learning, three out of the four questions posed in this section received higher positive response than negative. The highest favorable response of 84 per cent thought it is an excellent idea to use it as a collaborative tool with other students, followed by a 79 per cent positive rating for its use in seeking teacher assistance.

However, students were not enthusiastic about using cellphones to submit assignments to teachers, which registered a 55 per cent combined unfavorable response.

We should note the very strong agreement ratings of 24 per cent and 23 per cent respectively for its use in seeking teacher assistance and collaborating with others on projects, which points to its perception as an important interaction and engagement tool (Figures 8 and 9, Table II).

The final category was the only one, which returned more favorable than unfavorable responses to the questions posed. In fact, all questions retuned in the range of 64-75 per cent

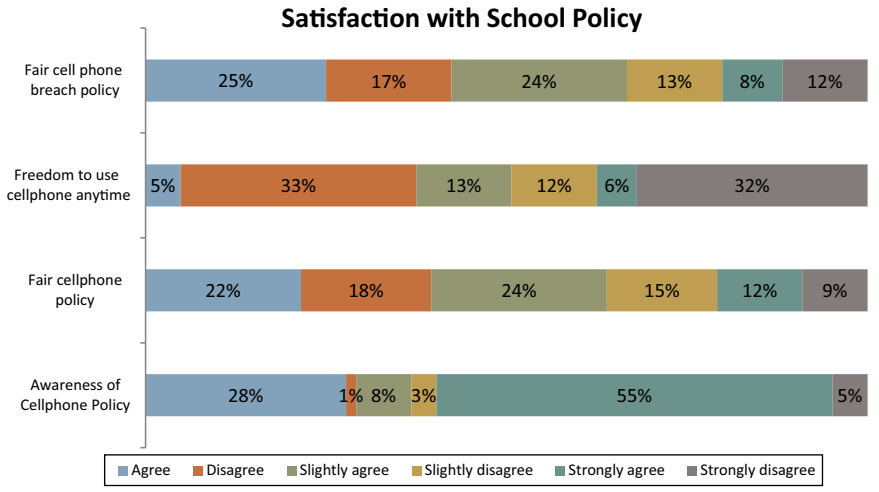

Figure 6. Response to Satisfaction with School Policy

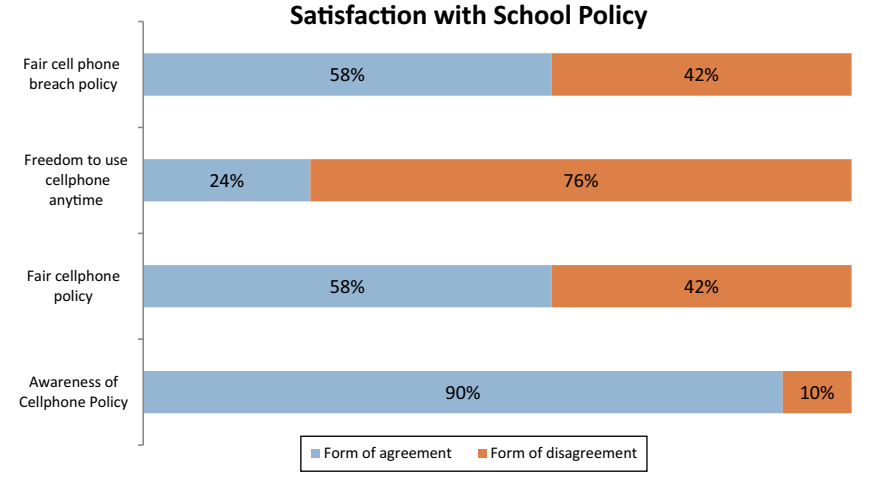

Figure 7. Favorable vs unfavorable response

Response	Awareness of policy	Fair cell phone policy	Freedom to use cellphone	Fair breach policy
Total respondents	144	144	144	144
Mean	5.2	3.7	2.4	3.6
SD	1.3	1.5	1.5	1.5

Table I. Mean and SD–satisfaction with school policy

positive rating relating to the perception of use of cellphone as a teacher-initiated learning tool. Students strongly agreed that it could be used by instructors to provide feedback (18 per cent), followed by its use as an educational tool (15 per cent) and encourage students' participation in educational activity (13 per cent).

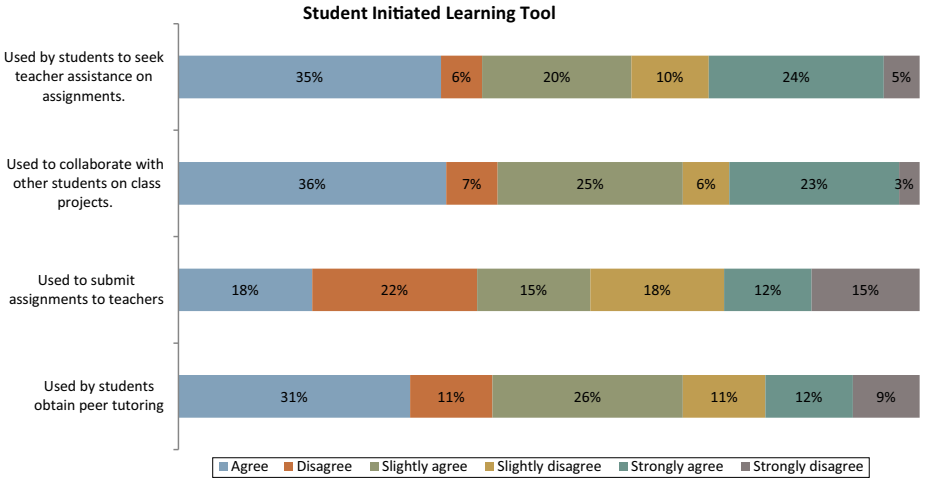

Figure 8.
Perception as student initiated learning tool

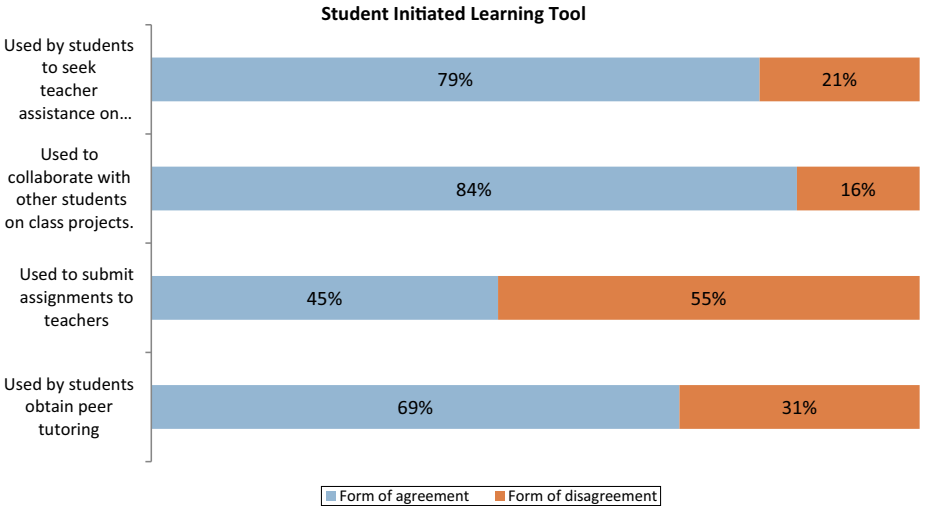

Figure 9.
Favorable vs unfavorable response–student initiated learning tool

Table II.
Mean and SD–perception as student initiated learning tool

Response	Used by students obtain peer tutoring	Used to submit assignments to teachers	Used to collaborate with other students on class projects	Used by students to seek teacher assistance on assignments
Total respondents	144	144	144	144
Mean	3.9	3.4	4.5	4.5
SD	1.5	1.6	1.3	1.4

The highest mean of 4.2, percentage favorable (75 per cent) and lowest unfavorable response of (25 per cent) was mobile phone use to provide feedback, which again indicates its perceived importance by students as a vital interaction and engagement tool.

In summary the question, which received the highest percentage favorable response was the student awareness of cellphone policy, which stood at 90 per cent. On the other hand, the question, which garnered the highest percentage unfavorable response is the freedom to use cellphone at any time. It is interesting to note that these fall in the first category relating to policy (Figures 10 and 11, Table III).

In addition, out of the 12 questions posed, 10 received generally more favorable than unfavorable responses, while two received more unfavorable than favorable responses as summarized in Figure 12 below.

Findings

The results of our study revealed a number of interesting findings. Students' perception regarding cellphone use as a learning tool was generally positive. In 10 of the 12 (83 per cent) questions posed returned a more favorable than unfavorable rating regarding its adoption. A number of important patterns or trends emerged, which contributed to students' views. We see from Figure 12 that students place the greatest premium on mobile phone use for collaborating (84 per cent), communicating (75 per cent) and seeking teacher assistance (79 per cent).

This finding confirms previous research studies, which attest that students view the adoption of cellphone in classroom environment as an important collaboration, communication, accessing and information sharing. Students place a high priority on its use as a source of greater interaction and encouraging higher levels of engagement. In addition, they leveraging cellphone technology features as a means to a complement and enrich the learning experience and collaborate outside the classroom (Biddix *et al.*, 2015; Andrews *et al.*, 2015).

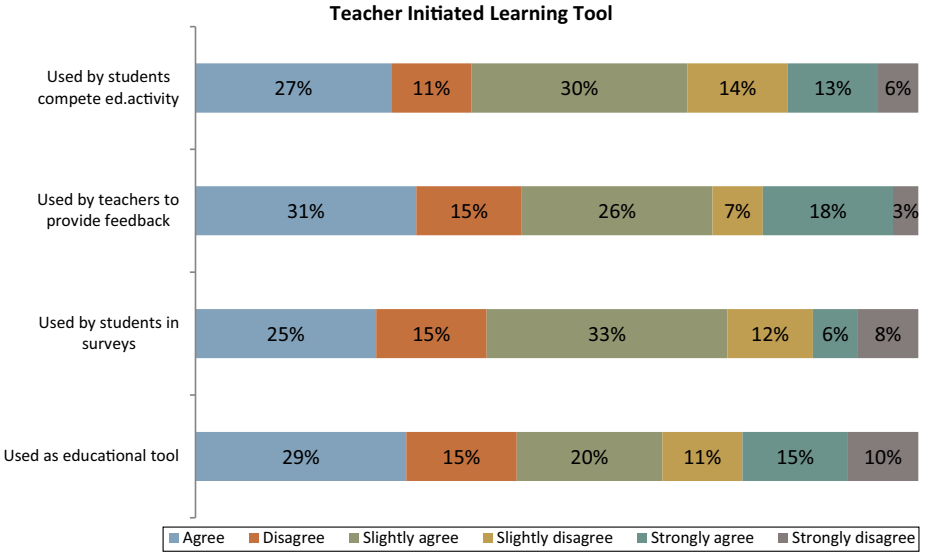

Figure 10.
Perception as a teacher initiated learning tool

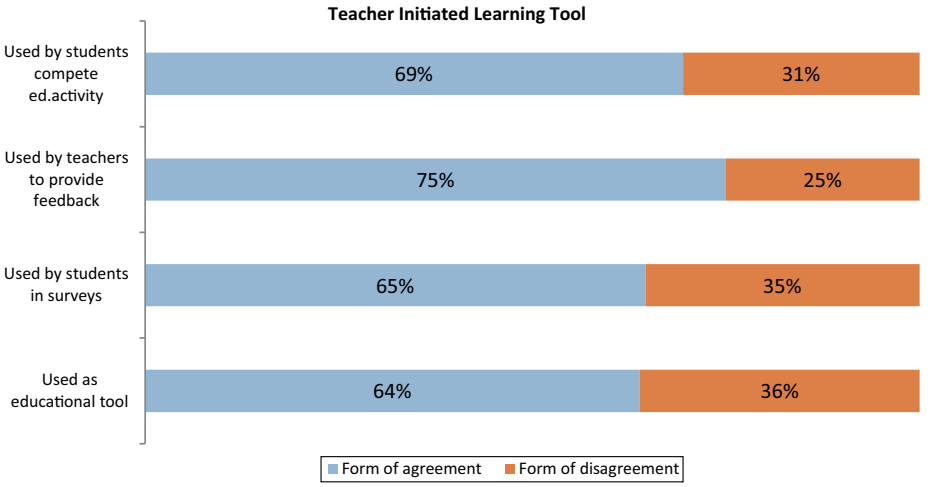

Figure 11.
Favorable vs unfavorable response–teacher initiated learning tool

Table III.
Mean and SD–perception as a teacher initiated tool

Response	Used as educational tool	Used by students in surveys	Used by teachers to provide feedback	Used by students to compete in educational activity
Total Respondents	144	144	144	144
Mean	3.9	3.7	4.2	4.0
SD	1.6	1.4	1.4	1.4

Summary of Favorable and Unfavorable Response Rating

Response	Form of agreement	Form of disagreement	More favorable	More Unfavorable
Awareness of Cellphone Policy	90%	10%	Favorable	
Fair cellphone policy	58%	42%	Favorable	
Freedom to use cellphone anytime	24%	76%		Unfavorable
Fair cell phone breach policy	58%	42%	Favorable	
Used by students obtain peer tutoring	69%	31%	Favorable	
Used to submit assignments to teachers	45%	55%		Unfavorable
Used to collaborate with other students on class projects.	84%	16%	Favorable	
Used by students to seek teacher assistance on assignments.	79%	21%	Favorable	
Used as Educational tool	64%	36%	Favorable	
Used by students in surveys	65%	35%	Favorable	
Used by Teachers to provide feedback	75%	25%	Favorable	
Used by students to compete in educational activity	69%	31%	Favorable	

Figure 12.
Summary of favorable and unfavorable response rating

Although less research has been conducted in developing countries, we find that the study confirms that students in this region are no different in displaying their worldwide affinity and comfort with the use of mobile technology. Also similar to findings in developed countries, we find that a strong awareness of the rules regarding restrictions on use of cellphones in class at 90 per cent with lesser support agreeing to the fairness of the policies and sanctions imposed for breaching the guidelines. The author is not surprised about students' knowledge of the guidelines and policies while registering strong opposition with restrictions placed on the use of cellphones at any time.

This researcher was somewhat surprised to find more students returning unfavorable (55 per cent) response to the use of cellphone for submitting assignments to teachers. This author would have expected that as a student-initiated tool, it would have been perceived as a means of fostering greater levels of student-teacher engagement.

However, this affirms earlier studies in developed countries that students in this part of the world also place greater priority on its use as a social connectivity, social networking and communication tool, which can be used in any context at any time, often "blurring the lines between formal and informal learning" (Pedro *et al.*, 2018).

For Caribbean students and the majority of mobile phone users in the developing world, portability and affordability are especially unique advantages, and is vital for maintaining important business, customer and personal "linkups" (Horst, 2006; Horst *et al.*, 2005).

Implications and recommendations

Advances in technology will continue to unravel higher education systems. Education policymakers will have to continuously rethink their pedagogies and models in the age of technology and the digital revolution. We see from the survey results that students are more responsive to using cell phones along with learning methods, which enhance communication, collaboration and sharing of learning experiences.

More importantly, mobile technology is making demands on the system for learning styles, which are more highly personalized and customized to the learners needs. Learning is increasingly taking place outside formal learning environments, and hence, institutions will have to adjust to this new shift in delivery methods.

Currently, what also seems to be evolving are rapid shifts in the nature of the global economy with the emergence of "on demand, collaborative, sharing economies" along with advances in digital and mobile technologies (5 G wireless, mobile cloud computing, etc.), which is creating an intersection between learning, technology and economic systems.

There is the view that higher learning institutions will have to build strong educational ecosystems driven by technology to meet the needs of this "on demand economy" and specifically to cater to young millennial and Generation Z students' demand for educational services, which are personalized and customizable. At one extreme end, is a vision of future learning pedagogies based on "platform learning" (Means, 2018) using mobile tech and other advances to integrate "on demand learning" and "on demand work" for this new economic system.

Others view the integrating newer advances in technology (smart technologies) with existing pedagogical frameworks but developed in a more seamless fashion (smart pedagogies) as the solution to deliver more student centric, socially collaborative, self-directed learning styles. For our purposes, regional higher institutions must have the ability to access and leverage advances in mobile technology irrespective of our economic, social or institutional strictures to reap the benefits of high-quality learning systems.

Integrating mobile technology with learning methods, which emphasize self- directed, lifelong and flexible learning while augmenting these with some degree of instructor led

activities can lead to significant savings and value without compromising on quality educational outcomes if the following strategies are integrated (Cuesta Medina, 2018):

- Ensure that teachers acquire new teaching skills, which emphasize interaction and assessment of students.
- Teachers should adopt more the role of facilitator, and maintain effective "facilitator-student" metrics.
- Institutions must have monitoring and assessment mechanisms to measure learning outcomes over time.

With respect to newer technologies, 5 G mobile wireless technology presents an especially pressing concern for developing countries. Some innovative initiatives to ensure greater digital inclusion and sustainable development goals with respect to education should be considered.

For instance, the "internet light" concept (Noll *et al.*, 2018) introduced via a partnership between more developed western European counties and some African countries, uses network slicing of distributed network systems to share certain content (e.g. educational material). Caribbean institutions could also consider increasing using such partnership initiatives as cost-effective ways to ensure mobile digital inclusion with the advent of new technologies.

The future of higher education is changing where new methods are being used to engage Millennials in business (e.g. CSR) and in education (e.g. artificial intelligence and other technologies) (Ahmad, 2019c; 2020; forthcoming-a, b). I close with the thought that the future of "classrooms" would have students sitting from different departments trying to solve problems using their interdisciplinary and entrepreneurial approach.

Limitations and future research direction

Only one university has been used in this research, which is one of the major limitations of this study. The author's future research direction is to replicate this study in other universities and also include student interviews in future research.

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