

**QR Cache: Assessing the feasibility of using Quick Response (QR) codes and mobile devices to help students master computer-related workplace English competencies**

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## Abstract

Qatar presents a unique opportunity to explore potential mLearning applications in a theoretical context. The geographically small country in the Arabian Gulf has nearly ubiquitous mobile and wireless network coverage. The penetration of devices such as smartphones is also incredibly high, including amongst students. And those students have expressed an overwhelming desire to integrate their mobile devices into their learning. With its virtual absence of infrastructural barriers, Qatar offers the potential to focus research on how mobile technologies can fulfill the promise of increasing student engagement by creating novel situated learning experiences. QR Cache was developed to provide an exemplar of mobile reusable learning objects (RLOs). In the pilot phase, RLOs accessed by scanning Quick Response (QR) codes were developed to teach English computer terminology. Feedback was solicited from participating students and instructors to demonstrate the desirability of using such RLOs in combination with learners' own mobile devices. The study also draws upon *Transactional Distance Theory* (TDT) (Moore, 1989, 1991) and Koole's (2009) FRAME model to provide theoretical grounding for both RLO and instructional design decisions. Early results show increased engagement, and reduced transactional distance. They also indicate that the RLOs show a strong convergence of the activity types delineated by the FRAME model.

Keywords: *FRAME, mobile learning, Qatar, QR Codes, reusable learning objects, situated learning, Transactional Distance Theory,*

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## Project Overview

The QR Cache project was developed as a direct response to explicitly stated stakeholder needs at CNA-Q and in the State of Qatar. Learners have expressed a desire to see more integration of their own mobile devices (Warraich & Dahlstrom, 2012). CNA-Q has expressed a desire to increase innovative ICT use to promote blended learning (CNA-Q, 2011). Employers have expressed a desire to integrate mLearning approaches to deliver just-in-time, situated learning for both technical and workplace English training. The current infrastructural context allows research to focus on pedagogical elements, as opposed to technical barriers (MacLeod, 2011; Metodieava, 2012; Nagy, 2012; Warraich & Dahlstrom, 2012). This research will contribute to the growing understanding of mLearning issues by examining “what... the various pedagogies (and their cultures and epistemologies) look like once [we’ve] removed the infrastructural and technical barriers” (J. Traxler, personal communication, April 13, 2012). The QR Cache project uses a Design-Based Research (DBR) approach to explore the iterative development of mobile RLOs to meet stakeholder needs. TDT (Moore, 1989, 1991) and Koole’s (2009) FRAME model are used to guide the RLO design process, and to evaluate their pedagogical effectiveness.

The first phase involved the development of a set of mobile RLOs to be used by English Foreign Language (EFL) students enrolled in CNA-Q’s Technical Preparatory Program (TPP). The RLOs were accessed using learners’ own mobile devices by scanning Quick Response (QR) codes, and were used to learn English computer hardware terminology. Participants have shown a positive response to the situated mLearning strategy. It is hoped that future iterations of the QR Cache project will lead to increased adoption of mobile RLOs by college instructors and in the Qatari workplace, as well as to the development of a comprehensive mLearning strategy at CNA-Q. It is also hoped that future iterations will lead to an increased understanding of how mobile RLOs can improve student engagement and learning by reducing transactional distance and increasing activity between students, content, their peers, and technology itself. Lessons learned from this, and future iterations of the QR Cache project will be used to help develop a practical mobile RLO design checklist, grounded in applicable learning theory, that can guide instructors in the development of effective mLearning activities and resources.

## Background Information

### What is Mobile Learning?

There are a number of definitions of mLearning. Wexler et al. (2008) define mLearning as “any activity that allows individuals to be more productive when consuming, interacting with or creating information mediated through a compact portable digital device that the individual carries on a regular basis, has reliable connectivity and fits in a pocket or purse” (p. 7).

### What are Mobile RLOs?

RLOs are Reusable Learning Objects. Mobile RLOs are RLOs designed for easy access and display using mobile devices such as a smartphone or tablet.

The RLOs for the QR Cache project cover topics related to English computer component terminology. Each RLO takes about five minutes to complete.

The RLOs have the following benefits:

- Create a situated, just-in-time learning experience;
- Can be accessed and reused at any time;
- Are easy and fun to use;
- Help learners develop additional soft skills related to both technology and lifelong learning;

### **What is a QR Code?**

A Quick Response (QR) code is a square picture, comprised of a pattern of smaller squares. The picture contains instructions that can be scanned by a mobile device to:

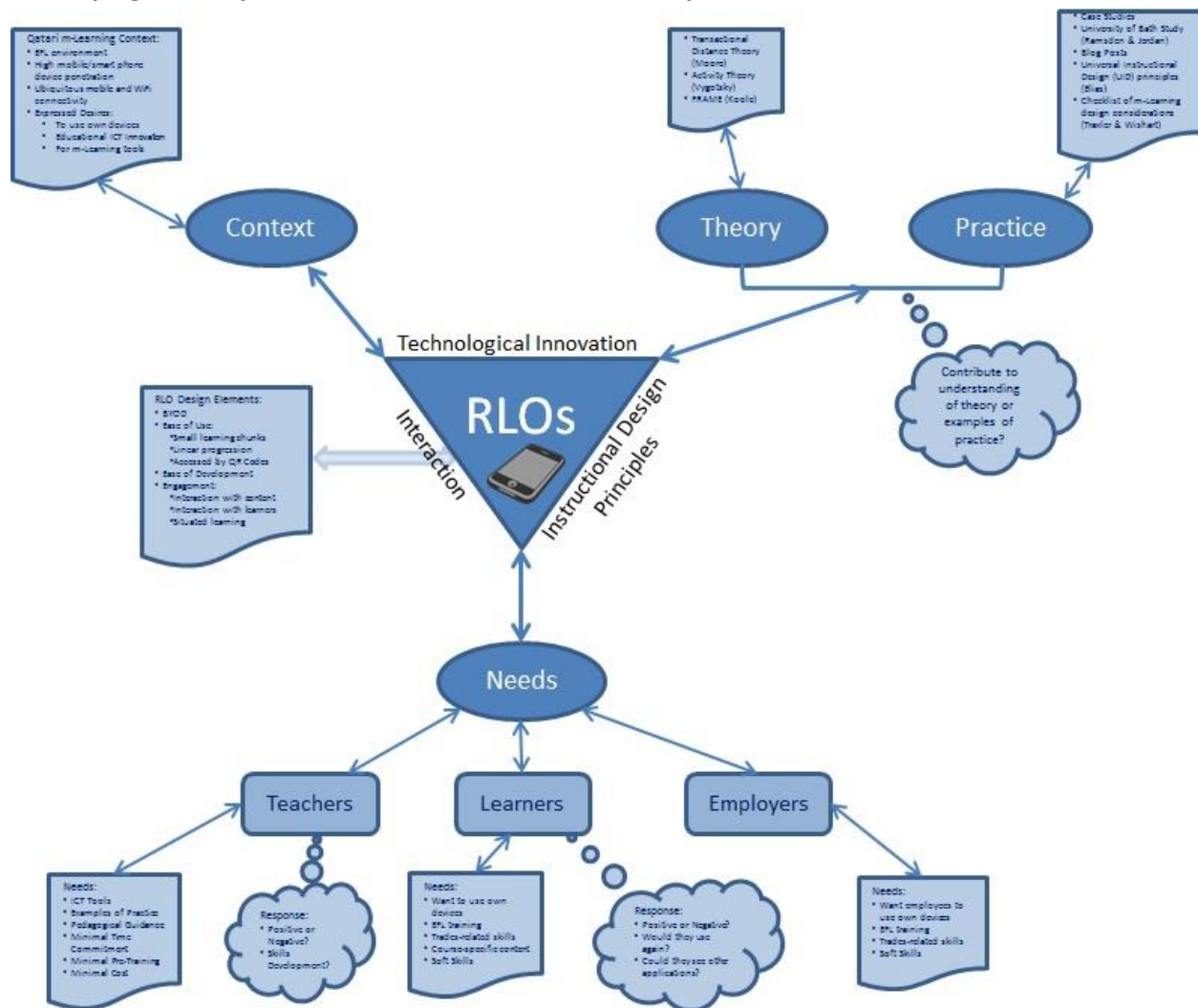
- Open a web page
- Send a text message
- Dial a phone number
- Connect to a messenger contact (such as Blackberry Messenger)
- Download a file
- Or anything else that you want to tell a mobile device to automatically do!

## **Conceptual Framework**

### **What is a Conceptual Framework?**

Without proper planning, researchers run the risk of conducting and reporting on efforts that are poorly conceived, have weak theoretical grounding, and fail to meet their overall objectives. Such research wastes critical time, resources, and energy, and is likely to be quickly dismissed by the academic community (Koro-Ljungberg et al., 2009, p. 687; MacDonald, et al, n.d.). Avoiding such pitfalls starts with developing a conceptual framework. A conceptual framework is a vision of what the purpose of the research is, and how the major variables relate to each other (Cohen et al., 2011, p. 117). This vital first step will help the researcher to make informed decisions at key junctures in the planning and implementation of the research. A conceptual framework often includes a diagram, or concept map, of the variables and themes under investigation (MacDonald, et al., n.d.). This is typically followed by a brief description of the diagram. Once a conceptual framework has been created, it is much easier to determine the overall themes of the literature review that will establish the theoretical basis of the research. This page presents the conceptual framework that has been developed for a study into the use of mobile Reusable Learning Objects (RLOs) in Qatar called *QR Cache: Assessing the feasibility of using Quick Response (QR) codes and mobile devices to help students master computer-related workplace English competencies* (Power, 2012d).

### Developing a Conceptual Framework for the QR Cache Project



**Figure 1: Conceptual Map of the QR Cache Conceptual Framework**

Mobile Reusable Learning Objects (RLOs) are an effective way to meet the interconnected needs of teachers (and institutions), learners and employers in Qatar. The Qatari context supports the investigation of pedagogical practice and stakeholder responses to the use of mobile RLOs in an environment where infrastructural barriers have already been overcome (MacLeod, 2011; Metodieava, 2012; Nagy, 2012; J. Traxler, personal communication, April 13, 2012; Warraich & Dahlstrom, 2012). The QR Cache mobile RLOs are designed to meet the expressed needs and demands of these stakeholders. Their design is grounded in the principles of Transactional Distance Theory (Moore, 1989, 1991) and Vygotsky's Activity Theory (Koole, 2009). It is guided by examples from current mobile learning (mLearning) practice, past research into stakeholder responses to the use of Quick Response (QR) codes, and the principles of Koole's (2009) FRAME model, Elias's (2010) Universal Instructional Design (UID) principles for mLearning, and Traxler and Wishart's (2011) checklist of mLearning design considerations.



The conceptual framework (Figure 1, above) shows how the Qatari context, stakeholder needs, and mLearning theory and practice converge to shape the QR Cache mobile RLOs. That convergence is surrounded in the diagram by the interaction between factors influencing technological innovation, theories of learner interaction, and effective design principles. To serve as an effective exemplar of how mobile RLOs can meet current teaching and learning needs, answers are needed to the variables highlighted in the clouds in the conceptual framework. That is, how do teachers and learners in Qatar respond to the mobile RLOs? A third cloud represents the potential for the use of the mobile RLOs to contribute to the examples of effective m-learning practice, and to lend support to existing mLearning theory.

## Literature Review

The QR Cache research project is grounded by the work of a number of researchers who have contributed to an understanding of how learners interact in technology-mediated learning situations (Moore, 1989, 1991), how multimedia elements impact teaching and learning (Clark, 1983, 1985, 1994a, 1994b; Hastings & Tracey, 2005; Joy & Garcia, 2000; Kozma, 1994a, 1994b), and what should be considered when designing effective mLearning experiences (Bates, 2005; Bradley et al., 2009; Elias, 2010; Fitzgerald, 2012; Koole, 2009; Naismith & Smith, 2009; Traxler & Wishart, 2011). These works have shaped an understanding of what an effective mLearning RLO should look like.

Moore's *Transactional Distance Theory* (TDT) (1989, 1991) has been central to much of distance education and mLearning research. TDT views learning as an attempt to reduce physical and mental distance between the learner and the instructor, the content, and other learners. Koole's FRAME model (2009) builds upon TDT, as well as Vygotsky's *zone of proximal development*, in an mLearning context (p. 37). It presents a framework for designing and evaluating mLearning by maximizing key elements, and by reducing transactional distance and the gap between "what the learner is currently able to do and what she could potentially do with assistance from more advanced peers (p. 37)". The FRAME model (Figure 2, below) describes the convergence of the Device Aspect, the Learner Aspect and the Social Interaction Aspect to create an optimal mLearning scenario.

The reduction of transactional distance through situated learning is a central aim of the QR Cache research project. Koole's FRAME model will be used to examine how effectively the RLOs create such a learning scenario (p. 41).

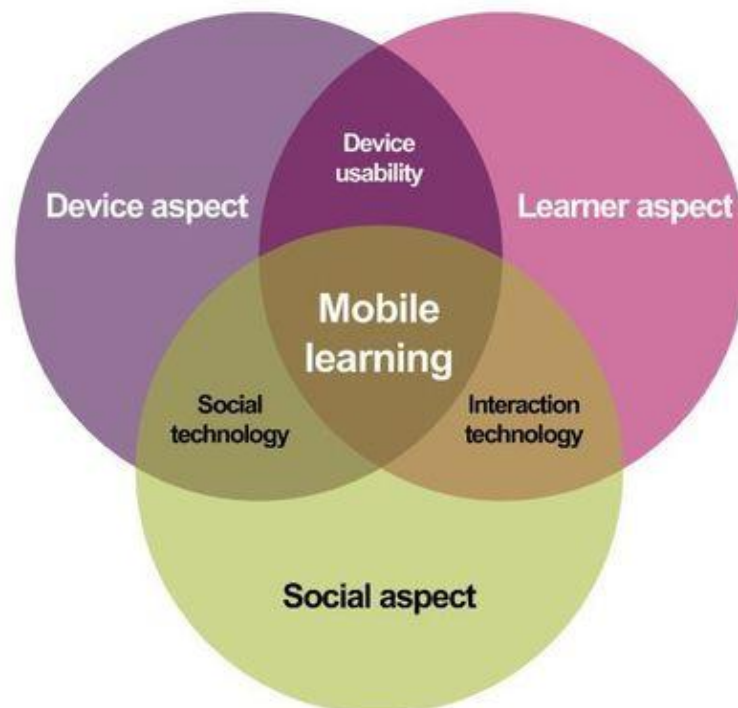


Figure 2: The FRAME Model (Koole, 2009, reproduced with permission)

A theoretical debate continues as to whether the introduction of multimedia elements, such as the QR Cache RLOs, will actually have an impact on student learning (Clark, 1983, 1994a, 1994b; Hastings & Tracey, 2005; Joy & Garcia, 2000; Kozma, 1994a, 1994b). The QR Cache research project explores elements of this debate. One of the stated aims is to demonstrate the technical feasibility of introducing mobile RLOs by teachers at CNA-Q. Both sides of the media effectiveness debate are consistent with this aim. It is anticipated that the RLOs will be at least as effective as previously employed strategies. They will also provide an enriched learning experience that imparts additional technology-related skill sets that would otherwise not be possible (Traxler & Wishart, 2011, pp. 4-7).

In light of understandings of TDT and media effectiveness, recent work has focused on providing practical advice for instructional design using mobile technology (Beddall-Hill, 2011; Bradley et al., 2009; Elias, 2010; Fitzgerald, 2012; Koole, 2009; Naismith & Smith, 2009; Traxler & Wishart, 2011). Koole's FRAME model (2009) illustrates how learners, social interaction, and mobile technologies intersect to create optimal mLearning scenarios. Elias (2010) and Traxler and Wishart (2011) both provide checklists for the effective design of mLearning. Bradley et al. (2009) and Naismith and Smith (2009) provide case studies of how mLearning RLOs should be designed to meet the needs of specific groups of learners. Similarly, Fitzgerald (2012) explores standards for creating mLearning applications with more effective interaction and the production of more meaningful RLOs. These works provided the bases for the development of the RLOs for the QR Cache research project. The works of Koole (2009), Elias (2010) and Traxler and Wishart (2011) also played central roles, and will be used to provide theoretical grounding in the analysis of the effectiveness of the mobile RLOs.

## Research Questions

The development of a conceptual framework (Power, 2012a) has enabled the articulation of an appropriate and focused set of questions that are consistent with pragmatic, mixed-methods research. The specific research questions are articulated below:

1. How do learners respond to the use of mobile RLOs, accessed by scanning QR codes, to learn English computer terminology and concepts?
  - i. Do learners experience any difficulties when accessing the RLOs?
  - ii. Do learners enjoy using such mobile RLOs?
  - iii. Would learners like to use such RLOs more often?
  - iv. Is there any impact on student achievement?
  
2. How do teachers respond to the integration of mobile RLOs, accessed by scanning QR codes, to teach English computer terminology and concepts?
  - i. Do teachers experience any difficulties when accessing the RLOs?
  - ii. Do teachers enjoy using such mobile RLOs?
  - iii. Would teachers use similar RLOs to teach other topics/courses?
  
3. Does the integration of the mobile RLOs, accessed by scanning QR codes, reflect the principles and benefits of effective mLearning design?
  - i. Do the RLOs help to reduce transactional distance between learners and content, learners and other learners, or learners and teachers (Moore, 1989, 1991)?
  - ii. Do the RLOs create optimal interaction between individuals, technology, and social elements, as outlined by the FRAME model (Kaptelinin & Nardi, 2006; Koole, 2009)?

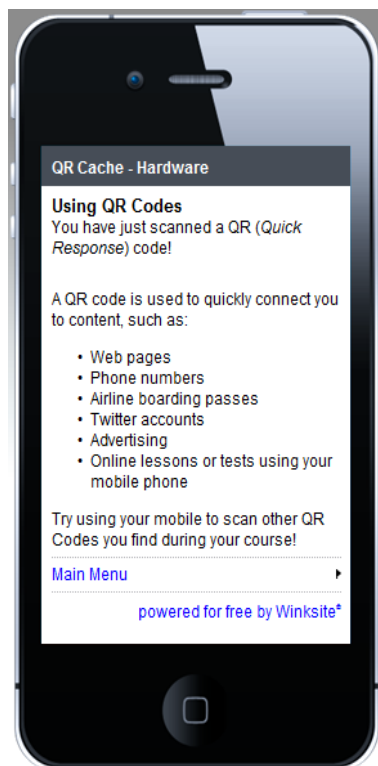
## Methodology

### RLO Design Methodology

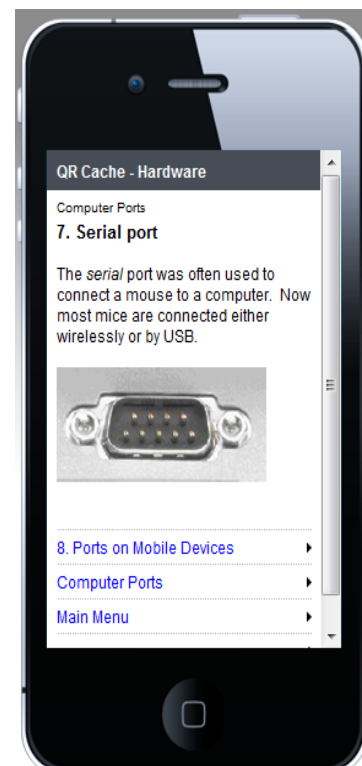
The QR Cache research project involved the development of a set of mobile device compatible RLOs for use in a specific course. Each RLO is designed to be completed in less than five minutes. Students use an app on their own mobile devices to scan QR codes mounted on computer devices. This automatically redirects their mobiles to the online RLOs (Educause, 2009; Ramsden, 2008). The RLOs use a linear progression strategy (Bradley et al., 2009), and contain a combination of graphics and textual content (to provide pronunciation guidance, and brief functional descriptions of the related computer hardware component(s)). At the end of each RLO, students can access a survey designed to “Test Your Knowledge” of the topic. The surveys are incorporated to provide formative feedback, and to spark discussion amongst students and their instructors. The actual RLOs were created using a mobile tablet, and are hosted on a free mobile website hosting service (Winksite, 2012). This decision was made for two reasons. First, CNA-Q does not currently have an operational mobile compatible learning management system (LMS). Second, the development of the specific RLOs is intended to demonstrate the technical ease with which such resources could be developed and integrated by practicing instructors (if provided with appropriate instructional design guidance).

### A Closer Look at the QR Cache Mobile RLOs

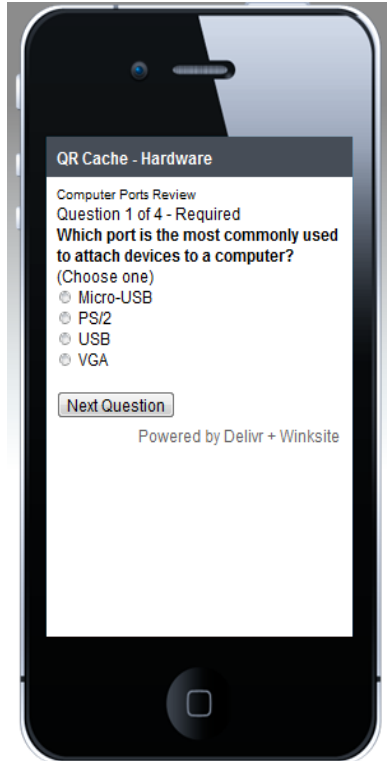
The following are screenshots of sample mobile RLOs for the QR Cache project:



QR Code Primer Lesson RLO  
(Response seen by students when they scan their first RLO)

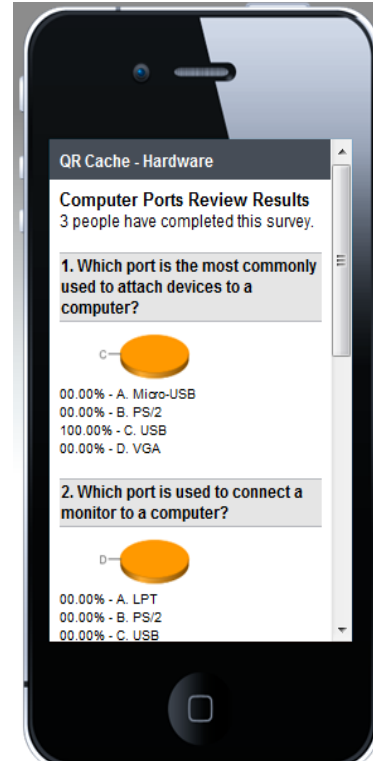


Serial Ports  
(A page from the Computer Ports RLO)



Test Your Knowledge!

(A survey question to follow-up the Computer Ports RLO)



Formative Feedback

(Survey question results presented to students)

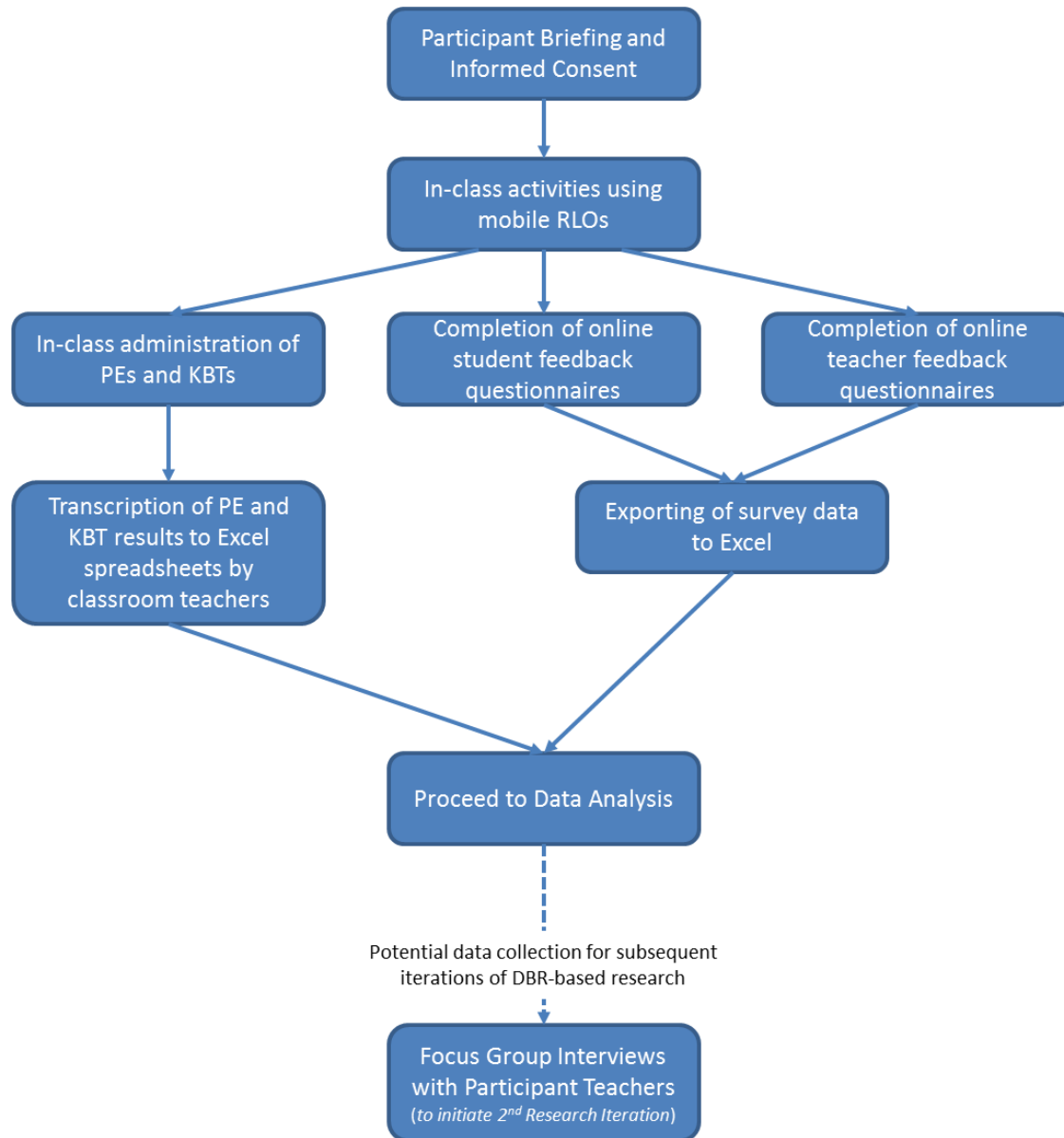
## Research Methodology

For the first phase of the QR Cache project, the mobile RLOs were used to replace workbook-based learning for a computer hardware components unit in the TPP Introduction to Computers course. A primer lesson was integrated to teach students about QR codes, and provide them with an opportunity to explore the QR code scanning capabilities of their own mobile devices (see Appendix E for the detailed lesson plans). Instructors and students worked together to locate and install QR code applications (if none were already installed on students' mobile devices). The next two class sessions were used by students to explore samples of computer hardware components to which QR codes had been mounted. Students were responsible for learning the English terminology and basic functions of the devices. Mastery of the required competencies was assessed using the standardized Practical Evaluation (PE) (Appendix C) and Knowledge-Based Test (KBT) (Appendix D) assessment instruments employed in the TPP MC-105 course. The results of the number of students who successfully completed the PE and KBT assessments, and the number of attempts needed for successful completion of each assessment, were compared to those from a control group of students in a section of TPP MC-105 that did not use the mobile RLOs.

Upon completion of the in-class activities, participating students were invited to complete an online questionnaire about their learning experiences using the QR codes and their own mobile devices (see Appendix A for the detailed Student Feedback Survey Script). The questionnaires consisted of a combination of fixed and open-response items (Cohen et al., 2011, p.382) covering such themes as ease

of access, the look and feel of the RLOs, levels of interaction with their peers and instructor, and overall impressions. A similar questionnaire was prepared for participating instructors to provide feedback on the learning activities and RLO designs (see Appendix B for the detailed Teacher Feedback Survey Script). Responses to fixed and open-response questionnaire items were coded to reflect the research issues (p. 559-563). These were analyzed for the identification of major themes related to student and instructor perceptions, and evidence of effects upon transactional distance and the types of activities that form the domains of the FRAME model.

The data collection and analysis plan for the QR Cache project is outlined in Figure 4, below:



**Figure 3: Data Collection and Analysis Plan for the QR Cache Project**

## Results

A total of seven students and two instructors completed online feedback surveys during the first iteration of the QR Cache project. Responses to demographic questions about mobile device ownership were consistent with previously reported figures for CNA-Q, Education City, and the State of Qatar (MacLeod, 2011; Metodieava, 2012; Nagy, 2012; Warraich & Dahlstrom, 2012). All of the respondents reported owning smartphones. Four students reported owning two devices, and one student reported owning three (or more) mobiles. Of the seven students, only two indicated that they already had a QR code scanning app previously installed on their devices. The remaining respondents were able to download a free QR code scanning app without any reported difficulty. Four students had previously scanned QR codes to access websites, while only one person reported previously accessing text-based content, and one reported previously using a QR code to automatically dial a phone number.

In terms of accessing the mobile RLOs, all of the students indicated that scanning the QR codes was either easy or very easy and that the RLOs loaded quickly on their devices. Only one student reported that an RLO did not load properly. All of the students responded that it was easy to view the text and images, and the RLOs were easy to navigate. Six students indicated that it was either easy or moderately easy to understand the content, and to complete the “Test Your Knowledge” feedback questions at the end of each RLO. One student indicated that the RLOs contained too much information, and that the “Test Your Knowledge” activities were difficult to complete.

With respect to interaction with technology, content, peers and instructors, six out of seven student respondents indicated that they shared their mobile devices with another classmate while participating in the RLO activities. Five students and both teachers indicated that they discussed the mobile RLOs during the class activities, and four students indicated that they engaged in discussions of the “Test Your Knowledge” activities. All seven students indicated that they viewed the RLOs more than once, and five indicated that they showed the RLOs to friends outside of the class.

Students and teachers generally indicated that they found the use of the RLOs, and their own mobile devices, appealing. Five of the seven students responded that they found these types of learning activities appealing, while one reported a neutral opinion, and one indicated that they found it somewhat unappealing. Only two of the seven students reported having ever used a mobile device for formal learning before, but all of the respondents indicated that they would like to do so again either at school or while on the job. When asked what they liked about using QR code scanners and their own mobile devices to access RLOs, students commented on the speed and ease of accessing the learning materials. As one student commented, “it’s very easy to scan and find the page that you want.”



## Discussion

The results of the first iteration of the QR Cache project show trends in mobile device ownership and the desire to use mobile devices in formal and informal learning similar to those previously reported in Qatar (MacLeod, 2011; Metodievava, 2012; Nagy, 2012; Warraich & Dahlstrom, 2012). Students and teachers reported enjoying learning with their mobile devices, and found the RLOs easy to access and use. Students indicated that they would like to use their mobile devices for learning more often. These results provide a degree of justification to pursue further investigations into integrating mLearning strategies at CNA-Q. But a stronger justification can be provided by grounding these findings in learning theories that explain how the mobile RLO approach creates an effective learning experience.

*Transactional Distance Theory* (TDT) (Moore, 1989, 1991) and the FRAME model (Koole, 2009) provide useful and complimentary lenses for examining the effectiveness of the QR Cache RLOs. Student and teacher responses show a reduction in transactional distance between learners and the content. The content is easy to access and re-access, and it is situated so that it is easier for learners to contextualize the topics. Learner-learner and learner-teacher transactional distance also appears to have been reduced. Data indicate that students interacted with each other and their instructors while participating in the learning activities. The results also indicate that the RLOs generated optimal activity across the domains of the FRAME model. Student and teacher survey responses indicate a high degree of device usability. They also show that learners are actively engaged in social interaction during the learning activities, and that the use of their mobile devices facilitated that interaction by creating a shared situated learning experience, and by generating both formal and informal social discussion. Beyond creating an enjoyable and easily accessible learning experience, TDT and the FRAME model illustrate how the use of the mobile RLOs positively affect the learning that is taking place.

## Conclusions

While the first phase of the QR Cache project was a small-scale pilot of the mobile RLOs designed for the TPP MC-105 Hardware Components unit, the results do hold promise for future research and understanding of the effectiveness of situated mLearning approaches. Future iterations of the DBR project are needed to verify the findings with larger samples, and to provide further RLO exemplars for instructors at CNA-Q. Further research is also needed to more deeply explore the ability of such RLOs to reduce levels of transactional distance, and to create an optimal convergence of learner, device and social interaction activities. Such research holds promise for moving beyond merely exploring the utility of mLearning strategies, and moving into their justification through connection to established learning theory.

### Next Steps?

- Integration of the QR Cache mobile RLOs into the regular TPP MC-105 curriculum
- Further research with an expanded sample size, and additional departments / subject areas
- Partnerships to expand the research to other academic institutions and/or local worksites
- Development of an integrated mobile / blended learning strategy for CNA-Q

## References

- Akbayrak, B. (2000). A comparison of two data collection methods: Interviews and questionnaires. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 18, 1-10. Retrieved from <http://www.efdergi.hacettepe.edu.tr/200018BURCU%20AKBAYRAK.pdf>
- Ally, M. (Ed). (2009). *Mobile learning: Transforming the delivery of education and training*. Edmonton, AB: AU Press. Retrieved from <http://www.aupress.ca/index.php/books/120155>
- Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, 41(1), 16-25. DOI: 10.3102/0013189X11428813. Retrieved from <http://edr.sagepub.com/content/41/1/16.full>
- Bates, A. W., (2005). Selecting and using technologies in distance education. *Technology, e-learning and distance education* (2nd ed.), 41-66. New York: Routledge.
- Beddall-Hill, N. (2011). Post-graduates, field trips and mobile devices. In Traxler, J. & Wishart, J. (Eds), *Making mobile learning work: Case studies of practice*, 18-22. Bristol, UK: ESCalate. Retrieved from <http://escalate.ac.uk/8250>
- Boote, D., & Beile, P. (2005). Scholars before researchers: On the centrality of the dissertation literature review in research preparation. *Educational Researcher*, 34(6), 3-15.
- Bradley, C., Haynes, R, Cook, J, Boyle, T. & Smith, C. (2009). Design and development of multimedia learning objects for mobile phones. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training*, 157-182. Edmonton, AB: AU Press. Retrieved from <http://www.aupress.ca/index.php/books/120155>
- Changing Minds (2012). *Parametric vs. non-parametric tests*. Retrieved from [http://changingminds.org/explanations/research/analysis/parametric\\_non-parametric.htm](http://changingminds.org/explanations/research/analysis/parametric_non-parametric.htm)
- The Chinese University of Hong Kong (2010). *Prepare QR codes for teaching*. Retrieved from <http://137.189.161.34/mlearning/V3/TeacherCornerQR.html#>
- Clark, R.E. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53(4), 445-459.
- Clark, R.E. (1985). Confounding in educational computing research. *Journal of Educational Computing Research*, 1(2), 445-460.
- Clark, R.E. (1994a). Media will never influence learning. *Educational Technology Research and Development*, 42(2), 21-30.
- Clark, R.E. (1994b). Media and method. *Educational Technology Research and Development*, 42(3), 7-10.
- Clearview (n.d.). *Cultural awareness: Middle East cultural overview*. Retrieved from <http://www.clearviewqatar.com/culturalawareness.html>

- Cohen, L., Manion, L & Morrison, K. (2011). *Research methods in education* (7th ed). New York: Routledge.
- College of the North Atlantic-Qatar (2011). *Strategic plan 2011-2016: Creating the future...together*. Doha: College of the North Atlantic-Qatar.
- College of the North Atlantic-Qatar (2012). *Introduction to computers: TPP-MC-105 course workbook*. Doha: College of the North Atlantic-Qatar.
- De Lorenzo, R. (2010, November 17). *QR codes and mobile learning*. [Web log comment]. Retrieved from <http://themobilelearner.wordpress.com/2010/11/17/qr-codes-and-mobile-learning/>
- Denzin, N. K. (2008). The new paradigm dialogues and qualitative inquiry. *International Journal of Qualitative Studies in Education*, 21(4), 315-325. Retrieved from <http://dx.doi.org/10.1080/09518390802136995>
- The Design-Based Research Collective (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5-8. Retrieved from <http://www.designbasedresearch.org/reppubs/DBRC2003.pdf>
- Dwyer, S. & Buckle, J. (2009). The space between: On being an insider-outsider in qualitative research. *International Journal of Qualitative Methods*, 8(1), 54-63. Retrieved from <http://ejournals.library.ualberta.ca/index.php/IJQM/article/view/2981/5198>
- Educause (2009). *Seven things you should know about... QR codes*. Retrieved from <http://net.educause.edu/ir/library/pdf/ELI7046.pdf>
- Elias, T. (2010). Universal instructional design principles for mobile learning. *The International Review Of Research In Open And Distance Learning*, 12(2), 143-156. Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/965/1675>
- FitzGerald, E. (2012), Creating user-generated content for location-based learning: an authoring framework. *Journal of Computer Assisted Learning*. doi: 10.1111/j.1365-2729.2012.00481.x
- Flyvbjerg, B. (2004). Five misunderstandings about case study research. In Seale, M., Gobo, G., Gubrium, J. & Silverman, D. (Eds.), *Qualitative research practice*, 420-434. Thousand Oaks, CA: Sage. Retrieved from <http://poli.haifa.ac.il/~levi/res/fivemisunder.pdf>
- Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *The American Journal of Distance Education*, 15(1), 7-23.
- Gerring, J. (2004). What is a case study and what is it good for? *American Political Science Review*, 98(2), 341-354. Retrieved from <http://people.ucalgary.ca/~nmstuewe/CaseStudy/pdf/whatisacasestudy.pdf>

- Hastings, N., & Tracey, M. (2005). Does media affect learning: Where are we now? *TechTrends*, 49(2), 28-30.
- Hockley, N. (2010, August 12). *A dummies guide to QR codes*. [Web log comment]. Retrieved from <http://www.emoderationskills.com/?p=246>
- Hockley, N. (2010, August 17). *Yes we can: QR codes in the classroom*. [Web log comment]. Retrieved from <http://www.emoderationskills.com/?p=278>
- Huckaby, M. (2011). Researcher/researched: Relations of vulnerability/relations of power. *International Journal of Qualitative Studies in Education*, 24(2), 165-183. DOI: 10.1080/09518398.2010.529851. Retrieved from <http://0-www.tandfonline.com.aupac.lib.athabascau.ca/doi/pdf/10.1080/09518398.2010.529851>
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26. Retrieved from <http://edr.sagepub.com/content/33/7/14>
- Joy, E., & Garcia, F. (2000). Measuring learning effectiveness: A new look at no-significant difference findings. *Journal of Asynchronous Learning Networks*, 4(1), 33-39.
- Kanuka, A., & Anderson, T. (2007). Ethical issues in qualitative e-learning research. *International Journal of Qualitative Methods*, 6(2), 20-39. Retrieved from <http://ejournals.library.ualberta.ca/index.php/IJQM/article/view/537/2491>
- Kaptelinin, V., & Nardi, B. (2006). *Acting with technology: Activity theory and interaction design*. Cambridge, MA: MIT Press.
- Koole, M. L. (2009). A model for framing mobile learning. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training*, 25-47. Edmonton, AB: AU Press. Retrieved from <http://www.aupress.ca/index.php/books/120155>
- Koro-Ljungberg, M., Yendol-Hoppey, D., Smith, J. & Hayes, S. (2009). (E)pistemological awareness, instantiation of methods, and uninformed methodological ambiguity in qualitative research projects. *Educational Researcher*, 38(9), 687-699. DOI: 10.3102/0013189X09351980
- Kozma, R. (1994a). Will media influence learning? Reframing the debate. *Educational Technology Research and Development*, 42(2), 7-19.
- Kozma, R. (1994b). A reply: Media and methods. (1994). *Educational Technology Research and Development*, 42(3), 11 - 14.
- Lunsford, T. & Lunsford, B. (1996). Parametric data analysis. *Journal of Prosthetics and Orthotics*, 8(2), 65-76. Retrieved from [http://www.oandp.org/jpo/library/1996\\_02\\_065.asp](http://www.oandp.org/jpo/library/1996_02_065.asp)



- Power, R. (2012a). *Developing a conceptual framework for the QR cache research project*. Unpublished manuscript, Centre for Distance Education, Athabasca University, Athabasca, Canada.
- Power, R. (2012b). *Examining theoretical paradigm issues in the QR cache m-learning research project*. Unpublished manuscript, Centre for Distance Education, Athabasca University, Athabasca, Canada.
- Power, R. (2012c). *Planning research strategies for the QR Cache research project*. Unpublished manuscript, Centre for Distance Education, Athabasca University, Athabasca, Canada.
- Power, R. (2012d). *QR Cache: Assessing the feasibility of using Quick Response (QR) codes and mobile devices to help students master computer-related workplace English competencies*. Research proposal submitted to the Research Ethics Committee, College of the North Atlantic-Qatar, Doha, Qatar.
- Power, R., (2012e). *QR Cache: Hardware mobile website*. Retrieved from <http://winksite.mobi/robpower/qrcodeA>
- Qatar Academy (n.d.). Cultural competency guidelines. *Qatar Academy staff handbook*. Retrieved from <http://qapstaffhandbook.qataracademy.wikispaces.net/Cultural+guidelines>
- Qatar Visitor (2000). *Essential do's and don'ts for Qatar living*. [Web log comment]. Retrieved from <http://www.qatarvisitor.com/index.php?CID=412&PID=1386>
- QUIA (2012). *About QUIA*. Retrieved from <http://www.quia.com/findout.html>
- Ramsden, A. & Jordan, L. (2009). *Are students ready for QR codes? Findings from a student survey at the University of Bath*. Working paper, University of Bath, Bath, UK. Retrieved from [http://opus.bath.ac.uk/12782/1/qrcodes\\_student\\_survey\\_uniofbath\\_feb09.pdf](http://opus.bath.ac.uk/12782/1/qrcodes_student_survey_uniofbath_feb09.pdf)
- Ramsden, A. (2008). *The use of QR codes in education: A getting started guide for academics*. Working paper, University of Bath, Bath, UK. Retrieved from [http://opus.bath.ac.uk/11408/1/getting\\_started\\_with\\_QR\\_Codes.pdf](http://opus.bath.ac.uk/11408/1/getting_started_with_QR_Codes.pdf)
- Ramsden, A. (2010). *The level of student engagement with QR codes: Findings from a cross-institutional survey*. Working paper, University of Bath, Bath, UK. Retrieved from [http://opus.bath.ac.uk/19974/1/students\\_qr\\_codes\\_cross\\_ints\\_survey\\_2010.pdf](http://opus.bath.ac.uk/19974/1/students_qr_codes_cross_ints_survey_2010.pdf)
- Rost, M. (2006). *Generating student motivation*. Retrieved from <http://www.pearsonlongman.com/ae/worldview/motivation.pdf>
- Roulston, K. (2011). Working through the challenges in doing interview research. *International Journal of Qualitative Methods*, 10(4), 348-366. Retrieved from <http://ejournals.library.ualberta.ca/index.php/IJQM/article/view/8305/9359>

- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2009). *Teaching and learning at a distance: Foundations of distance education* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- Stemler, S. E. (2004). A comparison of consensus, consistency, and measurement approaches to estimating interrater reliability. *Practical Assessment, Research & Evaluation, 9*(4). Retrieved from <http://PAREonline.net/getvn.asp?v=9&n=4>
- Stockburger, D. W. (1996). *Introductory statistics: Concepts, models and applications* (WWW version 1.0, Rev. ed.). Retrieved from <http://www.psychstat.missouristate.edu/introbook/sbk00.htm>
- Traxler, J. & Wishart, J. (2011). *Making mobile learning work: Case studies of practice*. Bristol: UK: ESCalate. Retrieved from <http://escalate.ac.uk/8250>
- Trochim, M. K. (2006). Likert scales. In *Research knowledge database*. Retrieved from: <http://www.socialresearchmethods.net/kb/scallik.php>
- Warraich, K. & Dahlstrom, E. (2012, February). *A profile of student mobile computing in Education City*. Presented at the Technology in Higher Education Conference 2012, Doha, Qatar. Retrieved from <http://technology.qatar.tamu.edu/2885.aspx>
- Wexler, S., Brown, J., Metcalf, D., Rogers, D. & Wagner, E. (2008). *Mobile learning: What is it, why it matters, and how to incorporate it into your learning strategy*. Retrieved from <http://www.elearningguild.com/research/archives/index.cfm?id=132&action=viewonly>
- Wireless Inc. Corporation (2012). *Winksite*. Retrieved from <http://winksite.com/site/index.cfm>



## Appendix A

### TPP MC-105 Student Feedback Survey: QR Cache Research Project

#### Page 1: Informed Consent

- Include a version of the informed consent letter previously signed by participants.
- Notify participants that completion of the survey is optional.
- URL for online survey site:
  - <http://www.quia.com/pages/rpower/studentsurvey>

#### Page 2: Survey Questions

##### Questions related to Accessing the Resources

1. How many mobile phones do you own? *[Select one]* \*
  - a. 0
  - b. 1
  - c. 2
  - d. 3 (or more)
2. Do you own a “smartphone?” (Example: Blackberry, Galaxy, iPhone, etc) *[Select one]* \*
  - a. Yes
  - b. No
3. What type of mobile device did you use? *[Select one]* \*
  - a. Apple
  - b. Blackberry
  - c. Motorola
  - d. Nokia
  - e. Sony
  - f. Samsung
  - g. Other (Please Specify)
4. Did you need to install a QR Code Reader app on your device? *[Select one]* \*
  - a. Yes
  - b. No
5. If YES, where did you find the QR Code Reader app? *[Select one]*
  - a. Android App Store
  - b. Apple iTunes App Store
  - c. Blackberry App World
  - d. Google Search
  - e. Other (Please Specify)
6. Did anyone (student or teacher) help you to find and install the QR Code Reader App? *[Select one]*

- a. Yes
  - b. No
7. How easy was it to scan the QR Codes using your mobile device? *[Likert Scale]* \*
  8. How quickly did the QR Code launch the related mobile web page? *[Likert Scale]* \*
  9. Did the mobile web pages load properly? *[Select one]* \*
    - a. Yes
    - b. No
  10. Did you encounter any problems when trying to access the mobile web page? (Please describe)  
*[Comment Box]*

#### Questions related to Mobile Website Content

11. How easy was it to read the text on the mobile web pages? *[Likert Scale]* \*
12. How easy was it to view the images on the mobile web pages? *[Likert Scale]* \*
13. The amount of content on each mobile web page was: *[Select one]* \*
  - a. Not enough information
  - b. Just about right
  - c. Too much information
14. How easy was it to understand the content on the mobile web pages? *[Likert Scale]* \*
15. How easy was it to move from page to page? *[Likert Scale]* \*
16. How easy was it to complete the “Test Your Knowledge” activities at the end of each lesson?  
*[Likert Scale]* \*

#### Questions related to Group Interactivity

17. Did you share your mobile device with a classmate while viewing the mobile web pages? *[Select one]* \*
  - a. Yes
  - b. No
18. Did you talk about the mobile web pages or the lessons with your classmates or instructor?  
*[Select one]* \*
  - c. Yes
  - d. No
19. Did you talk about the “Test Your Knowledge” activities with your classmates or instructor?  
*[Select one]* \*
  - e. Yes
  - f. No
20. Did you show the mobile web pages to anyone else in your class, or outside of class? *[Select one]* \*
  - g. Yes
  - h. No
21. Did you look at any of the mobile web pages more than once? *[Select one]* \*
  - i. Yes
  - j. No

**Additional Comments**

22. What did you like most about using the QR Code Scanner and your mobile phone for these lessons? (Please describe) *[Comment Box]*
23. What did you like least about using the QR Code Scanner and your mobile phone for these lessons? (Please describe) *[Comment Box]*
24. Have you ever used a QR Code Scanner on your mobile phone before? *[Select one] \**
  - a. Yes
  - b. No
25. If you scanned a QR Code before (in Question 24), what did it do? *[Select all that apply]*
  - a. Access a website
  - b. Access a text document
  - c. Access a multimedia file (audio or video)
  - d. Send an SMS text to a phone number
  - e. Dial a phone number
26. How appealing is using a QR Code Scanner compared to manually typing in a website address? *[Likert Scale] \**
27. Have you ever used your mobile phone for schoolwork before? *[Select one] \**
  - a. Yes
  - b. No
28. Would you like to use your mobile phone for schoolwork in the future? *[Select one] \**
  - a. Yes
  - b. No
29. Would you like to use your mobile phone to learn about new devices or equipment while at work? *[Select one] \**
  - a. Yes
  - b. No
30. Would you ever use your mobile phone to help you learn about something when you are not at school or work? *[Select one] \**
  - a. Yes
  - b. No
31. Is there anything that you think should be added to these mobile web pages? *[Comment Box]*
32. Is there anything that you think should be removed from these mobile web pages? *[Comment Box]*
33. Do you have any additional comments about using the QR Code Scanners and your mobile phone to do school work? *[Comment Box]*

**Notes:**

- *[Denotes type of question]*
- \* denotes required question

## Appendix B

### TPP MC-105 Instructor Feedback Survey: QR Cache Research Project

#### Page 1: Informed Consent

- Include a version of the informed consent letter previously signed by participants.
- Notify participants that completion of the survey is optional.
- URL for online survey site:
  - <http://www.quia.com/pages/rpower/teachersurvey>

#### Page 2: Survey Questions

##### Questions related to Accessing the Resources

1. Did you need to assist any of the students with finding and installing a QR Code Scanner app on their mobile devices? *[Select one]* \*
  - a. Yes
  - b. No
2. Did any of the students help each other to find and install a QR Code Scanner app on their mobile devices? *[Select one]* \*
  - a. Yes
  - b. No
3. Did you need to assist any of the students with using a QR Code Scanner app to scan a QR Code? *[Select one]* \*
  - a. Yes
  - b. No
4. Did any of the students help each other to scan QR Codes? *[Select one]* \*
  - a. Yes
  - b. No
5. How quickly did the QR Code Scanners load the mobile web pages? *[Likert Scale]* \*
6. Did the mobile web pages load properly? *[Select one]* \*
  - a. Yes
  - b. No
7. Did students encounter any difficulties when accessing the mobile web pages? (Please describe) *[Comment Box]*

##### Questions related to Mobile Website Content

8. How easy was it to read the text on the mobile web pages? *[Likert Scale]* \*
9. How easy was it to view the images on the mobile web pages? *[Likert Scale]* \*
10. The amount of content on each mobile web page was: *[Select one]* \*
  - d. Not enough information
  - e. Just about right

- f. Too much information
- 11. How easy was it to understand the content on the mobile web pages? *[Likert Scale]* \*
- 12. How easy was it to move from page to page? *[Likert Scale]* \*
- 13. How easy was it to complete the “Test Your Knowledge” activities at the end of each lesson? *[Likert Scale]* \*
- 14. Did the content of the mobile web pages accurately reflect the requirements of course unit and student competencies? *[Comment Box]*

**Questions related to Group Interactivity**

- 15. Did you use your mobile device during these learning activities? *[Select one]* \*
  - a. Yes
  - b. No
- 16. Did you share your mobile device with a student during these learning activities? *[Select one]* \*
  - a. Yes
  - b. No
- 17. Did your students discuss the mobile web pages or the lessons with either you or their classmates? *[Select one]* \*
  - a. Yes
  - b. No
- 18. Did your students discuss the “Test Your Knowledge” activities with either you or their classmates? *[Select one]* \*
  - a. Yes
  - b. No

**Questions related to Personal Teaching Experience (during this activity)**

- 19. What did you like most about using the QR Code Scanner and your mobile phone for these lessons? (Please describe) *[Comment Box]*
- 20. What did you like least about using the QR Code Scanner and your mobile phone for these lessons? (Please describe) *[Comment Box]*
- 21. Have you ever used a QR Code Scanner on your mobile phone before? *[Select one]* \*
  - a. Yes
  - b. No
- 22. Have you ever used your mobile phone for your own schoolwork before? *[Select one]* \*
  - a. Yes
  - b. No
- 23. Have you ever used mobile phones for teaching before? *[Select one]* \*
  - a. Yes
  - b. No
- 24. Would you consider using your mobile phone for teaching or schoolwork in the future? *[Select one]* \*
  - a. Yes
  - b. No

25. Would you ever use your mobile phone to help you learn about something when you are not at school or work? *[Select one]* \*
- Yes
  - No
26. Is there anything that you think should be added to these mobile web pages? *[Comment Box]*
27. Is there anything that you think should be removed from these mobile web pages? *[Comment Box]*
28. Do you have any additional comments about using the QR Code Scanners and mobile phones to do school work? *[Comment Box]*

**Notes:**

- *[Denotes type of question]*
- \* denotes required question

### Appendix C



PORTFOLIO OF PRACTICAL ASSESSMENTS



Corporate Training Department  
Industrial Training Division

A003b

Practical Exercise 1 (PE1): Computer Hardware Devices				
Performance Criteria: MEM 16008A – 1.1, 1.2, 1.3, 2.1, 2.2, 3.2				
Task	1 <sup>st</sup> Attempt	2 <sup>nd</sup> Attempt	3 <sup>rd</sup> Attempt	4 <sup>th</sup> Attempt
Complete the exercise.				
<b>Comments (Remedial Work):</b>          				
Instructor Sign:		Student Sign:		Date:

## Appendix D



## ASSESSMENT COVER SHEET



Corporate Training Department  
Industrial Training Division

A003a

*Trainees to sign this document when submitting an assessment*

Trainee Name:			CNA-Q No:	
			QP No:	
Unit/Elements:	MEM16008A – Interact with Computer Technology			
Performance Criteria:	1.2, 1.3, 2.2, 2.3, 2.4, 3.1, 3.2			
Assessment Tool Title:	KBT			
<b>STUDENT DECLARATION</b>				
Yes	No			
<input type="checkbox"/>	<input type="checkbox"/>	I have read and understand the details of the assessment.		
<input type="checkbox"/>	<input type="checkbox"/>	I have been informed of the conditions of the assessment and the appeals process.		
<input type="checkbox"/>	<input type="checkbox"/>	I agree to participate in this assessment.		
<input type="checkbox"/>	<input type="checkbox"/>	I certify that the attached is my/our own work.		
Signed:			Date:	
<b>ASSESSMENT RESULTS</b>				
	<input type="checkbox"/>	Competent	<input type="checkbox"/>	Hold
Feedback to Trainee:				
<i>If you have not passed this assessment, ask your Instructor if you are eligible for reassessment.</i>				
Rev 09-18-11				
Instructor/Coach:		Signature:		Date:



<b>Trainee Name:</b>		<b>Signature:</b>		<b>Date:</b>	
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*Note to instructor: Paper copies of this document may not be current. Check the validated folder*

## Appendix E

### Detailed Lesson Plans for the QR Cache Project

#### Lesson Plan #1: QR Codes Primer Lesson

**Week:** 1?

**Course Unit:** Searching and Browsing the Internet

**Course Competencies:** MEM 160008A, Competencies 2.1, 2.2, 2.3, 2.4, 3.1, 5.1, 5.2

**Location:** Computer Laboratory

**Duration:** 15 mins

**Resources:**

- Course Workbook Insert page 7a: Using QR Codes
- Student and/or instructor owned mobile phone or tablet with:
  - Wifi and/or 3G connectivity;
  - Native mobile web browser;
  - Built-in camera;
  - QR Code Scanner app (may be installed as part of the class activities);

#### Detailed Lesson Plan:

Time (approximate)	Activity	Resources
1-2 mins	<ul style="list-style-type: none"> <li>• Introduce topic:               <ul style="list-style-type: none"> <li>○ What are QR Codes?</li> <li>○ What are we going to be doing in this lesson?</li> </ul> </li> <li>• Distribute workbook insert page on Using QR Codes</li> </ul>	<ul style="list-style-type: none"> <li>• Course Workbook Insert page 7a: Using QR Codes</li> </ul>
10 mins	<ul style="list-style-type: none"> <li>• Students determine whether or not they have a QR Code Scanner app currently installed on their mobile device:               <ul style="list-style-type: none"> <li>○ Students may work together to explore their phones, and determine if they have an app, and how to use it;</li> </ul> </li> <li>• Location and installation of a free QR Code Scanner app (if needed):               <ul style="list-style-type: none"> <li>○ Students may work together and/or consult their instructor to get help with locating, downloading and installing a free QR Code Scanner app;</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Student and/or instructor owned mobile phone or tablet with:               <ul style="list-style-type: none"> <li>○ Wifi and/or 3G connectivity;</li> <li>○ Native mobile web browser;</li> <li>○ Built-in camera;</li> <li>○ QR Code Scanner app</li> </ul> </li> </ul>
5 mins	<ul style="list-style-type: none"> <li>• Using the QR Code Scanner App:               <ul style="list-style-type: none"> <li>○ Students will use a QR Code Scanner app on their mobile devices to scan the QR Code on the handout (Using QR Codes) to access the mobile RLO associated with this topic;</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Course Workbook Insert page 7a: Using QR Codes</li> <li>• Student and/or instructor owned mobile phone or tablet with:               <ul style="list-style-type: none"> <li>○ Wifi and/or 3G connectivity;</li> <li>○ Native mobile web browser;</li> <li>○ Built-in camera;</li> <li>○ QR Code Scanner app</li> </ul> </li> </ul>
1-2 mins	<ul style="list-style-type: none"> <li>• Debriefing:               <ul style="list-style-type: none"> <li>○ Instructor will advise students that they will be using the QR Code Scanner app and their mobile devices again, to access learning activities when they begin the Hardware Components course unit;</li> </ul> </li> </ul>	

**Lesson Plan #2: Computer Hardware Functions and DCS Lesson****Week:** 2?**Course Unit:** Computer Hardware**Course Competencies:** MEM 160008A, Competencies 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, 5.1, 5.2**Location:** Computer Laboratory**Duration:** 50 mins**Resources:**

- Printed (and laminated?) QR Codes images for:
  - Hardware Functions (Hardware Functions.png)
  - The DCS (The DCS.png)
- Computer terminal (to mount QR Code for Hardware Functions)
- Cardstock (to mount QR Code for The DCS)
- Student and/or instructor owned mobile phone or tablet with:
  - Wifi and/or 3G connectivity;
  - Native mobile web browser;
  - Built-in camera;
  - QR Code Scanner app (may be installed as part of the class activities);

**Detailed Lesson Plan:**

Time ( <i>approximate</i> )	Activity	Resources
5 mins	<ul style="list-style-type: none"> <li>• Introduce topic:               <ul style="list-style-type: none"> <li>○ What are Hardware Devices?</li> <li>○ What are the four Hardware Functions?</li> <li>○ What is a DCS?</li> <li>○ What are we going to be doing in this lesson?</li> </ul> </li> <li>• Direct students attention to the QR Codes mounted on various computer terminals in the lab.</li> </ul>	<ul style="list-style-type: none"> <li>• Printed (laminated?) and mounted QR Codes for:               <ul style="list-style-type: none"> <li>○ Hardware Functions</li> <li>○ The DCS</li> </ul> </li> <li>• Student and/or instructor owned mobile phone or tablet with:               <ul style="list-style-type: none"> <li>○ Wifi and/or 3G connectivity;</li> <li>○ Native mobile web browser;</li> <li>○ Built-in camera;</li> <li>○ QR Code Scanner app</li> </ul> </li> </ul>
30 mins	<ul style="list-style-type: none"> <li>• Students locate the QR Codes that have been mounted in the lab.</li> <li>• Students use their mobile phones and QR Code Scanner apps to scan the mounted QR Codes</li> <li>• Students complete the mobile RLO activities:               <ul style="list-style-type: none"> <li>○ Students may work together to explore the mobile RLOs, and to discuss the results of the “Test Your Knowledge” surveys at the end of each RLO activity;</li> </ul> </li> </ul>	
10 mins	<ul style="list-style-type: none"> <li>• Group discussion of the results of the “Test Your Knowledge” activities at the end of the RLOs.:</li> </ul>	
5 mins	<ul style="list-style-type: none"> <li>• Debriefing:               <ul style="list-style-type: none"> <li>○ Instructor will advise students that they can use the “History” features of the mobile browsers and/or QR Code Scanner apps to revisit the RLO activities at any time.</li> <li>○ Instructor will advise students that they will be tested on what they have learned in Practical Evaluation (PE) #1 and Knowledge-Based Test (KBT) #1.</li> </ul> </li> </ul>	

**Lesson Plan #3: Memory, Processors, Monitors and Ports Lesson****Week:** 2?**Course Unit:** Memory, Processor, Monitors and Ports**Course Competencies:** MEM 160008A, Competencies 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, 5.1, 5.2**Location:** Computer Laboratory**Duration:** 50 mins**Resources:**

- Printed (and laminated?) QR Codes images for:
  - Computer Memory (Computer Memory.png)
  - Computer Processors (Computer Processors.png)
  - Computer Monitors (Computer Monitors.png)
  - Computer Ports (Computer Ports.png)
- Computer terminals (to mount QR Codes for Computer Monitors and Ports)
- Sample Computer Processor (CPU) (to mount QR Code for Computer Processors)
- Sample RAM sticks and/or hard disks (to mount QR Code for Computer Memory)
- Student and/or instructor owned mobile phone or tablet with:
  - Wifi and/or 3G connectivity;
  - Native mobile web browser;
  - Built-in camera;
  - QR Code Scanner app (may be installed as part of the class activities);

**Detailed Lesson Plan:**

Time (approximate)	Activity	Resources
5 mins	<ul style="list-style-type: none"> <li>• Introduce topics:               <ul style="list-style-type: none"> <li>○ What is Computer Memory?</li> <li>○ What are Computer Processors?</li> <li>○ What are Computer Monitors?</li> <li>○ What are Computer Ports?</li> <li>○ What are we going to be doing in this lesson?</li> </ul> </li> <li>• Direct students attention to the QR Codes mounted on various computer terminals and sample devices in the lab.</li> </ul>	<ul style="list-style-type: none"> <li>• Printed (laminated?) and mounted QR Codes for:               <ul style="list-style-type: none"> <li>○ Computer Memory</li> <li>○ Computer Processors</li> <li>○ Computer Monitors</li> <li>○ Computer Ports</li> </ul> </li> <li>• Student and/or instructor owned mobile phone or tablet with:               <ul style="list-style-type: none"> <li>○ Wifi and/or 3G connectivity;</li> <li>○ Native mobile web browser;</li> <li>○ Built-in camera;</li> <li>○ QR Code Scanner app</li> </ul> </li> </ul>
30 mins	<ul style="list-style-type: none"> <li>• Students locate the QR Codes that have been mounted in the lab.</li> <li>• Students use their mobile phones and QR Code Scanner apps to scan the mounted QR Codes</li> <li>• Students complete the mobile RLO activities:               <ul style="list-style-type: none"> <li>○ Students may work together to explore the mobile RLOs, and to discuss the results of the “Test Your Knowledge” surveys at the end of each RLO activity;</li> </ul> </li> </ul>	
10 mins	<ul style="list-style-type: none"> <li>• Group discussion of the results of the “Test Your Knowledge” activities at the end of the RLOs.:</li> </ul>	
5 mins	<ul style="list-style-type: none"> <li>• Debriefing:               <ul style="list-style-type: none"> <li>○ Instructor will advise students that they can use the “History” features of the mobile browsers and/or QR Code Scanner apps to revisit the RLO activities at any time.</li> <li>○ Instructor will advise students that they will be tested on what they have learned in Practical Evaluation (PE) #1 and Knowledge-Based Test (KBT) #1.</li> </ul> </li> </ul>	

**Follow-up/Assessment:**

- Students will be assessed using Practical Evaluation (PE) #1 and Knowledge-Based Test (KBT) #1

## Appendix F

### TPP-MC-105 Workbook Insert Page for QR Codes Primer Lesson

## Using QR Codes

If you have a QR (*Quick Response*) Code Scanner app on your mobile phone, use it to scan this picture:



If you do not have a QR Code Scanner app on your mobile phone, or if you are not sure, ask your instructor (or one of your friends) to help you find one and start using it!



You can find free QR Code Scanner apps by:

- Visiting Blackberry App World
- Visiting the Apple iTunes App Store
- Performing a Google Search (or using any other search engine of your choice!)

Try using your mobile phone's QR Code Scanner anytime you see a new QR Code!

## **Appendix G**

### **Student Debriefing 'Lesson Plan' Script**









- Open discussion by asking students if they feel comfortable with the materials that they learned about Computer Hardware Components using their mobile devices.
  
- Review the following key terms/concepts:
  1. What is a QR Code?
  2. What are the four Computer Functions?
    - a. Input
    - b. Processing
    - c. Storage
    - d. Output
  3. What are some common Input Devices?
  4. Which device is used for computer Processing?
  5. What are the two main types of computer Memory?
    - a. What is an example of Primary Memory?
    - b. What is an example of Secondary Memory?
  6. What is an example of an Output Device?
  7. What is a DCS?
    - a. Where would you find a DCS?
  8. What is a bit?
  9. What is a byte?
  10. What is a kilobyte?
  11. What is a megabyte?
  12. What is a gigabyte?
  13. What is a hertz?
  14. What is a Kilohertz?
  15. What is a Megahertz?
  16. What is a Gigahertz?
  17. How do we measure the size of a computer monitor?
  18. How are each of the following ports used?
    - a. USB
    - b. PS/2
    - c. Ethernet
    - d. Serial Port
    - e. LPT
    - f. VGA
    - g. Audio Jacks
    - h. Mini-USB
    - i. Mini-HD

## j. Mini-Audio Jack

- Discuss with students how they can use their mobile devices at school, at home, or at work to look up any information they need for just about any purpose!
- Remind students of the following regarding their participation in the QR Cache research project:
  - The online surveys that they completed are anonymous;
  - The only information that will be used from their course progress will be anonymous information about whether or not they passed the Observation Assessment and Practical Evaluation for the Hardware Components unit;
  - That they can choose at any point to have their course progress records excluded from the research project;
  - That all of the data collected from the online surveys and course progress records will be used to:
    - Help assess technical aspects of the new learning resources;
    - Student perceptions and attitudes about using their mobile devices for their schoolwork;
  - That they can choose to be notified when the research results have been published, and how to access the results, by providing their instructor with their preferred contact information;
    - That contact information provided for this notification will not be used for any other purpose;

## Appendix H

### QR Codes for the QR Cache Research Project Hardware Components Lessons

 <p style="text-align: center;">QR Cache Main Site</p>	 <p style="text-align: center;">Using QR Codes</p>
 <p style="text-align: center;">Hardware Functions</p>	 <p style="text-align: center;">The DCS</p>
 <p style="text-align: center;">Computer Memory</p>	 <p style="text-align: center;">Computer Processors</p>
 <p style="text-align: center;">Computer Monitors</p>	 <p style="text-align: center;">Computer Ports</p>



**Appendix I**  
**College of the North Atlantic-Qatar**  
**Informed Consent Form (Student Participants)**

**Date:** \_\_\_\_\_

**Study Name:** *QR Cache: Assessing the Feasibility of Using Quick Response (QR) Codes and Mobile Devices to Help Students Master Computer-Related Workplace English Competencies*

**Researchers:** Robert Power (Information Technology Instructor and ICDL Training & Testing Centre Coordinator)

**Sponsors:** College of the North Atlantic-Qatar

**Purpose of Research:** The purpose of this research is to test the use of Quick Response (QR) Codes and mobile phones in the completion of schoolwork. We are examining the technical aspects of using QR Codes and mobile phones, as well as student attitudes about using mobile phones in their schoolwork.

**What you will be asked to do in the Research/Focus Group:** Your section of TPP MC-105: Introduction to Computers, will be using mobile phones to complete learning activities as part of the Hardware Components unit of your course. You will be using your mobile phone to scan Quick Response (QR) Codes mounted on various computer devices, which will then launch short web-based learning activities on your phone. Once you have completed all of the learning activities using your mobile phone, you will be asked to complete a brief online survey about the activities.

**Notification of Research Results:** The final report of the results of this research study is expected to be completed by September 2012, at which time a copy of the report and summaries of the research findings will be made available through College of the North Atlantic-Qatar's LibGuide system. You may choose to receive a personal notification of the publication of the report and findings by providing your course instructor with your preferred contact information. This information will be stored in a password-protected database, and will only be used for the purposes of providing the specified notification.

**Risks and Discomforts:** We do not foresee any risks or discomfort from your participation in the research.

**Benefits of the Research and Benefits to You:** It is hoped that this research will help College of the North Atlantic-Qatar to be better able to use mobile devices, such as mobile phones, to provide students with more learning resources and an enriched learning experience. It is also hoped that participation in this research will enable you to make better use of your mobile devices to assist you in your learning at school, in the workplace, and at home.

**Voluntary Participation:** Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence your access to the learning resources that will be used by your section of TPP MC-105: Introduction to Computers, the nature of the ongoing relationship you may have with the researchers or study staff, the nature of your relationship with your sponsor, *or the* nature of your relationship with College of the North Atlantic-Qatar either now, or in the future.

**Withdrawal from the Study:** You can stop participating in the study/focus group at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, the College of the North Atlantic-Qatar, or any other group associated with this project.

**Confidentiality:** No information will be collected during the course of this research project that could in any way identify you as a participant. Unless you choose otherwise, all information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Your data will be safely stored in a locked facility and only research staff will have access to this information. Confidentiality will be provided to the fullest extent possible by law. The use of any photographic or video material will only be permitted with your permission by using the College's form.

**Questions About the Research?** If you have questions about the research in general or about your role in the study, please feel free to contact Robert Power by telephone at (974) 4495-2520, or by email ([robert.power@cna-qatar.edu.qa](mailto:robert.power@cna-qatar.edu.qa)). This research has been reviewed by the Institutional Review Board, College of the North Atlantic-Qatar and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines and the Supreme Council of Health guidelines for the State of Qatar. If you have any questions about this process, your rights as a participant in the study, or for copies of the results of this study, please contact Dr. Michael Long either by telephone at (974) 495-2236, or by e-mail ([mike.long@cna-qatar.edu.qa](mailto:mike.long@cna-qatar.edu.qa))

**Legal Rights and Signatures:**

I ( \_\_\_\_\_ ), consent to participate in  
( \_\_\_\_\_ )

conducted by \_\_\_\_\_. I have understood the nature of  
this project and wish to participate. I am not waiving any of my legal rights by signing this form. My  
signature below indicates my consent.

**Participant**

Signature \_\_\_\_\_

Date \_\_\_\_\_

**Principal Investigator**

Signature \_\_\_\_\_

Date \_\_\_\_\_

**Appendix J**  
**College of the North Atlantic-Qatar**  
**Informed Consent Form (Faculty Participants)**

**Date:** \_\_\_\_\_

**Study Name:** *QR Cache: Assessing the Feasibility of Using Quick Response (QR) Codes and Mobile Devices to Help Students Master Computer-Related Workplace English Competencies*

**Researchers:** Robert Power (Information Technology Instructor and ICDL Training & Testing Centre Coordinator)

**Sponsors:** College of the North Atlantic-Qatar

**Purpose of Research:** The purpose of this research is to test the use of Quick Response (QR) Codes and mobile phones in the completion of schoolwork. We are examining the technical aspects of using QR Codes and mobile phones, as well as student attitudes about using mobile phones in their schoolwork.

**What you will be asked to do in the Research/Focus Group:** Your section of TPP MC-105: Introduction to Computers, will either be using mobile phones to complete learning activities as part of the Hardware Components unit of your course (Experimental Group), or will be completing the previously approved course workbook activities for the Hardware Components unit (Control Group). Students in the experimental group(s) will be using their mobile phones to scan Quick Response (QR) Codes mounted on various computer devices, which will then launch short web-based learning activities on their phones. Once students have completed all of the learning activities using their mobile phones, you will be asked to complete a brief online survey about the activities. You will also be asked to complete a rubric to help evaluate the effectiveness of the integration of the new multimedia-based learning resources into the course. You will also be asked to complete a summary spreadsheet (using Microsoft Excel) detailing the number of students in your course section who have successfully completed the Observation Assessment and Practical Evaluation Assessment (from the standard Evidence Portfolios used for TPP MC-105) related to the Hardware Components unit, and the number of attempts taken by each student to successfully complete each assessment. Student identifying data will be excluded from this summary spreadsheet. After the completion of the learning activities, surveys, and statistical data collection, you may be asked to participate in plenary discussions regarding possible future integration of the new mobile learning resources into regularly scheduled TPP MC-105 course activities.

**Notification of Research Results:** The final report of the results of this research study is expected to be completed by September 2012, at which time a copy of the report and summaries of the research findings will be made available through College of the North Atlantic-Qatar's LibGuide system. You may choose to receive a personal notification of the publication of the report and findings by providing the Study Investigator with your preferred contact information. This information will be stored in a

password-protected database, and will only be used for the purposes of providing the specified notification.

**Risks and Discomforts:** We do not foresee any risks or discomfort from your participation in the research.

**Benefits of the Research and Benefits to You:** It is hoped that this research will help College of the North Atlantic-Qatar to be better able to use mobile devices, such as mobile phones, to provide students with more learning resources and an enriched learning experience. It is also hoped that participation in this research will enable you to make better use of mobile devices in your own teaching, and to assist you in your learning at school, in the workplace, and at home.

**Voluntary Participation:** Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence your students' access to the learning resources that will be used by your section of TPP MC-105: Introduction to Computers, the nature of the ongoing relationship you may have with the researchers or study staff, *or the* nature of your relationship with College of the North Atlantic-Qatar either now, or in the future.

**Withdrawal from the Study:** You can stop participating in the study/focus group at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, the College of the North Atlantic-Qatar, or any other group associated with this project.

**Confidentiality:** No information will be collected during the course of this research project that could in any way identify you as a participant. Unless you choose otherwise, all information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Your data will be safely stored in a locked facility and only research staff will have access to this information. Confidentiality will be provided to the fullest extent possible by law. The use of any photographic or video material will only be permitted with your permission by using the College's form.

**Questions About the Research?** If you have questions about the research in general or about your role in the study, please feel free to contact Robert Power by telephone at (974) 4495-2520, or by email ([robert.power@cna-qatar.edu.qa](mailto:robert.power@cna-qatar.edu.qa)). This research has been reviewed by the Institutional Review Board, College of the North Atlantic-Qatar and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines and the Supreme Council of Health guidelines for the State of Qatar. If you have any questions about this process, your rights as a participant in the study, or for copies of the results of this study, please contact Dr. Michael Long either by telephone at (974) 495-2236, or by e-mail ([mike.long@cna-qatar.edu.qa](mailto:mike.long@cna-qatar.edu.qa))

**Legal Rights and Signatures:**

I ( \_\_\_\_\_ ), consent to participate in  
( \_\_\_\_\_ )

conducted by \_\_\_\_\_. I have understood the nature of  
this project and wish to participate. I am not waiving any of my legal rights by signing this form. My  
signature below indicates my consent.

**Participant**

Signature \_\_\_\_\_

Date \_\_\_\_\_

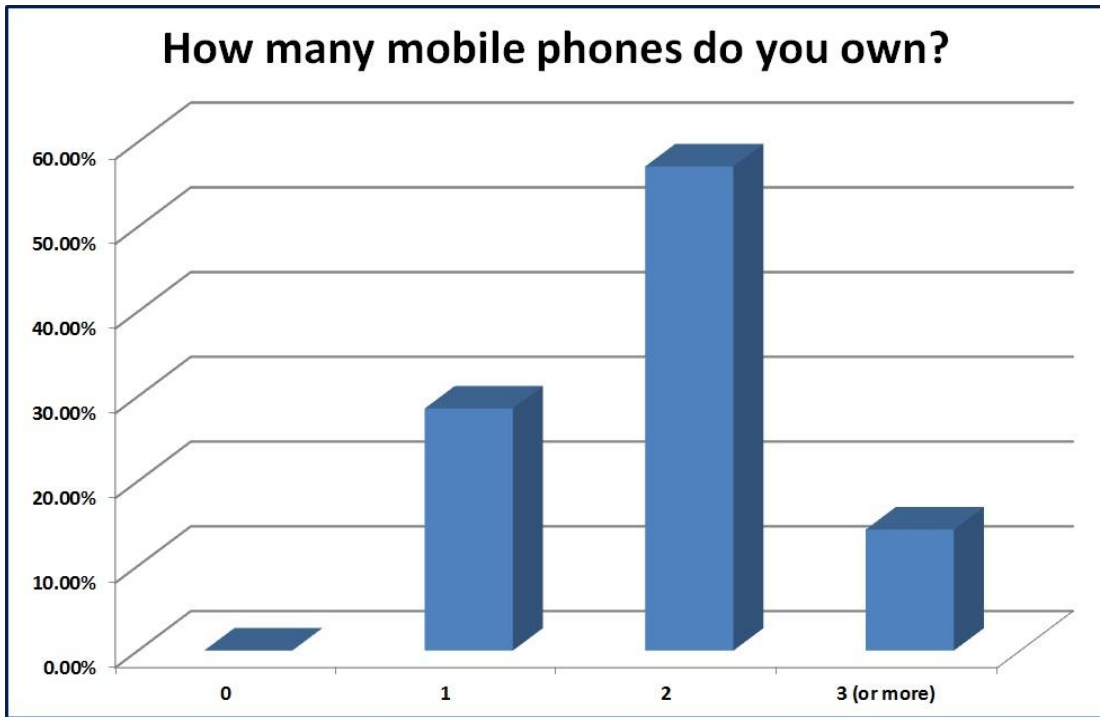
**Principal Investigator**

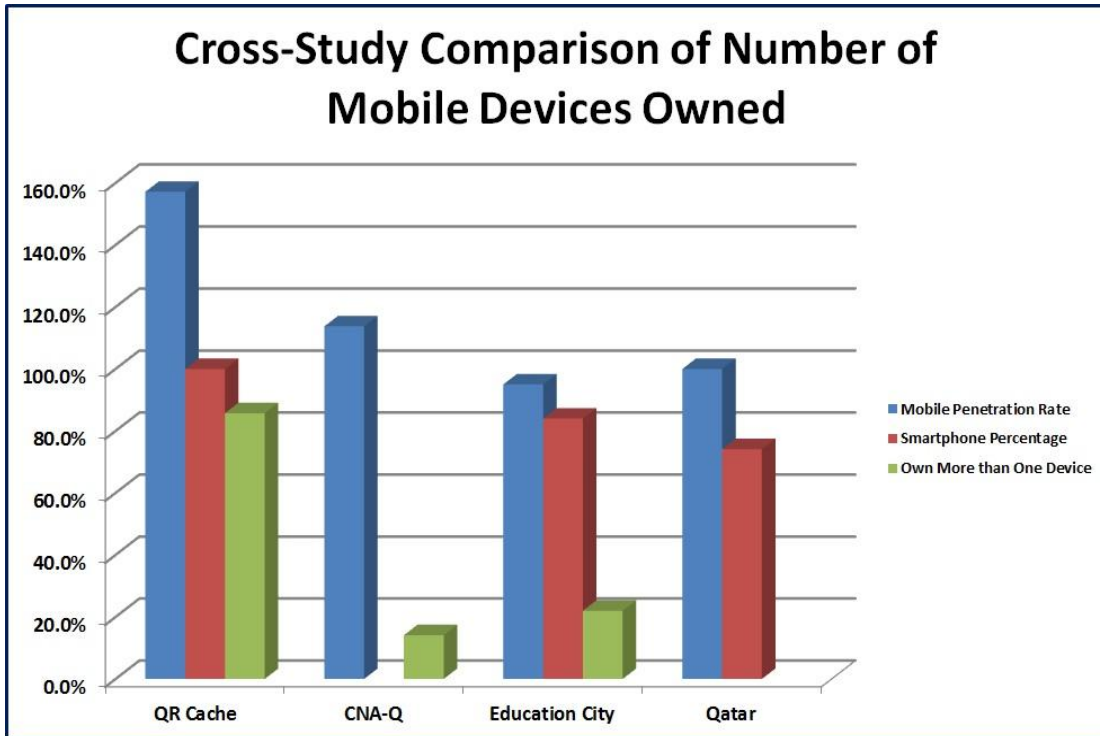
Signature \_\_\_\_\_

Date \_\_\_\_\_

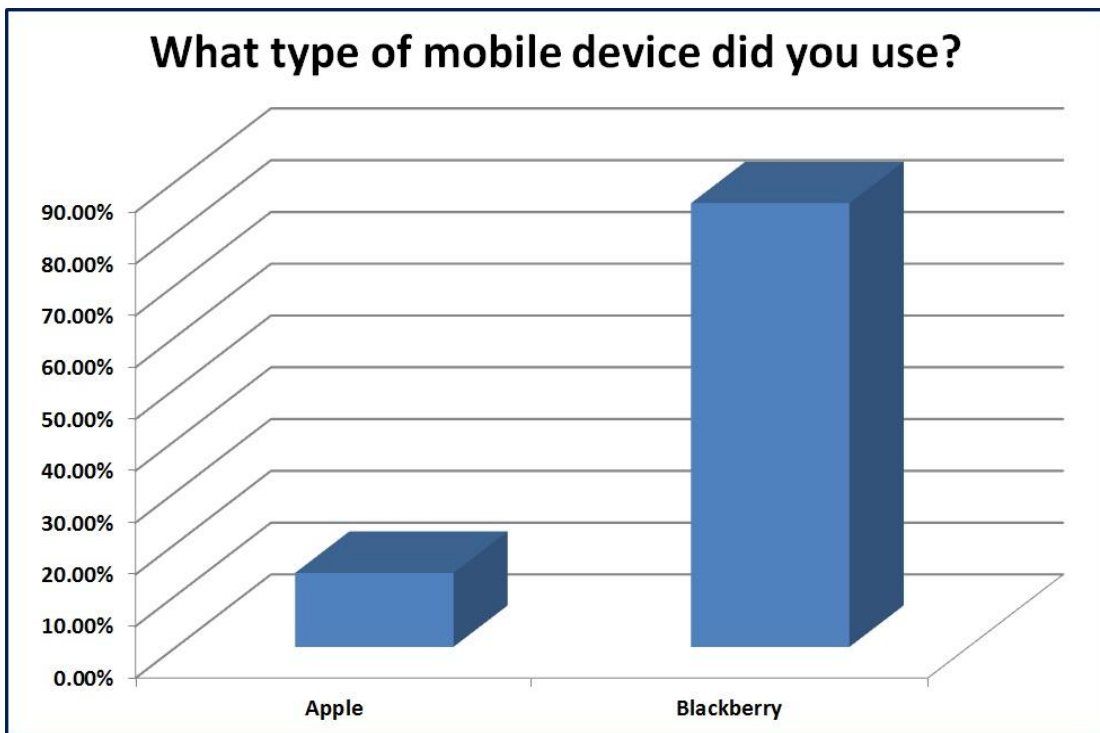
## Appendix K Graphs of Key Findings

### Results of Survey Questions Related to Mobile Tech

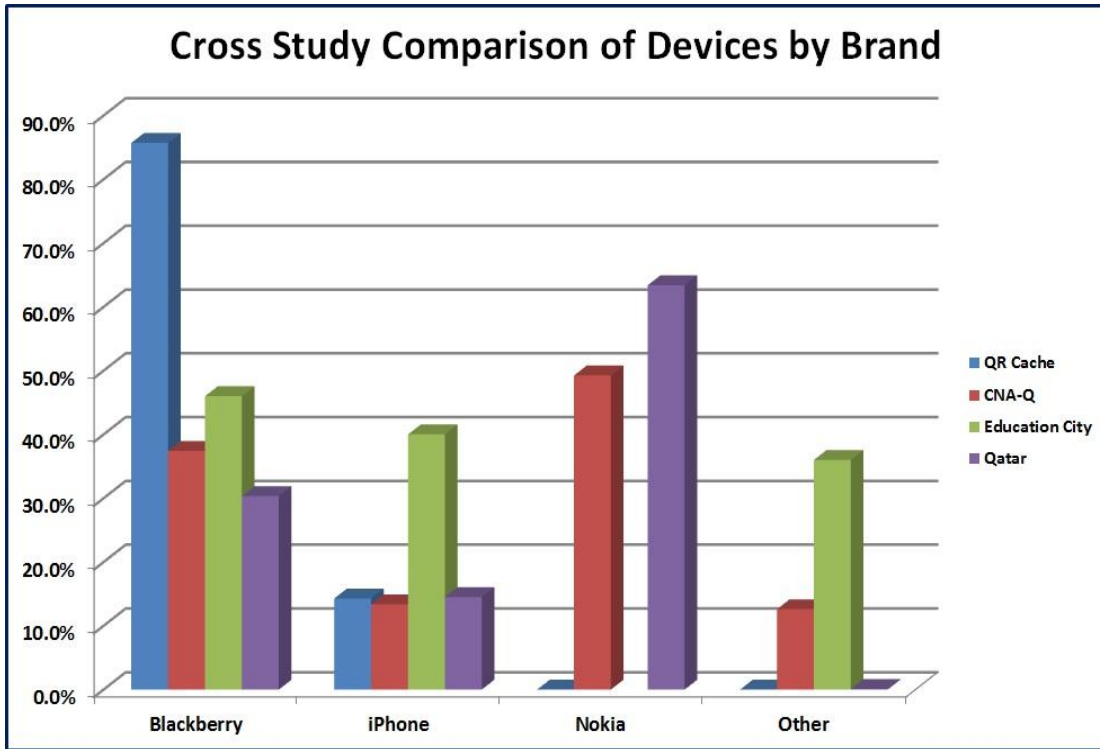




(Source: MacLeod, 2011; Metodieava, 2012; Nagy, 2012; Warraich & Dahlstrom, 2012)

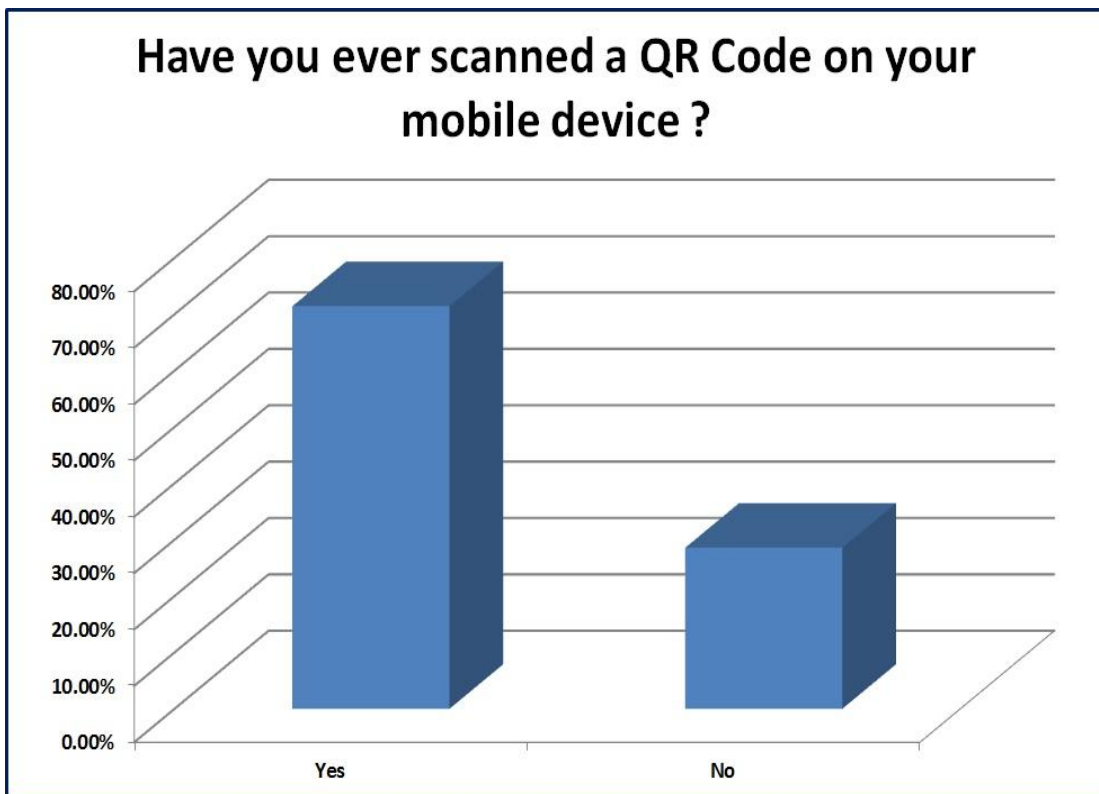
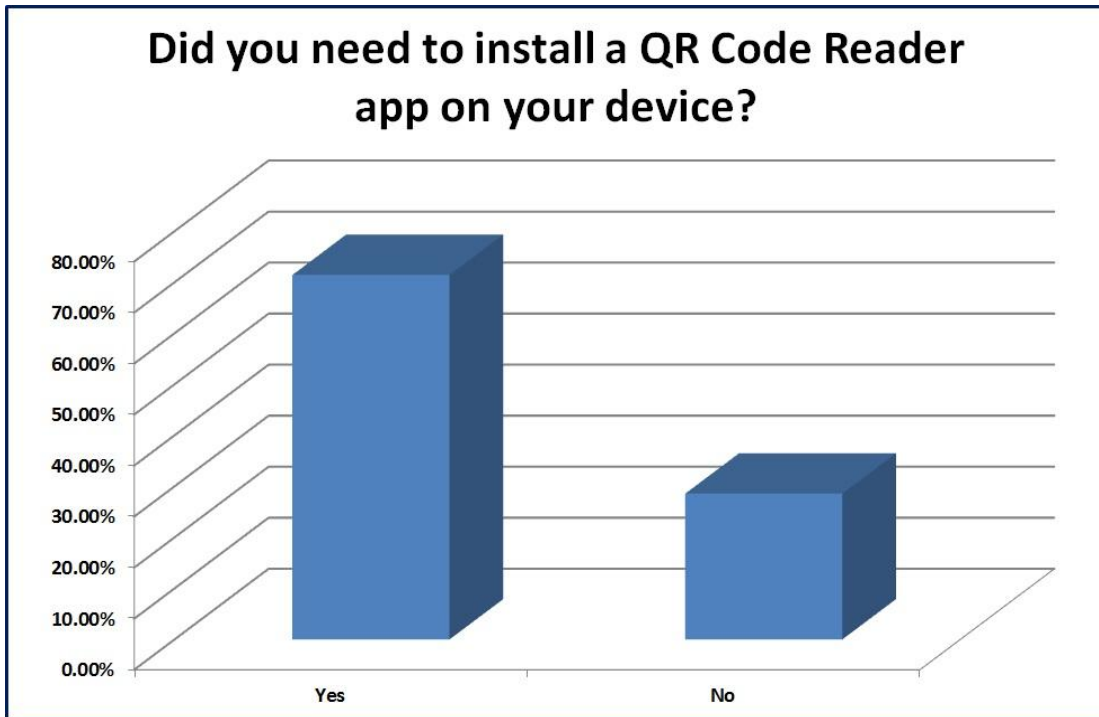


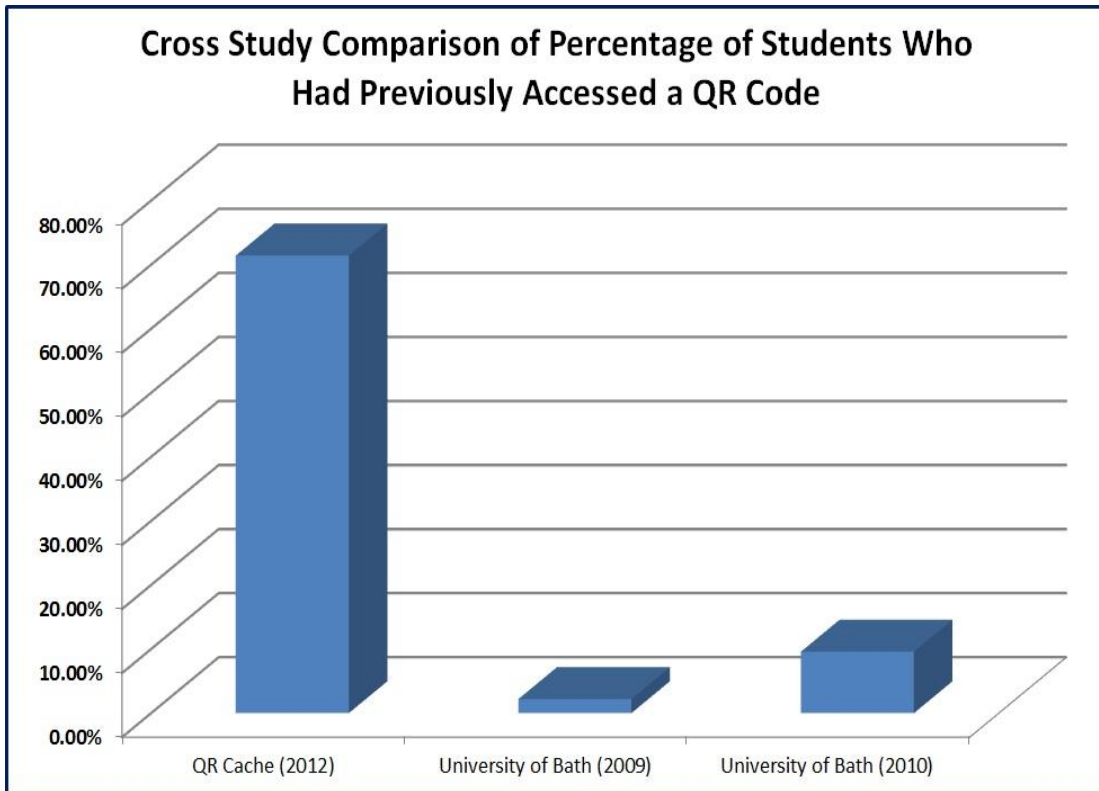




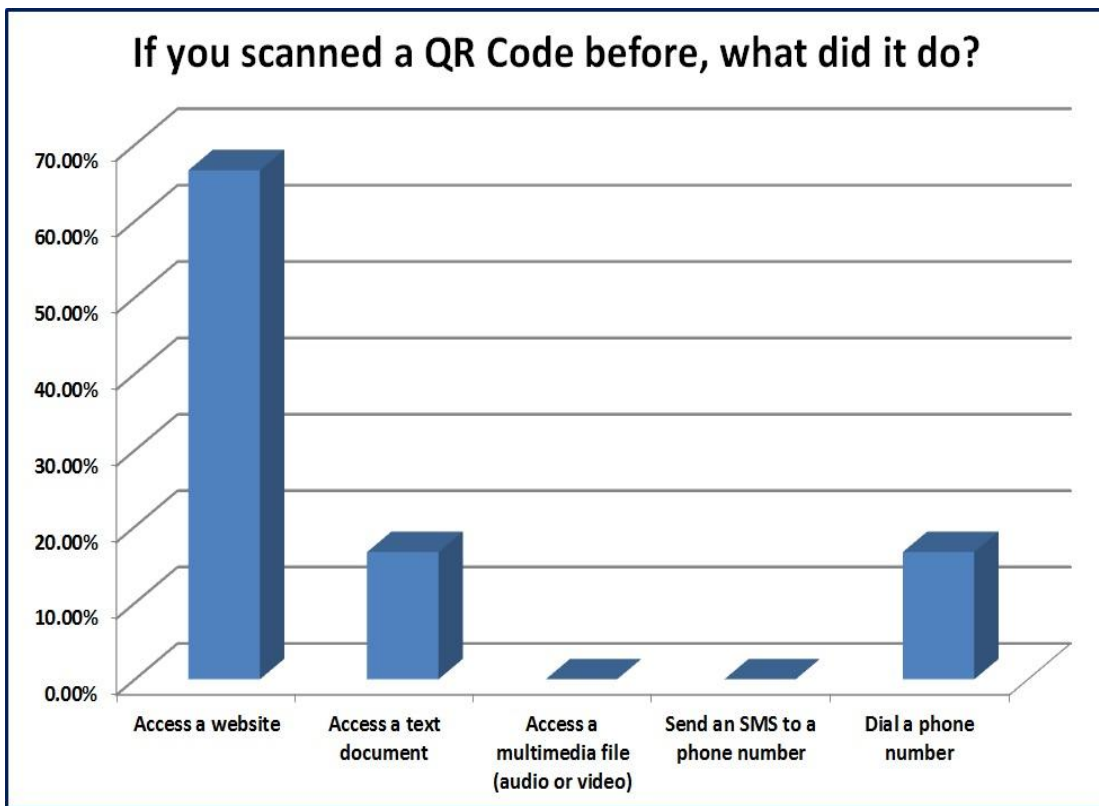
(Source: MacLeod, 2011; Metodieava, 2012; Nagy, 2012; Warraich & Dahlstrom, 2012)

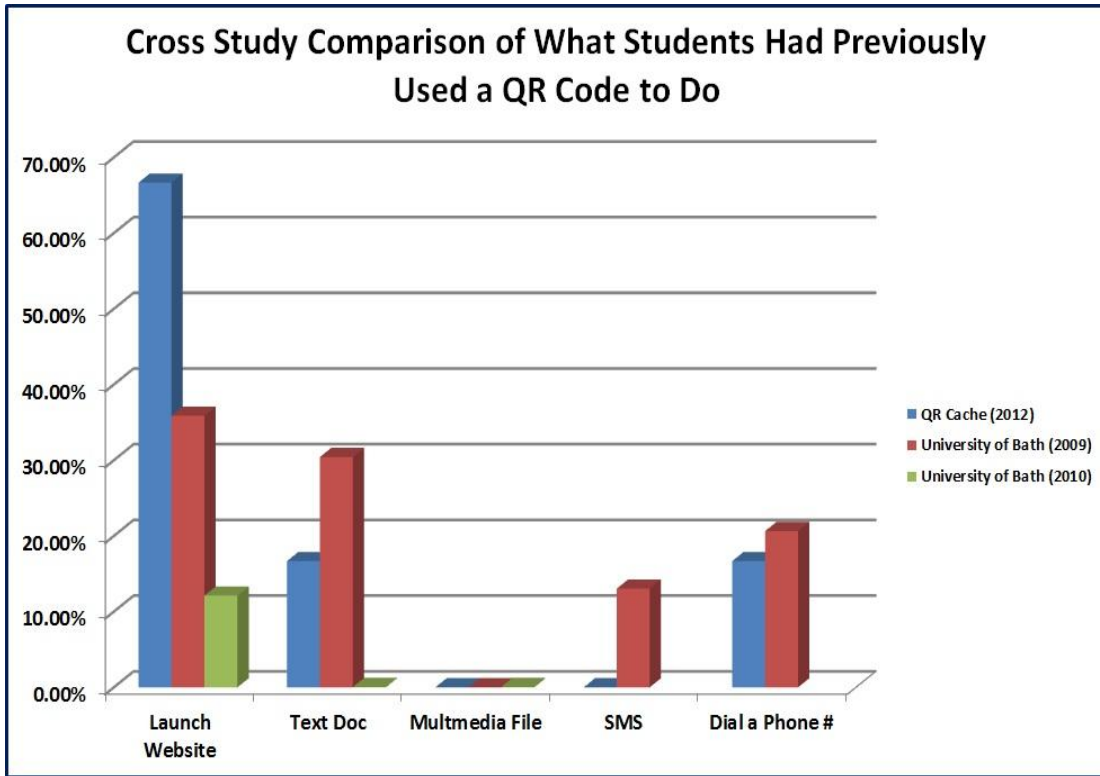
**Results of Survey Questions Related to Previous Experience with QR Codes**





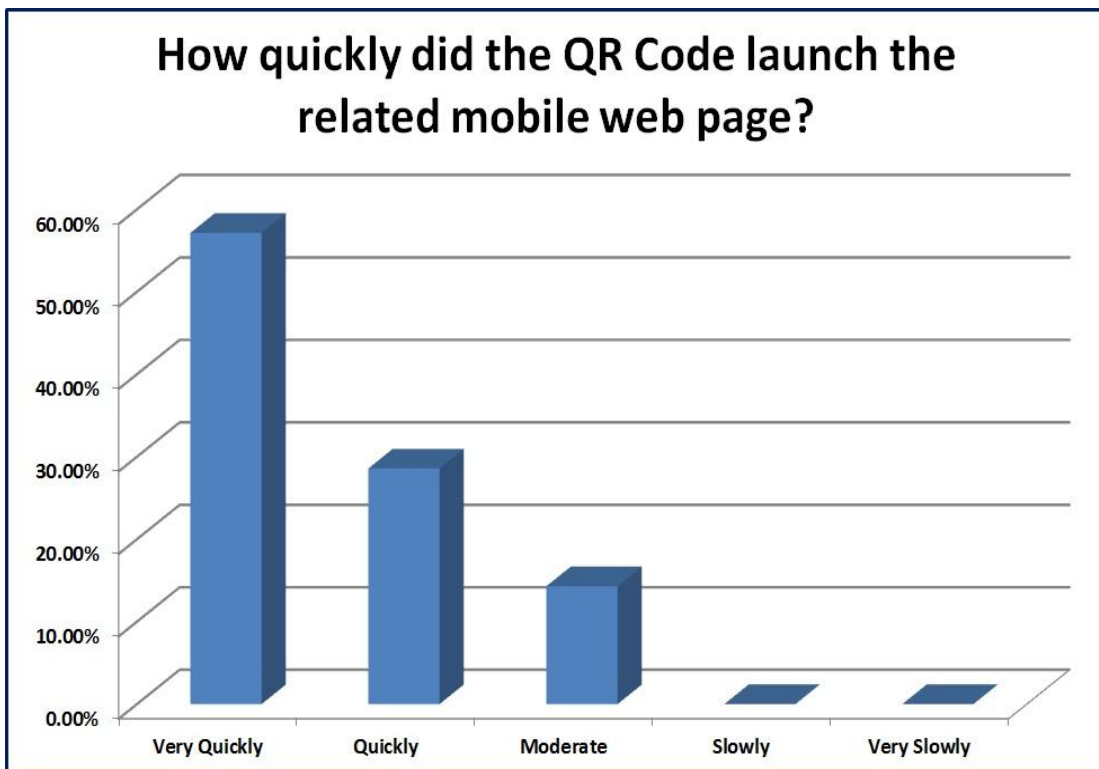
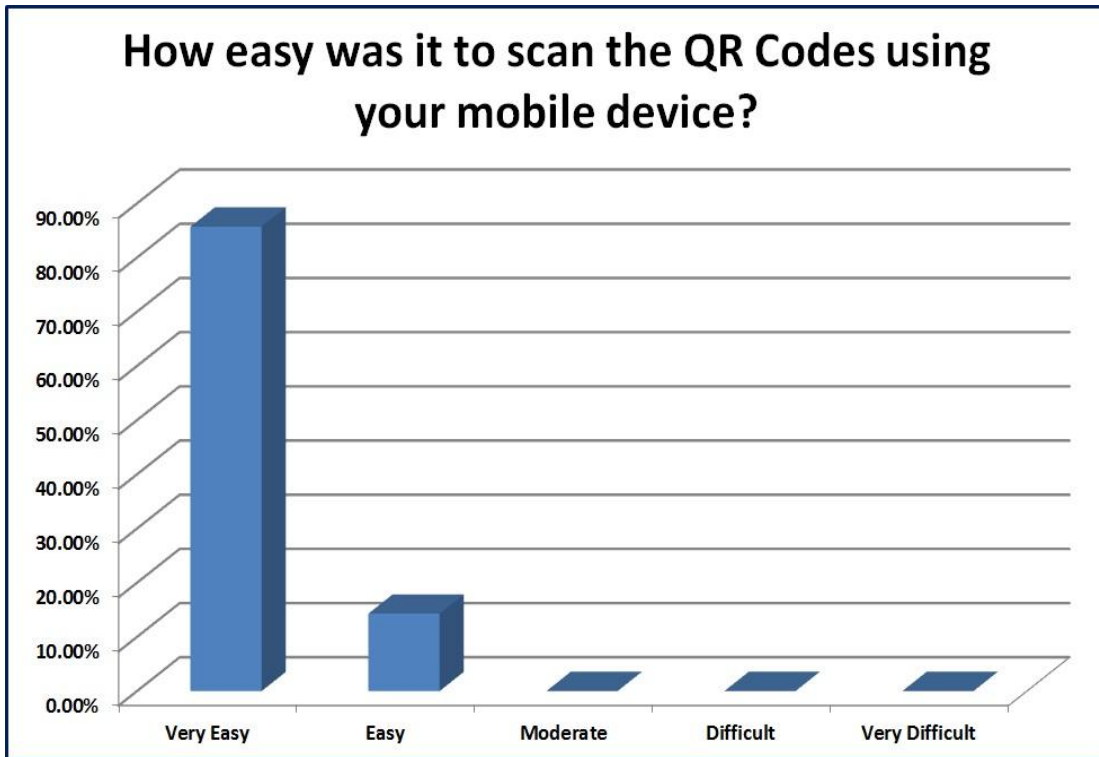
(Source: Ramsden, 2010; Ramsden & Jordan, 2009)



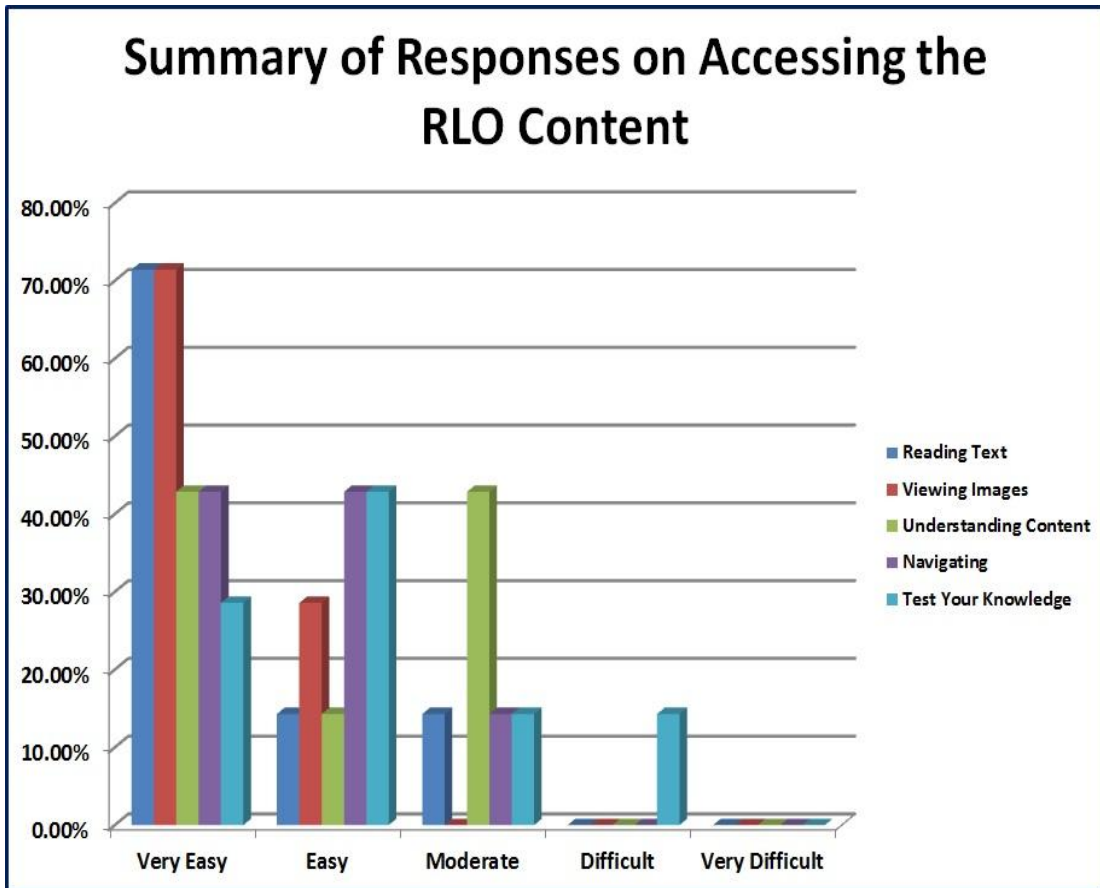


(Source: Ramsden, 2010; Ramsden & Jordan, 2009)

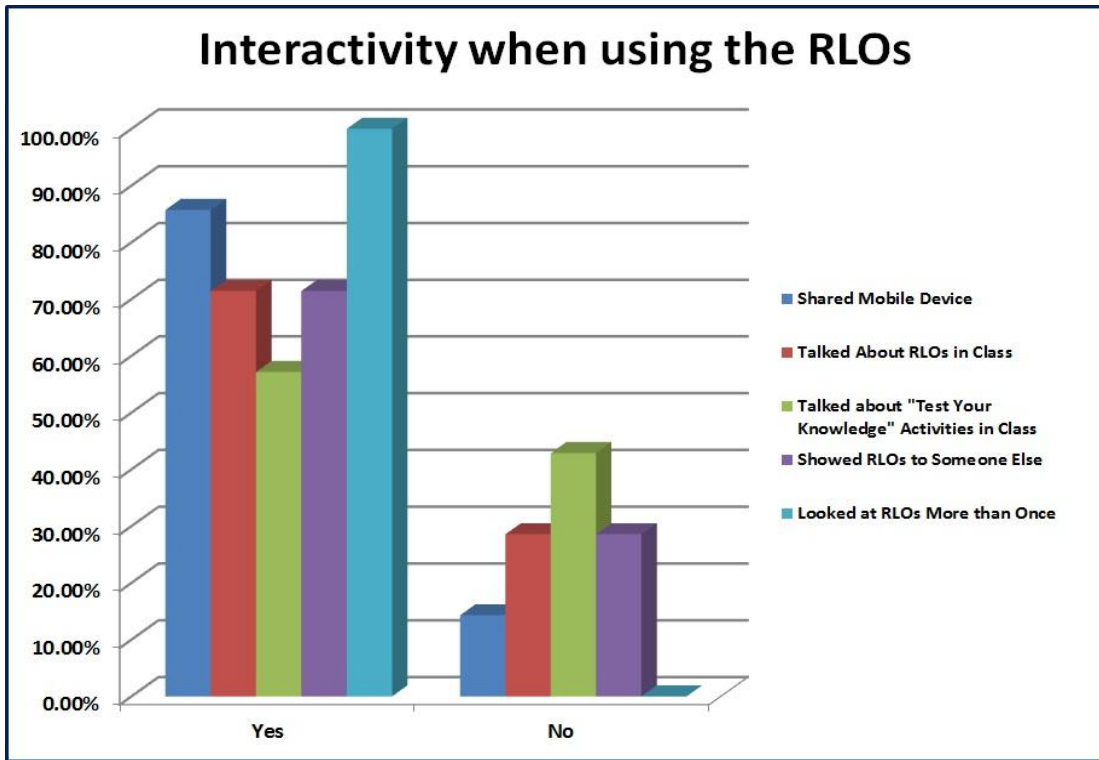
Results of Survey Questions Related to Accessing the RLOs



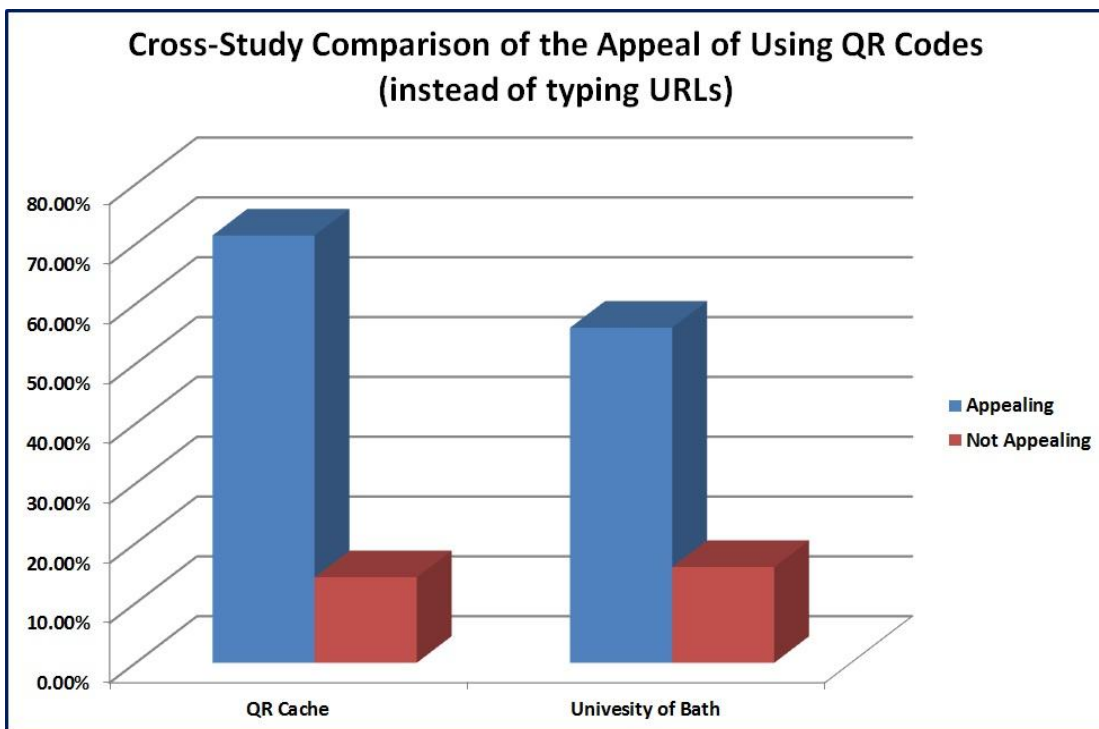
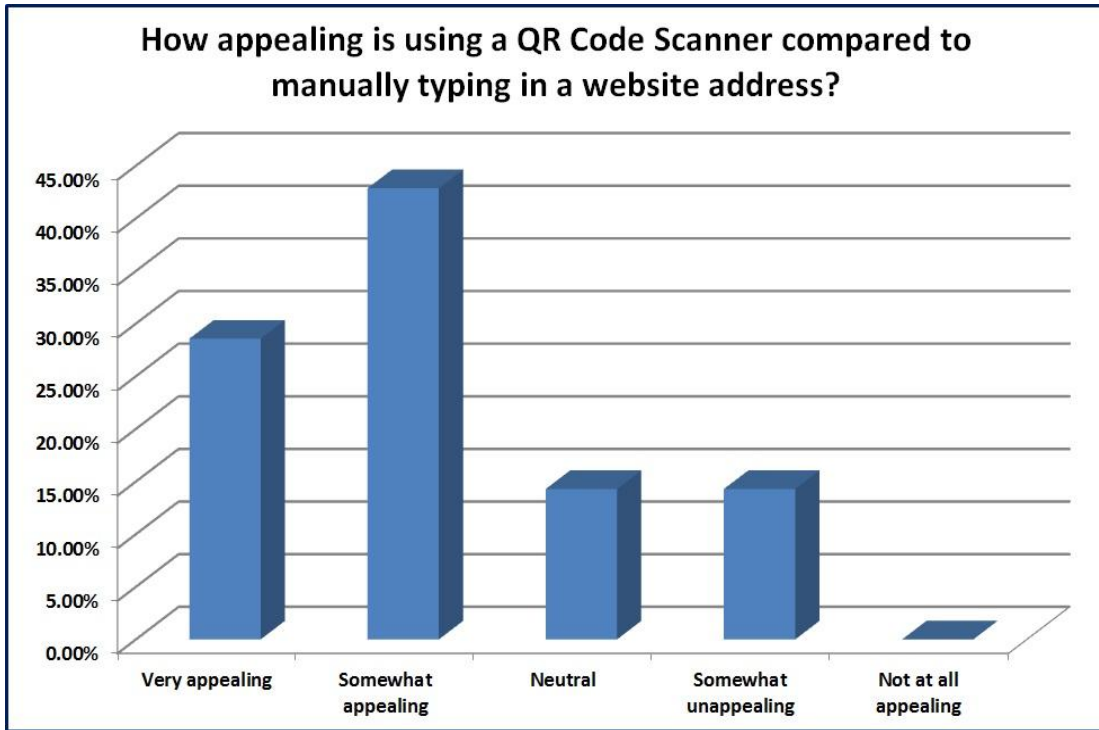
### Results of Survey Questions Related to RLO Content



### Results of Survey Questions Related to Interactivity



**Results of Survey Questions Related to General Perceptions of Mobile Learning, Mobile RLOs, and QR Codes**



(Source: Ramsden & Jordan, 2009)



