



Scaffolding C++ on smart phone for novice learners of programming

By

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A Dissertation submitted for the Degree of Master in Computer Science in the
Department of Computer Science, School of Systems and Technology,
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July, 2016

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Declaration

I declare that this dissertation is my own original work. Where collaboration with other researchers are involved, or materials generated by other researchers are included, the parties or materials are acknowledged or are explicitly referenced as appropriate.

This work is being submitted for the degree of Master of Computer Science at University of Management and Technology. This Thesis has not been submitted to any other university or institution for any other degree or examination.

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Publications

Ideas, figures and tables of this dissertation are in process of being appeared in the following journals and conferences:

Raza, Farooq, Abid, Ahmad (2016). A Survey on scaffolding and its variants for novice learners of programming. **(Under review for ACM CSUR)**

Raza, Farooq, Abid, Ahmad (2016). Design of Scaffoldy: A C++ editor for novice learners **(Submitted at International Conference on Innovative Computing, 2016)**

Raza, Farooq, Abid, Ahmad (2016). Scaffolding Techniques provided to learners in Tools for Learning and Teaching **(Submitted at International Conference on Innovative Computing, 2016)**

Dedication

To my Teacher

*This thesis is dedicated to my Mentor **Dr. Muhammad Shoaib Farooq** who guided, motivated me and I always felt boosted because of his love and kindness. Because of him, I see world now from a different perspective. He always helped me in realising my potential and showed me light of knowledge.*

To my Late Father

I miss my father every day, I cherish and remember every wonderful and joyous moment we have spent together

To my Family and Loved ones

My Family and loved ones for their support in this testing times.

Acknowledgement

I am once again thankful to my kind and helpful advisor Dr. Muhammad Shoaib Farooq, he taught me everything about research and development. He really helped me in moving my mind to next level. I am in his forever debt for building me not only education wise but morally also.

I want to give my sincere thanks and regards to Dr. Adnan Abid for his continuous guidance and support. He always taught me not to be afraid of anything. It is because of him that I am not afraid trying and experimenting new things. I really find myself lucky to be under his guidance. He showed me how to work on different research ideas and specially how to stand out your research article. I am immensely grateful to him for being a critic on my work, this thing really opened my mind and I learned a lot from my mistakes. Finally, how much he has motivated me, it cannot be summed up in words.

I also want to thank Sir Asif Subhani for his support as a wonderful human being and teacher. He stood like an elder brother for me in time I needed motivation most. I am also thankful to Sir Fakhar Abbas for being an excellent reviewer.

I want to say big thank you to my sincere and helpful friend, Mr. Ishfaq Ahmad. He really helped me during coursework and thesis. He was always there in the hour of need. I would have been working alone in the university, if Ishfaq would not have been there as my friend in testing times. I am thankful to all the persons who helped me achieve this feat.

I am very thankful to my family members, specially my Mother, brother and sisters for showing so much patience in this time. They always extended their support and love for me even when I was not able to give them much time because of my study and research schedule.

I appreciate the environment of the University of Management and Technology, Lahore which was always peaceful and ambient during my whole time spent at university. I thank Department of Computer Science specially for making project labs where I have spent time working for long, long time. I am thankful to all the students' and other participants who took part in the experimentation.

Most importantly, I am thankful to Allah Almighty for giving me strength, wisdom and courage for completing this dissertation, which would not have been complete without the might of God.

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List of Abbreviations used

UOS - University of Sargodha

UOL - University of Lahore

Abstract

Learning programming has been a tedious and challenging task for the novice programmers of high school and university level. If timely guidance is not provided to the learners then dropout from programming courses is increased and overall low score by students is achieved. If Scaffolding (support) is being provided to students then results can be optimistic for the novice learners of programming that can not only provide them guidance but will also increase their learning ability with constructive interest.

Scaffolding is guidance, the support provided to learners in the form of tools, curriculum, pedagogy, advice or any tutorial to accomplish a task which learner would not have been able to do without any support. As the learner make the transition from naïve to expert, the guidance provided to learner starts to fade off.

The use of Smartphones in Pakistan is on the rise, especially in the young generation of the country. This thing motivates us to build a programming environment in C++ for novice learners of computer programming. In order to design this application, a comprehensive scaffolding framework has been proposed which helps novices for learning computer programming on handheld devices. To provide proof of concept, a programming environment for novice learners outside the classroom/lab is provided, which is built on the scaffolding principles. Most of the Pakistani universities use C++ as a first programming language in their fundamental computer programming course. We implemented the proof of concept in the form of a programming environment on Smartphones that provides scaffolding (Support) to learners.

This application is specifically created for the android platform because of the low cost of an android phone and large audience of this platform. Two experiments have been conducted in order to understand the effectiveness of the construction of programs on Smartphones in C++. Participants from both universities UOS and UOL participated in the experimentation. Our designed first draft of the application named “Scaffoldy” was compared with a non-scaffolded system taken from Google Play store. A study was evaluated using different parameters such as task success, efficiency, a time required for the task, number of errors and learnability.

Learners were provided scaffolding in the “Scaffoldy” in the form of static and automatic scaffolding. Learners showed a great response to the support provided to them in both the forms. Specifically programming with parts, default statements and hints were highly appraised by the participants in the experiment. Learners found practising with errors feature highly effective as they were able to learn about new errors. Their error finding skill enhanced greatly as they practised error finding feature. “Scaffoldy” showed better results in term of attempted and completed tasks as compared to a non-scaffolded system. Learners showed fruitful results specifically in terms of efficiency, task success and learning from their errors. The feedback from learner suggested that working with the “Scaffoldy” was helpful for them and learners adopted to scaffolding techniques again, when scaffolding provided to them was faded away.

Chapter 1: Introduction

1.1 Introduction

Computer programming is tough subject for the novice programmers [2][3].Self-learning in the field of programming is sometimes impossible for novices. The scaffolding is best way of learning programming. Supervised learning with guided support is called scaffolding. In scaffolding, guidance is provided in the form of the chunks. The implication of the scaffolding varies in the form of guidance required from the students. For example, a child learning bicycle ride could be supported with the extra wheels. The extra wheels in this case are providing scaffolding to the child.