The Ripple Effect: An Outreach Project for High School Teachers Using a Cell Phone Programming Tool

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Abstract: This paper describes the development and delivery of an outreach program that targeted secondary school Information Technology (IT) teachers. Like many westernised nations Australia has also seen a dramatic decline in school student interest and realization of computing courses. This in turn appears to have a flow-on effect to student enrolment in university computing courses. Providing tools and strategies for secondary school teachers to create an interesting curriculum is a strategy showing success in other countries and was trialled in our university. The outreach activity described in this paper was evaluated via pre- and post-surveys of attendees and reflections of student facilitators. The evaluation assessed the transferability of programs into a different education environment. An important finding was that school teacher enthusiasm for new and creative curricula is often limited by time constraints and resource availability, indicating a niche where strong school and university partnerships could be developed.

1 Introduction

Information and communication technologies (ICT) have become the foundation on which a majority of our everyday tasks are conducted. Many if not all secondary school students we come in contact with own a smart phone and a majority are using it for more than just communicating with friends (ACMA, 2010). There are a multitude of tools and languages that are available to use with mobile phones, and a growing number of visual block programming interfaces on the market that can introduce students to programming concepts (Ericson 2011, Ericson and McKlin 2012, Krishnendu 2012, Mills College 2012, Uludag, Karkus, and Turner 2011).

App Inventor is one such block programming interface that “is a visual drag-and-drop tool for building mobile apps on the Android platform” (Wolber, Abelson, Spertus and Looney 2011 p xv). The attractiveness of App Inventor is that it interacts readily with Android smart-phones, allowing students the excitement and pleasure of creating an app that they can use on their own device. This provides the tools for a constructivist approach to learning that is both active and tangible as well as aligning the activity with a real world task (Radloff, 2005).

Through an international academic alliance between our university and the National Centre of Women in IT in the USA, we were given access to webinars and other materials that have proven to be successful in encouraging students to commence computing programs and improve the diversity in students who are attracted to computing courses and careers at Georgia Institute of Technology (Ericson 2011). This led to the successful bid for a Faculty Research Grant to allow us to connect with this institution. This paper reports on the experiences of delivering two workshops based on the College of Computing at Georgia Tech model (Ericson and McKlin 2012).

The program we initiated and conducted twice influenced a relatively small number of secondary school teachers in comparison to the US-based program. However, we believe that if school teachers can be enlightened, enthused and encouraged to explore activities using mobile technologies, they will take this attitude back to their classrooms and schools, and spread the enthusiasm and engagement to their students, hence a ripple effect is created, as referred to in our paper title.

In adapting an international program to our own university environment we also capitalised on our existing strong culture of using female students as workshop facilitators, to normalise women in IT in the classroom. Volunteers were drawn from our Faculty’s Women in IT group Using students as role-models and facilitators has proven successful in other outreach programs we have been involved in (Lang, Craig, Fisher and Forgasz 2010).
Another aspect of our program, which Wolber (Spertus, Mark, Gestwicki and Wolber 2010) hypothesised in 2009: “students would be especially motivated to learn programming if they were able to build applications that they and others might actually use on commonly available computing devices” (p. 326). This was evident and received as feedback from teachers who implemented the activity in their classrooms. While our ultimate aim is to reverse the trend of declining enrolments in our discipline at university level (Uludag et al 2011), we know that this is just the beginning.

Our workshops are already having a flow-on effect and have resulted in the App Inventor module being included in the curriculum in several schools. This paper will present the background behind the project, our method of delivery, feedback from the teachers who participated in the two outreach activities, feedback from the undergraduate students involved in delivery of the program as well as the limitations and recommendations for the wider adoption of this accessible program.

2 Background

During the last decade, research has shown that the number of students enrolling for courses in the Information and Communication Technology (ICT) area has been in decline. The Australian Computer Society released their Australian ICT Statistical Compendium for 2011 which included an analysis of statistical data showing ICT economic and social trends. The report revealed university ICT annual enrolments are down in every state, and national enrolments are less than half the number a decade ago. Further, it reported less than 3% of Australian students in undergraduate (Australian Computer Society 2012). This is a worldwide issue, in the USA the number of female Computer Science graduates is also in decline and has reached an all-time low of only 13% (Mentor Net 2012). In Europe the percentage of women in the field is reported to be 24% (Durando, Wastiau and Joyce, 2009).

Technology has become more pervasive and ICT offers a dynamic career and opportunities to work in any sector. Prior research into factors that influence student course choices (Lang 2012) and experience with outreach programs to address gender diversity (Lang et al 2010) emphasised the importance of enthusiastic teachers to student course choices. Australia’s secondary education curriculum is currently undergoing a review and it is suggested that this will give school students relevant ICT skills and knowledge as well as offer a compelling learning experience that will inspire them to pursue ICT both at university and as a career (Tate 2012). Enthused and confident ICT teachers will be a necessary component to deliver the new curriculum.

The College of Computing at Georgia Tech outreach program offers particular synergies because it focuses on improving the quality and quantity of secondary school computing teachers and in doing so, to increase the quantity and diversity of Computer Science students in Georgia, U.S.A. They number of students in Georgia taking Advanced Placement tests in computing has been steadily on the rise since 2008 (Guzdial and Ericson, 2012). To help create this change, their outreach program was offered as a two week workshops in the summer term as well as one to two day workshops during the school year. The workshops train teachers with little or no experience in programming to teach introductory programming courses and provide them with interesting and creative curricula to take back to their school. App Inventor is just one of the tools used in these outreach programs (Ericson and McKlin 2012, Siraj, Kosa, and Olmstead 2012).

In another case, educators at Pomona College (Gonzales, Sood and Chen 2011) revealed the outcome of a four week summer program where a small class of students learnt to use the program, Python, and then used that knowledge to command Scribbler Robots to draw simple geometric shapes. They set a goal for the program: “give students a more accurate understanding of what computer science is and what computer scientists do…and to get them to think about taking a CS1 course their first year in college”. They shared issues faced by them during the summer program and things that could have been done differently. Some of these ideas were implemented during our workshops.

Finally we found a similar program run at the University of Michigan (Uludag et al 2011) where the authors summarized their teaching experience in using Scratch, App Inventor for Androids and Lego Mindstorms in the university’s introductory computer science winter term subject. The article disclosed statistics in the US that illustrated the decline of students enrolling into computer science courses and then related that to the objective for running the winter term subject. Further these authors mentioned the variety of languages used in introductory programming classes throughout primary, secondary and tertiary classes they had collected from published literature.

This literature search helped us plan the short (3 hour) workshop for teachers held in our university on a weekend. We chose to use App Inventor for several reasons, not the least being that it is based in the cloud (hosted
by MIT) eliminating many technical issues for us. There are extensive online resources, lesson plans and videos to support implementation of the activities. With reference to these existing resources, we could see how different schools have embedded this into their course structure to be able to gain student engagement as well as student interest within the ICT field. Lastly, we were able to draw on the expertise of experts and avoid making unnecessary mistakes.

3 Method

In planning and developing the program we had several aims:

1. To deliver a compelling ICT experience to ICT school teachers using the App Inventor for Android phones software to encourage and further support them in providing a similar experience in the classroom for their students.
2. Build connections between our university and secondary school teachers.
3. Intentionally role-model female students as leaders in the delivery of the workshop to help dispel traditional male stereotypes associated with the ICT discipline.
4. Lastly, we hoped that by involving undergraduates in delivery of the workshops and introducing them to aspects of research, we could spark their interest to continue their studies into an honours year.

To this end an advertisement was circulated to all undergraduates titled: School outreach project: cell phone programming for non-programmers. The Faculty grant enabled us to provide students with a summer scholarship. The advertisement emphasised that students needed to be available for four weeks over the summer break to help develop the outreach activities. We advertised for one male and one female undergraduate with the proviso that they were not due to complete their course before Semester 2, 2012. The advertisement was circulated via email and on the Faculty Facebook sites. The only other criterion was that they have good communication skills and interest in promoting ‘cool apps for smartphones to secondary school students’. Interestingly, despite being only 18% of the student body, only female students applied for the position.

Survey instruments were developed for the workshop attendees (pre and post) and Ethics approval was obtained from the university. The pre survey gathered demographic information (teaching method, gender, school year levels taught) as well as what the teachers expected from the workshop. The post survey focused on what teachers thought of the utility of the App Inventor tool and whether they felt confident to apply it in their classes. A follow up email was sent several months after the workshop to determine whether the practical had been implemented in the classroom.

After recruiting the undergraduates, planning for the first workshop began. We purchased 20 android phones through the internet to use in the workshops. While these phones were not strictly necessary because there is an emulator included in the App Inventor program, the benefit of using the device adds considerably to the attractiveness of the outreach program. We could not be sure that all teachers had their own android phone; however we did encourage them to bring their own if they did.

Due to a serendipitous opportunity we were able to host a visit from an expert from the College of Computing at Georgia Tech to run the first workshop. Our two undergraduate students joined us and were encouraged to take an active role in supporting the delivery of the workshop to help them gain the confidence for the second workshop where their role would be more prominent. The workshops were advertised and limited to twenty each and the registrations were completed online.

Workshops were conducted on campus on a Saturday in November 2011 and April 2012. In both cases, despite the workshops being completely subscribed, just over half the teachers attended. Teachers were emailed a link to the pre-survey prior to attending, and completed the post survey in paper form at the end of the workshop. In total 25 secondary school teachers completed the surveys.

While the original grant had stated that we would conduct the outreach with school students, the decision was made quickly to focus the workshops on teachers because, through the ripple effect, we felt that this was a more effective strategy. Each teacher has the potential to influence at least twenty students in their own classes and perhaps many more in the future. The final part of our methodology was to collect a written reflection on their experiences and suggestions for improvement from the two undergraduate workshop facilitators at the conclusion of each workshop.
Findings

The results of the pre-survey to gather information on teacher expectations of the forthcoming workshop and the post-survey to determine if these expectations had been met are presented in this section.

The teachers came from each of the school sectors (Catholic, Independent and Government) and were just under one-third female (7:25). We asked them to rate their confidence level prior to the workshop on a scale of one to five with five being the most confident. The average was 3.24 confidence levels with Mac computers and 4.84 with PCs. The lab was conducted with Mac computers in both cases. This decision was made with no preference other than availability because the program runs equally well on either platform. Except for one teacher who only taught up to grade 10 and 2 teachers who only taught Grade 12, all the others taught students from Grade 7 through Grade 12. All the teachers had been trained in Information Technology.

The responses to the question that asked their reason for attending the workshop, which was conducted on a weekend, were very closely aligned to our aims for the project. Some sample responses are presented:

- Want to learn about AppInventor with a view to introducing a unit at Yr 10 level.
- I wanted to add a bit more value to the Year 11 IT programming topic and have a few lessons on developing applications to enhance student learning.
- Similar to the aims of the workshop. I teach VELS IT classes from years 7 to 10 and am always looking for new possibilities for our syllabus.
- Hoping to gain an insight into a new area of great interest to the kids with the view of introducing it into electives at year 9 or 10.
- To learn something new and engaging to share with the teachers and students I work with.
- Keep my IT skills current and learn new skills.
- To learn more about Google apps, android apps, AppInventor, visual basic and teaching programming using the above topics to be more versatile in creating applications and apps for teaching in year 9 and 10 Programming class.

A second question asked teachers what their intentions for applying their learning when they returned to their schools. All had practical intentions, and felt that it would apply to classes between years 7 to 12.

- Would like to introduce a unit in our year 10 class, but possibly also a lunch time group.
- I would like to incorporate it into the Year 11 IT subject during the Programming topic.
- Need to wait and see, but I’m hoping it could be relevant for inclusion at year 9 or 10 ICT.
- I want to include the development of apps in a year 10 Programming and Multimedia course. Programming to partner games programming; Multimedia to extend their video, audio, image editing into a simple app; as well as introducing them to Flash.
- Possibly introduce it in the year 7 program and as an elective in year 9.
- Hope to add it to the Yr 9 / 10 IT course. Maybe a term unit.
- To carry on with ideas of workshopping for my students aspects of android apps, google apps, visual basic, google python, and more variety in programming and instruction for class.
- To write a course for students to enrol in next year.

These representative responses clearly indicate the synergies between the secondary school teachers and the aims of this outreach program: that the curricula at secondary school could be re-invigorated with this program.

Post survey responses were harder to obtain. At the conclusion of the first workshop we emailed teachers a link to an electronic survey, however very few teachers responded. After this poor feedback we conducted a paper based post survey and asked the teachers to complete it before they left the room. We asked them what they like best about the activity and what we could improve. Everyone congratulated the team for running an effective and engaging workshop [n=16]. We were very pleased with this but more interested in how we could improve the event.

Some suggestions were:
- More tutorials on paper which we can follow, which are suitable for use with students
- Not much. Overall it was very good. Maybe better resources. More examples.
- more time and building to a greater level of complexity
• Could have been a stronger focus at the beginning on what was needed to setup not just websites but phone settings etc.
• The written material is very verbose and confusing
• More screen shots but it was OK
• Simpler written instructions, perhaps?

While we had provided printed instructions taken from the resource website, it is apparent that some attendees did not find them clear enough.

A second question asked teachers if they thought it would be possible to implement the activities into their classroom, and once again, the majority of responses were positive. Only two were concerned about the availability of the resource and the level of the instructional materials.

The undergraduate student reflections were also very positive. The students found that assisting with the workshop contributed to their own self-confidence and learning, for example:

“Once I got to walk around and meet everyone, I did not feel as nervous as I initially did when starting off the workshop. I had gained some confidence and it was now my turn to instruct the teachers on what to do. I instructed the Paint Pot tutorial. I found it moderately easy to do however my instructing skills need some more work. I believe I need to speak in a louder voice so whoever is sitting in the back can hear as well as those in the front.”

The added benefit of using undergraduates to instruct and lead classroom teachers in the workshop is evident from this self-reflection. The verbal feedback from teachers at the second workshop confirmed our decision to allow the female students to take the lead in demonstrating some aspects of the program. Several congratulated us for challenging the traditional male stereotype.

5 Discussion

The experience of running workshops for secondary school teachers has been an informative and successful experience for all concerned. Classroom teacher are very interested in promoting the ICT discipline in their schools and they have the same need to encourage students to enrol in their classes as we do at university level. There is also the same desire to provide an interesting and relevant curriculum.

This is where programs like App Inventor that allow students to create apps that can be immediately transferred to the mobile phone are so important. The level of excitement in the workshop when the first few teachers transferred their app to the phones and showed the others was a pleasure to see.

This outreach activity satisfied two of our aims; it created an enthusiasm in the teachers to return to the classrooms and put the activities into practice as well as created connections between the university and secondary schools creating opportunities for future events. It also had the benefit of empowering our undergraduate students; however, it is too early to determine if they will consider further research. They have both subsequently volunteered for a follow up activity in secondary schools. Thirdly several of the teachers have since contacted the university to source mobile phones to allow them to deliver the activities in their classroom. At one teacher conference attended later in the year two teachers who had participated in our program were delivering their own workshop to other teachers (VITTA, 2012).

6 Conclusion

Based on the workshops and the research, the following conclusions were reached. The ripple effect of presenting a workshop to teachers rather than to students appears to be a powerful way of influencing a wide range of students. The format employed of having a subject expert present the first workshop, and then presenting the materials in the second workshop ourselves was a very successful format to follow in the future. This model allowed us to understand the requirements of running a workshop for teachers and to gain experience in other components such as activities at the beginning to help everyone mix and gain some understanding in logic programming. Since our university is placing a lot of resources into making connections with secondary schools this model is a good one to replicate here in Australia. Schools welcome free professional development for their staff and since running these two workshops, two schools have welcomed us into their classrooms to run outreach programs with their students. Secondly it is heartening to find that teachers are as keen as us to provide students with creative and engaging curriculum experiences as we are.
We will use the experience of these workshops to replicate further outreach programs within the classrooms of willing teachers and schools.

7 Limitations

The program had several limitations. The first was that these workshops were conducted during school holidays when teachers could be using their personal time for other things. While this is quite a common occurrence in the USA, it is not common practice in Australia. The dedication these teachers showed in attending was exceptional and gave us enough information to write this paper. However we could have had a better turnout if the event was run during the school term.

Secondly, the feedback we received from the teachers was that some of the material should be rewritten for delivery in the restricted time. They also commented that they would have preferred all the technical issues between the Android phones and the Mac to have been more seamless.

Another limitation was the size of the sample that makes the results of the survey and academic information only indicative of the success of the program and the findings not generalizable for use in comparison to a larger study.

Finally, an original limitation identified in this program was the hurdle of ensuring teachers had set up a Google account before they could gain access to the App Inventor resources and application. This was flagged as being a potential issue in the classroom as some parents will not allow their children to have Google accounts. We have since received information that the teacher can create a class Google account and assign accounts to individual students within the class group.

8 Future

A final comment is that while providing free workshops is highly regarded by principals and some teachers, at least a third of the original registrants did not show on the day. If running these events again we would certainly recommend a monetary contribution from each participant to reserve their place. These workshops were free and perhaps made it easier for those teachers who had signed up to attend not to show up on the actual day.

The way forward for our university is to explore running similar workshops in different time frames, for example at teacher conferences.

9 References


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10 Acknowledgements

This research was supported by a grant from the Faculty of <<deidentified faculty and university>> awarded to the authors. The statements made and the views expressed are solely the responsibility of the authors.

The authors would like to thank:
Barbara Ericson, Director of Computing Outreach, Senior Research Scientist. College of Computing, Georgia Tech;
Erica Lay and Michele Spiteri, undergraduate students <deidentified university> for their invaluable contributions to planning and conducting the workshops and contributing to the successful outcomes of this outreach program.