

# Teaching Android Application Development in a Collaborative Online Environment

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## Abstract

*Online education has gained significant popularity in recent years, and this trend is set to continue. One of the reasons for the explosion of online education is the fact that Colleges and Universities need to seek out new delivery methods and to reach out to people who cannot attend College or University. Funding and diversity of courses is also another reason for the increasing popularity of online education. Learning in an online environment should be considered as the process whereby participants have to discuss, reflect, collect and analyze information and be active participants in the learning community. This paper details the design, implementation and evaluation of an Android Application Development online course, an e-tivity. This paper also highlights the issues which are of major concern in the design of an online programming course, and in particular the issue of engaging the target audience and assessment issues. A comprehensive evaluation is also provided which will be used to determine the future direction of this online course.*

## I. INTRODUCTION

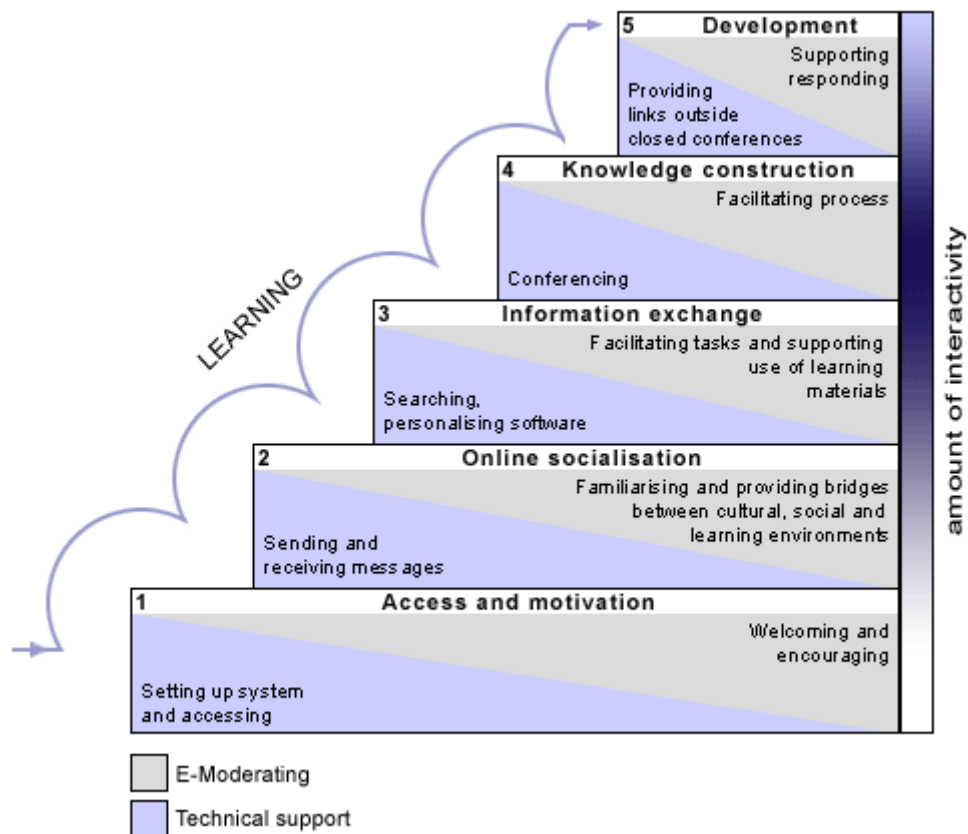
The main focus of this e-tivity is to expose the learners to Android application development in an online environment. The learners are expected to complete four activities in an asynchronous manner in order to complete the entire activity. The activities are asynchronous, in that the completion of task 2 follows and depends on successful completion of task 1, and likewise task 3, depends on the successful completion of tasks 1 and 2. Following completion of tasks 1, 2 and 3, the learners are required to participate in a collaborative task, which will involve the design and development of a Bluetooth app which will read the temperature in a room and display it on an Android phone.

The primary motivating factor in the selection of an Android application development e-tivity is that Android is the most robust mobile application development platform available and with leading Smartphone manufacturers rapidly adopting Android over their own operating systems, Android is growing at an unprecedented pace giving its rivals a run for their money. Taking these factors into account, it stands to reason that there will be a huge demand for Android application developers. This e-tivity will expose students to the potential benefits that can be obtained by becoming application programmers, and may even provide opportunities for future careers in Android development.

Wang (2011) discusses the major issues in the design of an online programming course. In particular, Wang emphasizes the fact that learning to program online is fraught with difficulties, not least the fact that in order to judge progress, it is necessary to see how learners approach a problem. Wang also highlights the issues surrounding collaboration, and discusses the difficulty in establishing a collaborative programming environment. El-Sheikh (2009), also state that one of the main challenges that faces an online course, is how to effectively engage the learners.

## II. E-TIVITY DESIGN

Blackboard is used as the learning management system for this particular e-tivity. The reason for this selection is the fact that it is widely used at Letterkenny Institute of Technology. Another reason is the fact that Blackboard allows for the construction of courses with interactive elements, ranging from simple discussions boards to real time streaming video. The design of this e-tivity is largely based around the Gilly Salmon five stage model, as shown in figure 1.



**Figure 1 Five stage model**

Stage 1 of Gilly Salmons' five stage model is access and motivation, and this is where learners are given opportunity to explore the online environment. The first assumption to make in the design of an e-tivity is to expect students to have poor IT skills, be terrified of discussion boards and to want to email or talk to you. Even logging on to a secure site such as Blackboard may be new to some. The first requirement is therefore to provide a welcome note to the learners. This will in turn provide positive encouragement to the learners. It is also desirable to keep the layout and organisation of the site simple and straightforward. It is also necessary to provide guidance on using the site e.g. netiquette.

Stage two of Gilly Salmons' model involves individual learners establishing their online identities and then finding others with whom to interact. Communication is key to success of the online learning environment. It is crucial to encourage the use of the discussion board for general queries. As an initial task, learners should be encouraged to post a short description of themselves and to describe their best hopes and worst fears in the participation of this course. The e-moderator should make the first move here, by introducing themselves, and maybe giving a short description of the course.

It is important to structure the discussion boards and set up a topic thread for each activity. Learners should also be encouraged to respond to others questions if they can. The e-moderator must supervise the board to make sure the answers learners give are correct. This e-tivity had four discussion forums established, namely welcome, task 1, task 2, task 3 and collaborative task.

It is also useful to develop FAQs and keep adding to them. A link to FAQ was also provided which was accessible via the main page on Blackboard.

The article presented by Kratz (2011), discusses the importance of a collaborative online environment, and states that online communication is a must have skill, which will also be hugely beneficial as learners progress through their eventual careers. Palloff and Pratt (2005), emphasise the importance of preparation and state that learners should be aware of the purpose of the e-tivity and the instructions for completing the e-tivity. Ensuring that learners are comfortable with the technology is also highly important.

At stage three of the Gilly Salmon model, learners exchange information with each other. To facilitate this, it is essential to use a variety of e-tivities to support learning and keep students working to a timetable e.g. quizzes, short pieces of written work, group work where they use the discussion boards to discuss an issue and reach a consensus. For this e-tivity, learners were organised into groups.

Stage four of Gilly Salmon model is the knowledge construction phase, which is where course-related group discussions occur and the interaction becomes more collaborative. This can be regarded as a crucial stage in that learners engage in a form of active learning. This provides the learner with an opportunity to gain a different insight on a particular topic through collaboration with other learners.

Stage five of Gilly Salmon model is the development phase. This is where the learners become responsible for their own learning. The learners are able to build on their ideas acquired in the earlier stages and apply them in individual contexts. Essentially, the learners become creative.

The tasks involved in this e-tivity were designed to be progressive from a short piece of writing posted on the discussion board to a short piece of writing submitted via email.

### III. ENGAGING THE TARGET AUDIENCE

According to Brown and Voltz (2005), there must be a reason or motivation for learners to undertake an educational activity, if the outcome is to be memorable or to be of any value i.e. the activity must have a meaning and include topics and themes which are interesting to the target audience. Presenting the target audience with an activity that contains skills that can be transferable to real world scenarios can be engaging for the target audience. From previous experience, learners do feel the need to know that what they are doing is a worthwhile task and one which will be beneficial to them in their future careers. It is also highly important to identify the target audience, in order to develop an activity that will engage and stimulate learning.

The target audience for this e-tivity are the final year Electronic Engineering students. There are a number of reasons for this selection. Firstly, since Android application development is a relatively new phenomenon, it has not been included in the current curriculum at LYIT, it would be extremely beneficial for this group of learners to be exposed to this type of development. Application programming is quite new and is something which will be part of future curriculum at LYIT as it would be considered a desirable skill for employers. Another reason for selecting this particular cohort of students is that they are quite familiar with Blackboard, and should encounter no real issues regarding the use of technology to manage or complete the activity.

Motivation can be defined as the process that initiates, guides and maintains goal-oriented behaviours. Motivation is what causes us to act, and it involves the biological, emotional, social and cognitive forces that activate behaviour. Motivation can be categorised as intrinsic or extrinsic, and every learner varies in their level of motivation and orientation. Intrinsic motivation refers to the act of performing a task as it is more interesting or enjoyable, while extrinsic motivation refers to the act of performing a task as it results in a reward. Taking into account the intrinsic and extrinsic motivation, this e-tivity was designed to intrinsically motivate the learners, by providing them with a 'spark' or 'stimulus' that would engage the learners and allow them to appreciate the significance of Android. Figure 2 is a snap shot of the lesson plan indicating the learning objectives and 'spark' to encourage learners to participate in this e-tivity.

<b>Android Application Development</b>  <b>Year 4</b>	<b>Student Name:</b>
	<b>Year Group:</b> BEng (Hons) Electronics Engineering
	<b>Date:</b> 25 <sup>th</sup> April 2012
	<b>Duration:</b> 1 Week
<b>Topic:</b> Android application development	

**Spark:** Android is becoming the dominant operating system in the Smartphone market. 33% of all Smartphones sold worldwide use the Android operating system. The demand for Android Smartphones and tablets is growing at an unprecedented rate. The opportunities for Android application developers is essentially endless.

**Prerequisites:**

None – although knowledge of Java is an advantage

**Learning Objectives:**

On completion of this course the students should be able to:

1. Know the basic concepts and technique of developing applications for the Android phone.
2. Be able to use SDK and other development tools.
3. Know the basic concepts of Android phone features and capabilities.
4. Be able to understand Java programming as it related to application development for the Android platform
5. Design, implement and deploy mobile applications using an appropriate software development environment.

**Figure 2 Lesson plan**

#### IV. LEARNING OUTCOMES

Determining the learning outcomes is a critical stage in the design of an online course. Learning outcomes provide the road map for lesson planning and explain desired “education results” (Posner & Rudnisky, 2001, p. 75). They should detail and list specific learning skills and knowledge learners must demonstrate at the completion of the course. Learning outcomes need to be active, observable and measurable. El-Sheikh (2009), state that an online course usually have the same objectives and learning outcomes and should aim to engage the learner in a meaningful way similar to face to face course. Other essential skills which are desirable from an employer perspective are teamwork skills, critical thinking and reasoning skills, oral and written skills and organisational skills. An online programming course such as this e-tivity, should support the development of these essential skills as well as promote software development skills.

This e-tivity was designed to encourage students to develop their analytic understanding of the applicability and limitations of Android development environment. A practical e-tivity was designed such that the learners could apply their knowledge through the development of a mobile app. This e-tivity was also designed to develop the learners critical understanding of the applicability of the mobile technologies involved, by moving from a theoretical understanding of Bluetooth to a more practical understanding of it features and functions. The e-tivity was also designed to extend the learners programming capabilities into more real-world applications.

#### V. THE ROLE OF E-MODERATOR

Salmons (2000) five stage model presents specific expectations for what learners will do and suggestions for the e- moderator. The e-moderator plays a vital role at all stages of the process and Salmon (2000) describes the role of the e- moderator to that of “weaving”.

Salmon emphasises the fact that the e-moderator’s role is to help students create meaning rather than to impart content. Anderson (2000) describes the role of the e-moderator as being “a guide on the side”, a facilitator rather than a lecturer. The e-moderator must encourage learners where appropriate. Heuer and King (2004) provide an interesting analogy for the role of the e-moderator, that of a conductor of a band of learners who knows how, when and to what degree to bring out the music, the strengths, and depths of various sections.

The e-moderator is also responsible for providing feedback to the learners. Learners may wait for individual feedback on their e-tivities before carrying on with the next piece of work. Some learners will expect instant responses. Learners should be informed not to expect this.

As the e-moderator, it is desirable to use e-tivities that do not need marking e.g. quizzes with the answers provided or provide generic feedback on Blackboard just after the target date for the learners to complete the e-

tivity. Inform the students when this generic feedback will be available. Despite feedback within quizzes, learners do expect individual marking.

The e-moderator is also responsible for timekeeping. It is important to be strict on time as it would not be desirable to be supporting learners during task 1 work while other learners are involved in task 3. It is also desirable to allow learners sufficient time to complete tasks. One of Gilly Salmons five tips in the design of an e-tivity is to “*imagine how long it's going to take them and multiply it by three*”. This e-tivity was run over the course of 1 week, learners were provided with a list of instruction to successfully complete the e-tivity. The learners were advised to carry out background reading during day 1. Tasks 1, 2 and 3 were designed to be completed with 2 hours, and learners were encouraged to participate in the online discussions forum by the end of day 2. The collaborative task was also designed to be completed within 2 days and learners were advised to complete this task by the end of day 4. Finally, a short 1000 essay was to be submitted via email by the end of day 5. Learners were also informed that individual feedback would be provided the following week.

## VI. PEDAGOGICAL STRATEGY

Weller (2002) provides details of the following approaches to online learning, and states that a successful course should try and combine many of these approaches.

- Constructivism
- Resource based learning
- Collaborative learning
- Problem based learning
- Narrative based learning
- Situated learning

Weller (2002) argues that constructivism is the dominant learning approach to an online course, and makes the following recommendations on the implementation of pedagogical strategies:

1. Select an appropriate pedagogy
2. Combine approaches
3. Be prepared to take on a different role
4. Utilise the strengths of the technology

The adoption of appropriate pedagogical strategies is highly important and determines how the e-moderator aims to achieve learning objectives. Fouquette (2011) emphasises that fact that we cannot expect traditional face to face strategies to work in the online environment. The use of video clips and You Tube presentations is also encouraged as it can present the material in an appealing way to the learner, and adds auditory learning to the mix. Interaction and collaboration is central and as long as learners actively participate, they will learn more and retain more.

Brindley et. al (2009), state that in a collaborative learning environment, knowledge is shared among learners as they work towards a common goal. Learners must be active in the process of knowledge acquisition, a strong argument is presented on the inclusion of small group collaborative learning experiences within online courses. It was also revealed that actively participating in group work can promote deeper understanding as well as the development of learning and teamwork skills. Collaborative learning appears to increase a sense of community, which was also shown to be closely linked to learner satisfaction and retention.

The use of and inclusion of video clips and You Tube videos was extremely beneficial in this e-tivity. The learners provided positive responses on the use of these mediums in the online environment. This e-tivity also included a collaborative task, which was used to promote online socialisation, as well as develop team work skills, to promote software development and to expose the learners to Bluetooth technology.

## VII. ASSESSMENT METHODOLOGIES

Since the role of the e-moderator changes significantly in an online environment, so also must assessment techniques. Assessment techniques should be based on desired learning outcomes. Assessment results should be used by the learners to evaluate progress through the course materials. They are also useful in providing the e-moderator with evidence of the effectiveness of the course material and provides indications of content areas that may require further enhancements.

Quizzes and tests can be viewed as a means of promoting learning, however, they should form only a small component of the overall assessment strategy for an online course. Runyon and Von Holsen (2001), state that the assessment strategy should “provide evidence of the mastery of the learning outcomes through student performance”. Rovai (2000) recommend online discussions as a good assessment method. The ability of the online discussions forum to promote text based communications can greatly support the construction of knowledge. It also provides a great opportunity for reflection through asynchronous online interactions. The e-moderator can use the information posted in the discussion forums as a summative and formative assessment. The observation schedule, figure 3, was also used as a means of evaluating the effectiveness of this e-tivity.

<p><b>A. Planning and preparation</b></p> <ul style="list-style-type: none"> <li>• Provide a welcome note for learners</li> <li>• Provide course policies for online learning in an information area</li> <li>• Provide course notes in the content area</li> <li>• Provide assessment criteria and any due dates of assessments</li> <li>• Providing invitations and sparks appropriately</li> </ul>
<p><b>B. Teaching strategies</b></p> <ul style="list-style-type: none"> <li>• Provide course material that is easily accessible to learners</li> <li>• Use a variety of media, i.e. podcasts, videos, slides etc</li> <li>• Encourage students’ to conduct their own research in a particular area</li> <li>• Encourage team-based collaboration among learners</li> <li>• Provide discussion areas that invite questions, discussions, reflections and responses</li> <li>• Provide positive encouragement and motivation</li> </ul>
<p><b>C. Classroom management</b></p> <ul style="list-style-type: none"> <li>• Provide learners with rules as to how to behave online</li> <li>• Be very clear about assessment criteria and assignment deadlines</li> <li>• Establish a positive working environment and encourage those who are not participating</li> <li>• Be mindful of differing personalities and background</li> </ul>
<p><b>D. Assessment</b></p> <ul style="list-style-type: none"> <li>• Provide an assessment schedule to learners</li> <li>• Allow learners adequate time to complete assessments</li> <li>• Provide learners with constructive feedback</li> <li>• Align learning outcomes with an appropriate assignment</li> <li>• Provide details with how assessments should be submitted</li> <li>• Inform students of penalty for late submissions</li> <li>• Provide information on the seriousness of plagiarism</li> </ul>
<p><b>E. Professional knowledge and the curriculum</b></p> <ul style="list-style-type: none"> <li>• Know and understand the requirements of the curriculum</li> <li>• Know and understand the way in which pupils develop and how they learn</li> <li>• Use the outcomes of assessment to evaluate teaching and plan for the future</li> </ul>
<p><b>F. Professional development</b></p> <ul style="list-style-type: none"> <li>• Reflect critically in order self-evaluates one’s own practice</li> </ul>

**Figure 3 Observation Schedule**

## VIII. E-TIVITY EVALUATION

From the start, it was clear that students were extremely taken with this e-tivity. The fact that they would be working in the real world Android development environment appealed to them greatly. This was evidenced by their motivated and enthusiastic discussions posted in the forums, and their constant emails to e-moderator during the week that the e-tivity was run.

The learners were all encouraged to work individually on tasks 1, 2 and 3 and collaboratively for the Bluetooth app. By working individually, the learners gained valuable experience in developing a simple app which was downloaded to their Android phones.

The students engaged with, and were very enthusiastic about this e-tivity, collaborating amongst themselves to solve common difficulties and even sharing mobile devices for testing purposes. All of the students who participated in this e-tivity were highly interested and classified it as being extremely useful and relevant.

The learners were encouraged to use discussion forums at every opportunity. All of the learners acknowledged the steepness of the learning curve involved in the development of Android applications, once such comment that was posted stated “learning Android took a lot of time on this e-tivity”. The learners also experienced difficulties in setting up the development environment which was task 1 of this e-tivity. A trouble shooting section was also provided for the learners providing solutions to common problems. The discussion forum was highly beneficial for this task as the learners were able to communicate with each other to resolve issues that occurred at this point. The learners also sent numerous emails to the e-moderator to highlight their difficulties. However, through intense communication and collaboration, we were all able to get the development environment established. Once this initial hurdle was overcome, tasks 2 and 3 completed with absolutely no difficulty.

On completion of task 3, the discussion forum for this task, was filled with excitement from the learners, as they now had completed and developed an app which was successfully downloaded to their Android phones. Typical comments posted here included “this is just great, I have just downloaded hello world app to my phone and it actually works”, “hello world downloaded to phone, and now on my second app a temperature converter”. The comments posted in this discussion forum were extremely positive, and the learners even went on to develop more apps with one learner completing a temperature converter app. This particular learner progressed quite quickly through Gilly Salmon five stage model, reaching stage five, the development stage, and encouraging other learners to develop their skills by participating in the development of another app.

The collaborative task involved the design and construction of an Android app to read a temperature sensor located in a room and display the temperature on an Android phone. The temperature would be communicated to the Android device via a Bluetooth module. Team 1 were required to work on the graphical user interface (GUI), while team 2 were required to work on the technical details of reading the information and displaying it on the Android App. Both teams were required to work together on the Bluetooth aspect of this project. A discussion area named collaborative task was set up to support communication and collaboration between team members.

The discussion forum was critical to the success of the collaborative task. All team members were actively involved in their respective tasks. All learners were provided with initial code samples that proved to be beneficial. Some of the comments posted in the discussion forum highlighted the difficulties with the Bluetooth aspect to this project, one such comment “the lack of Bluetooth support in the emulator made the development and testing of the app extremely difficult”. Other comments include “the simple chat application at the Android developers guide under Essential Links was very useful”.

A survey was provided for the learners to complete, and was based on a 5 step grading system from “Strongly Disagree” to “Strongly Agree”. All of the learners “Agree” and “Strongly Agree” that this e-tivity was useful as part of Mobile Operating System course”. All of them “Strongly Agree” that “Learning Android and Bluetooth technology was useful and they also all “Agree” that “The introduction to this Android e-tivity was a useful starting point for further development”.

Gilly Salmon (2002) identified several characteristics of participants in relation to e-tivities. It was interesting to note the different personalities of the participants of this e-tivity. Out of the eight participants, four would be considered ‘elephant’, three were ‘squirrel’ one was a ‘mouse’. It was quite surprising that 50% of the group were ‘elephants’, this was largely due to the fact that the participants were highly interested and motivated. All participants completed the work and the ‘mouse’ was gently encouraged on several occasions.

## IX. CONCLUSION

All of the learners who participated in this e-tivity were in possession of an Android based phone. However, one of the learners had to upgrade the version of Android on his phone in order to obtain full Bluetooth support. While this provided a learning opportunity for the individual involved, it had not been one of the intended outcomes of the e-tivity.

A major challenge learners experienced was the difficulty with task 1, the initial setting up of the environment, and also the lack of Bluetooth support in the emulator. This meant that the learners could not test the application before deployment on an actual physical device.

The learning curve for Android development also consumed a lot of the learner's time and effort. Learners had to utilise all the basic mechanisms of Bluetooth communications through the API, which did provide them with a general and practical understanding of the technology. The Bluetooth chat sample application which was accessible through the Essential Links menu in Blackboard proved an extremely useful starting point. One possible way to reduce the learning curve would be to provide the learners with machines that already have the development environment set up. This would remove the need for the learner to establish a working environment.

Overall, the learners were highly satisfied with their online learning experience. Although there were a few problems with the use of the technology, this was a largely successful learning experience for all involved. The feedback obtained from the learners will greatly enhance the course for future learners. It was hugely beneficial that the learners were provided with an e-tivity that was intrinsically motivating, and one which could be useful in their eventual careers.

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